International first aid and resuscitation guidelines 2016

For National Society first aid programme managers, scientific advisory groups, first aid instructors and first responders

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Saving lives, changing minds.

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The International Federation of Red Cross and Red Crescent Societies (IFRC) is the world's largest volunteer-based humanitarian network. With our 190 member National Red Cross and Red Crescent Societies worldwide, we are in every community reaching 160.7 million people annually through long-term services and development programmes, as well as 110 million people through disaster response and early recovery programmes. We act before, during and after disasters and health emergencies to meet the needs and improve the lives of vulnerable people. We do so with impartiality as to nationality, race, gender, religious beliefs, class and political opinions.

Guided by *Strategy 2020* – our collective plan of action to tackle the major humanitarian and development challenges of this decade – we are committed to saving lives and changing minds.

Our strength lies in our volunteer network, our community-based expertise and our independence and neutrality. We work to improve humanitarian standards, as partners in development, and in response to disasters. We persuade decision-makers to act at all times in the interests of vulnerable people. The result: we enable healthy and safe communities, reduce vulnerabilities, strengthen resilience and foster a culture of peace around the world.

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Note: Medical information changes constantly and therefore, should not be considered current, complete or exhaustive. You should not rely on the information in these guidelines to recommend a course of treatment for yourself or any other individual; doing so is solely at your own risk.

These guidelines provide general information for educational purposes only. They are not designed to and do not provide medical advice, professional diagnosis, opinion, treatment or services. They are not a substitute for medical or professional care, and the information should not be used as an alternative to a visit, call, consultation or advice of a physician or other healthcare provider. The International Federation of Red Cross and Red Crescent Societies is not liable or responsible for any advice, course of treatment, diagnosis or any other information, services or product you obtain through these guidelines.

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Foreword

A young volunteer treats an injured soldier as a battle rages around them. A volunteer bandages a young girl's head in the aftermath of an earthquake. A team of volunteers tend to the survivors of a building collapse.

First aid is central to our identity around the world. For many people, when they think of the Red Cross and Red Crescent, they think of our volunteers on the frontline of humanitarian crises, treating the wounded and sick, or of the training that we provide in schools, community centres, and places of work.

The members of the International Federation of Red Cross and Red Crescent Societies (IFRC) are some of the leading providers of first aid in the world. For more than 150 years, first aid has been one of the principal services provided by Red Cross and Red Crescent volunteers to injured people.

Each year, National Red Cross Red Crescent National Societies train more than 15 million people in first aid. There are currently more than 180,000 active first aid trainers serving their communities, making first aid available for all.

Why is this so important? Because when a disaster strikes, no first responder can respond as quickly as a neighbour or family member. And when that person knows first aid, crisis can be averted, and lives can be saved.

For more than 100 years, the Red Cross and Red Crescent has been a world leader in establishing training standards and in developing procedures and guidelines. Drawing on our extensive experience we have helped shape the world's understanding of, and approach to, first aid.

The *International first aid and resuscitation guidelines 2016* are designed to help National Societies expand their work in this important area. They build on our extensive experience, and draw on evidence that has been gathered over the past two decades, evidence drawn from existing literature, programme evaluations, and advice from experts.

The 2016 guidelines are targeted at National Societies' first aid programme managers and their first aid advisory bodies. National Societies can use these guidelines to update their first aid materials, education and skills in accordance with the latest evidence-based international standards. Each topic within this document includes an introduction and summary of the scientific findings, evidence-based guidelines and implementation considerations for National Societies to adapt and apply according to their local needs, circumstances and government legislation. This document represents the first stage in an ongoing IFRC effort to provide National Societies with evidence-based guidance for first aid, resuscitation and education through the work of our Evidence-Based Network.

Strategy 2020 calls on all of us to do more, do better and reach further. First aid remains a key means of reducing deaths and injuries, and of building safer and more resilient communities.

Elhadj As Sy
IFRC Secretary General

Abbreviations

AMS	Acute Mountain Sickness
ABCDE	Airway, breathing, circulation, disability, exposure
AED	Automated external defibrillator
AGE	Arterial gas embolism
BVM	Bag-valve-mask
BLS	Basic life support
CPR	Cardiopulmonary resuscitation
CEBaP	Belgian Red Cross Centre for Evidence-Based Practice
CPSS	Cincinnati Pre-Hospital Stroke Scale
CBHFA	Community-based health and first aid
DOI	Digital object identifier
DAN	Diver Alert Network
EMS	Emergency medical services
FAST	Face, arms, speech and time
FBAO	Foreign body airway obstruction
GCS	Glasgow Coma Score
GFARC	Global First Aid Reference Centre
HACE	High altitude cerebral oedema
HAPE	High altitude pulmonary oedema
IASC	Inter Agency Standing Committee
ICRC	International Committee of the Red Cross
IFRC	International Federation of Red Cross and Red Crescent Societies
ILCOR	International Liaison Committee on Resuscitation
KPSS	Kurashiki Pre-hospital Stroke Scale
LAPSS	Los Angeles Pre-hospital Stroke Scale
mTBI	Minor traumatic brain injuries
OPSS	Ontario Pre-hospital Stroke Scale
ORS	Oral rehydration salts
PLR	Passive leg raising
ROSIER	Recognition of stroke in the emergency room
SAMPLE	Signs and symptoms, allergies, medication, past medical history, last meal, event
The Movement	The Red Cross Red Crescent Movement
TIA	Transient ischemic attack
TTM	Transtheoretical model of behaviour change
VF	Ventricular fibrillation

01. Introduction

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First aid remains a core area of the International Federation of Red Cross and Red Crescent Societies (IFRC). The IFRC is a major first aid educator and provider in the world. Almost all 190 Red Cross Red Crescent National Societies have first aid as their core activity, and first aid, the act of saving a life, is central to the Fundamental Principles.

The IFRC believes that first aid is a vital initial step for providing effective and rapid intervention that can help reduce injury and suffering and improve the chances of survival. Taking immediate action and applying correct and appropriate first aid measures makes a difference. Having high quality, evidence-based first aid education available to people worldwide contributes to building safer and healthier communities by preventing and reducing risks in daily emergency and disaster situations.

The IFRC advocates for first aid to be accessible to all and that at least one person in each household has access to learning first aid regardless of their socioeconomic status or other potential discriminatory factors.

02. About this document

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This document evaluates and reports on the science behind first aid and resuscitation. The *International First Aid and Resuscitation Guidelines* (referred to as the guidelines) have been produced with the main goal of fostering harmonization of first aid practices among the Red Cross Red Crescent National Societies and provide a true evidence-base to these practices. It is part of quality assurance to ensure that the general public and volunteers receive first aid training in accordance with IFRC standards and to establish, in due course, the IFRC International First Aid Certification.

These guidelines do not replace first aid manuals and associated educational materials but serve as the basis for developing and updating first aid manuals, resuscitation programmes, apps, public information and associated educational materials. National Societies should adapt these guidelines as needed for their local contexts (culture, language, habits etc.), legal context, local prevalence of injuries or illnesses and their own capacities (*see* Local adaptation). In addition, these guidelines and evidence review serve as an excellent reference for first aid instructors, emergency responders and their agencies.

Link to *Strategy 2020*

In line with *Strategy 2020*, Red Cross Red Crescent National Societies commit to do more, do better and reach further. These guidelines provide National Societies a solid base to *do better* in first aid.

With the global trend moving towards greater urbanization, the negative impact on health is increasing, particularly among vulnerable communities. Promoting first aid and using proven prevention techniques to address some of these challenges can build the capacity of local communities and the National Societies in both preparedness and response. This effort bridges the initial response of first aid volunteers and the public to the formal health system in saving lives.

Where do the guidelines fit in IFRC policy?

First aid must be delivered using up-to-date, evidence-based guidelines and best practice. The IFRC supports National Societies and participates in the development of harmonized first aid techniques in accordance with scientific research, international standards, good practice guidelines and measures of quality services. All of this is linked with a good implementation policy developed through a wide consultative intergovernmental and inter-associative process established at regional and national levels.

To do this, the IFRC sets up alliances with scientific bodies, public health experts and pedagogical specialists. The resulting information includes trend and situation analysis and the latest evidence-based developments in the field of first aid education. These guidelines as well as the Consensus on Science in first aid were developed using this process.

The 32nd International Conference of the Red Cross and Red Crescent (8–10 December 2015) passed a resolution on legal aspects of first aid to:

- Encourage States to promote regularly refreshed first aid education across the life-span of their citizens, in particular through mandatory training for school children and teachers and, to the degree capacity allows, for driver's licence applicants.
- Encourage States to adopt and regularly update official guidelines as to the minimum content of first aid education programmes, taking into account standards already in use, including IFRC International first aid and resuscitation guidelines, as well as the results of impact assessments.
- Encourage States to consider all necessary steps to encourage the provision of first aid by laypersons with appropriate training, including, where appropriate, establishing protection from liability for their good faith efforts and ensuring that they are aware of this protection.
- Invite States to exchange good practices in this area and requests National Societies and the International Federation to support interested States in assessing and, as needed, strengthening their existing legal frameworks related to first aid.

As agreed in the resolution, these guidelines are a reference tool that will contribute to the harmonization of first aid education and training programmes around the world and assure that these are based on the latest evidence and information.

A distinction is made between *harmonization* and *standardization*. The intention is not to have one technique for each situation, but rather to have a consensus on minimum agreed principles based on critical review of the available evidence and information learnt from the experiences of the Red Cross Red Crescent Movement (the Movement). This is to ensure that all first aid providers practice evidence-based lifesaving techniques.

Several parameters guided these harmonization efforts. The major ones consist of the following:

- The promotion and inclusion of evidence-based first aid, resuscitation and educational approaches.
- The necessity to further disseminate consistent techniques of first aid and resuscitation, knowledge and practices.
- The educational focus on retaining skills and instilling confidence to act.
- The ongoing cross-border exchanges due to:
  - migration, which leads to mixing of populations;
  - tourism and business travel, putting people in different environments;
  - use of the internet, which can support self-learning and comparison between areas.
- The differences between techniques that are not justified by either scientific evidence or field experiences.
- The necessary bridging between scientific knowledge and its application in diverse situations that is different from the research condition.

03.
Definition, trends and facts and figures

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Definition of first aid

First aid is the immediate assistance provided to a sick or injured person until professional help arrives. It is concerned not only with physical injury or illness but also with other initial care, including psychosocial support for people suffering from emotional distress caused by experiencing or witnessing a traumatic event. First aid interventions seek to "preserve life, alleviate suffering, prevent further illness or injury and promote recovery".[1]

This document refers to the *first aid provider*: this should be understood as a layperson with basic first aid knowledge and skills.

This document also refers to the person requiring care as a *casualty*. National Societies should use the appropriate term as per their local context to describe the person in need of care (patient, victim etc.).

Progress and trends in first aid: community-based health and first aid in action

In addition to advocating for training and basic first aid measures to save lives, the IFRC strongly believes that first aid should be an integral part of a wider developmental approach. This approach focuses on prevention, to build safer and more resilient communities, and on improving long-term capacity for improved health programmes and community development. [Community-based health and first aid (CBHFA) tools] include an implementation guide, facilitators' guide, volunteers' manual and community tools that can be easily used in the field.

1 *International Liaison Committee on Resuscitation (ILCOR), 2015*

Number of people reached

In 2009, 21 National Societies in Europe trained more than 2.3 million people. During the same period, 7 million people were trained in certified first aid courses worldwide.

In 2014, approximately 15 million people were trained in first aid by Red Cross Red Crescent National Societies in 116 countries around the globe by more than 180,000 active first aid trainers (*See* Appendix 1 for data: Global survey data on first aid).

Annually, more than 50 Red Cross Red Crescent National Societies are active during World First Aid Day that is held every year on the second Saturday of September. Over 20 million people are reached globally each year, and more than 700,000 volunteers and staff mobilized.

The Red Cross Red Crescent National Societies have a long history of implementing community health programmes and services. CBHFA is an approach implemented by 109 Red Cross Red Crescent National Societies. CBHFA tools are adapted and translated to 46 languages. CBHFA empowers communities and volunteers to be in charge of their own health by applying community-based approaches to health promotion, behaviour change, primary prevention, social mobilization and health literacy. From 2011 to 2014, the Red Cross Red Crescent National Societies trained 127,703 volunteers and 5,148 facilitators in CBHFA at branch and community levels reaching more than 20 million people with community health services.

Thereby, each year more than 46 million people are reached by Red Cross Red Crescent National Societies with first aid and preventive health messages.

04. Process to develop these guidelines

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National first aid guidelines have been developed by Red Cross Red Crescent National Societies for more than 100 years. For more than 20 years several Red Cross Red Crescent National Societies have had evidence-based processes and published guidelines based on the same. In 2011, the IFRC published its first evidence-based guidelines based on Red Cross Red Crescent National Societies experiences.

It embarked on the process of developing these guidelines in 2013. This included identifying subject area coordinators, determining a list of topics to address, identifying evidence reviewers, cataloguing existing evidence-based processes, review by Red Cross Societies and holding planning meetings. Furthermore, as of 2013, IFRC participated in a strategic collaboration with the International Liaison Committee on Resuscitation (ILCOR), particularly the First Aid Task Force, in addition to several other task forces, including the Basic Life Support (BLS). GFARC and the Belgian Red Cross Centre for Evidence-Based Practice (CEBaP) have collaborated with Red Cross Red Crescent National Society experts from the American Red Cross, Austrian Red Cross, Canadian Red Cross, French Red Cross and the Hungarian Red Cross in the ILCOR task forces.

These guidelines have been developed based on the principles of evidence-based practice, represented in Figure 1.

Figure 1. Approach for the development of an evidence-based guideline.

First, the best available scientific evidence is collected through database searching for scientific studies. Next, practical experience and expertise of experts from the fields and preferences and available resources of the target group (first aid providers and people who receive first aid) are integrated to formulate recommendations.

After developing the list of topics and questions to be addressed, the first step in the development of evidence-based guidelines was to collect the best available scientific evidence. The Movement has been a leader in first aid science, including drowning process resuscitation, education and practice. National Societies, while experts in resuscitation in their own right, have traditionally worked in partnership with local resuscitation councils and their parent organization, ILCOR in cardiopulmonary resuscitation (CPR), automated external defibrillator (AED) and BLS.

In addition to the primary evidence review of topics, summaries from CEBaP, the American Red Cross Scientific Advisory Council and the IFRC Evidence-Based Network are included as a basis for the recommendations in these guidelines. Lastly, the ILCOR First Aid task force, which includes representation from Red Cross National Societies and CEBaP, worked on 22 different research questions related to first aid that are integrated into these guidelines.

As part of the process, the Evidence-Based Network organized two initial meetings, one in London (hosted by the British Red Cross, March 2014) and one in Paris (hosted by the French Red Cross, October 2014), with the aim of:
(1) Starting the process for the development of the guidelines;
(2) Training the new Evidence-Based Network members in the evidence-based methodology; and
(3) Developing evidence summaries.

Based on the available sources of evidence, draft recommendations were formulated by the different subject area coordinators of the Evidence-Based Network. Monthly conference calls were held to report on progress. In October 2015, a meeting was held in Prague with the subgroup coordinators (hosted by GFARC with the friendly cooperation of the Czech Red Cross) to consider the evidence conclusions and practical experience and to discuss proposed recommendations, taking into account the target group of these guidelines.

In January 2016, a final consensus meeting was held in Mechelen (hosted by the Belgian Red Cross), to consider how different target users in various contexts around the world could apply these guidelines. In order to include a field perspective and ensure that these guidelines are appropriate and relevant for the end user, three representatives from each IFRC region (Africa, Americas, Asia and the Pacific, Europe, Middle East and North Africa) participated in this meeting. This has added value to the process and demonstrates that these guidelines are rooted firmly in the context of practical application. This aspect is fundamentally important to the Movement. Together with the representatives of the different regions, final good practice points and implementation considerations were formulated. This part of the process recognizes the worth, quality and the importance of the link between science and practice.

Summary of scientific foundation and guidelines

For every topic a summary of scientific foundation is provided. In the search for evidence:
(1) Human studies were preferred over animal studies;
(2) Studies on interventions provided by laypeople (i.e. basic first responders, lay caregivers and/or community health workers) were preferred over interventions performed by healthcare professionals; and

(3) Studies on interventions requiring special equipment or competences were excluded.

To go from the scientific foundation to creating specific guidelines, the quality of the evidence, benefits, harms, risks, preferences and costs were all taken into account. The quality of the evidence was based on limitations in study design (well designed, prospective, randomized controlled studies start with a higher quality level than observational studies), inconsistency between studies and indirectness of the evidence.

All guidelines are classified as either **(strong) or *(weak) recommendation or as a good practice point. For a strong recommendation, the evidence of benefits strongly outweighs the evidence of harms. For a weak recommendation the evidence related to benefits is either weak or the studies conducted were at small scale. There was either no or weak evidence of harm that was outweighed by proof of benefit or appreciable uncertainty exists about the magnitude of benefits and risks. Table 1 provides an overview of the types of guidelines and implications for practice.

Where no clear evidence was available or missing but clinical practice or expert opinion is available, good practice points were formulated based on the experience of National Societies worldwide.

Table 1. Overview of the types of guidelines and implications for practice

Strength of guideline and terms used	Description and strength of evidence	Implications
** Recommendation terms: must/should (or must/should not)	• A **strong** recommendation • Benefits strongly outweigh the harms • This recommendation is the most appropriate action	Must be followed unless a clear and compelling rationale for an alternative approach is present
* Recommendation terms: may, could (or not recommended)	• A **weak** recommendation • Benefits and risks and burdens are finely balanced or appreciable uncertainty exists about the magnitude of benefits and risks • There is some uncertainty regarding the most appropriate action and different choices can be appropriate	Prudent to follow, but one should remain alert to new published evidence that clarifies the balance of benefit versus harm
Good practice point terms: can also contain active wording such as 'should', 'must'.	• Based on common sense, good practice or (very) low quality evidence, expert opinion, etc. • An important practical point for which the expert panel reaches a consensus and nobody is likely to question it	A good practice point is based on common sense and consensus, however could be sensitive to context

Local adaptation

When using these guidelines, National Societies should consider their specific epidemiological profile, pre-hospital care system and legislation relating to first aid. The common health concerns and injuries identified by specific communities or target groups must be addressed with special attention paid to their cultural and religious beliefs as well as the available resources. This should be done in conjunction with a National Society scientific advisory group. As used in this document, a scientific advisory group can include scientists, medical experts, researchers, first aid instructors and practitioners, educators and local community representatives. This can be accomplished through partnership with others, including National Societies.

Future development

IFRC is committed not only to building first aid skills within vulnerable groups but also to developing safer and healthier communities. It will continue to work with partners on first aid techniques and on factors that influence a layperson's willingness to provide first aid. IFRC wants to develop more effective ways for people to learn first aid and to be more confident to act, as well as use the best methodologies to influence behavioural change in preventing injury and adopting healthy lifestyles. For these reasons, education has been developed as an important part of these guidelines.

Inevitably, these guidelines are not exhaustive. First aid topics that were not reviewed have not been included here. For this edition, topics requested by National Societies and others thought to be current and relevant have been included. National Societies should alert the GFARC if there are topics they need an evidence-base for. The Evidence-Based Network will consider these requests for future work.

References

05. General principles

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Citizen preparedness for disasters and daily emergencies

Floods, fires, storms, earthquakes, avalanches, heat waves, industrial accidents, etc. can each have disastrous consequences on the population. Such disasters and technological risks often affect a large number of people (causing injury or death) and tend to receive much attention in the community. However, many dangerous situations affect individuals, families, and communities on a daily basis. These include fainting, burns, falls, intoxication, drowning, road crashes, etc. that can happen at home, school, in the workplace, stores and on the road among other places. The consequences for those affected and their relatives (families, friends, neighbours, work colleagues, etc.) are often both physical and psychological; this is also true for the witnesses of the emergency, the local authorities and the members of the organizations that provide care and assistance.

Summary of scientific foundation

Most of the data on how best to evaluate and monitor citizen preparedness for daily emergencies or disaster risks are presented in reports or as expert opinion. Studies with well-defined populations that explore evaluation during resuscitation training use a variety of methods. The lack of consistency in the use of methods means that no conclusions can be drawn.

Guidelines

- There are insufficient data to formally recommend specific training or information dissemination methods for citizen preparedness. However, key messages can be highlighted for education of the general public. First and foremost, it is necessary to recognize that citizens themselves are at the centre of prevention and response systems in emergency situations. Therefore, citizens must be active in these systems, alongside authorities and rescue, care and assistance organizations. Citizens can initially contribute to their self-protection by starting to express and identify their risks and their abilities to control those risks and to manage emergency situations.

Implementation considerations

To help disseminate the idea of self-protection, key messages for public education for disaster risk reduction should be integrated into all official training of the IFRC, including first aid training and education.

To explore the efficiency of citizen self-protection, well-designed studies are needed to compare training using simulation or other pedagogical methods, especially those for training laypeople. Well-designed studies on the effectiveness of this training in decreasing the impact of the disaster within the community are also required. The Red Cross Red Crescent National Societies may be able to use such studies to explore the efficiency of education in disaster and daily emergency preparedness throughout the world.

Citizens must be prepared to self-protect before, during and after emergency situations in the following ways:

- *Before an emergency* by getting information and identifying relevant risks, adopting suitable behaviour, taking preventive measures, and if necessary corrective ones, obtaining training (e.g. in lifesaving techniques), understanding and respecting security and safety instructions and taking part in the management programmes of emergency situations (such as risk analysis, simulation exercises, etc.).
- *During an emergency* by self-protecting from immediate consequences and any further risk or accident, carrying out appropriate first aid techniques, following instructions (e.g. evacuation), restoring social links (e.g. family, friends, neighbours, members of the local community, etc.) and volunteering and collaborating with rescue, care and assistance services and organizations.
- *After an emergency* by obtaining adequate assistance (care, water, food, shelter, etc.), being psychologically restored and materially compensated, volunteering for assistance operations for the local community and adapting behaviour and equipment based on the experience gained and lessons learnt.

Prevention

While these guidelines focus on the education and provision of first aid, preventing an injury or illness is always better than needing to treat it. Every educational programme addressing first aid should, when appropriate, incorporate key messages about prevention, shared with learners directly or indirectly as appropriate, depending on their needs and abilities. There are many National Societies with excellent preventative programmes outside of first aid education (e.g. water safety, disaster preparedness, road safety and violence, bullying and abuse prevention).

Personal safety

When first aid is provided, the safety of the first aid providers must always be considered. When creating first aid educational programmes, including pertinent information on personal safety is imperative. Information related to personal safety is general and applies to all situations, and resources vary across the regions. These general principles offer guidelines and implementation considerations that apply to all interventions. These are not repeated within the guidelines of this document in order to maintain the focus on the specific information relevant for each recommendation.

The two most important areas of personal safety are overall and scene safety and the prevention of disease transmission during care.

While providers are preparing to give care, they should ensure they do not place themselves in jeopardy, thus potentially creating additional casualties. First aid providers should enter risk areas (i.e. involving water, fire, etc.) only if they have been specially trained to conduct rescue in these environments. This is because the environment may be initially safe, but conditions may become more hazardous or the site may only be safe to enter for a brief period. First aid providers may need to remove the casualty (if trained to do so) to a safer area before providing care.

The second area of personal safety is prevention of disease transmission, which can be accomplished through adhering to universal precautions. Although these may vary somewhat among National Societies, based on the environment and on available resources, they should be standardized and based on the best available evidence. When contact with blood and body fluids is likely, use of nitrile gloves is recommended (vinyl is less robust and latex can cause an allergic reaction). The single most important aspect of infection control is good hand hygiene, which consists of frequent hand washing and, at a minimum, before and after rendering care. Hands should be washed with soap and water. If soap and water are not available, alcohol-based hand sanitizers can be used.

Linkages to other healthcare

While first aid is most accessible and provides the quickest care to a person suffering from an illness or injury, it is only one part of the continuum of care. Medical resources differ from country to country, and national standards of care may vary. First aid education must address when such care is sufficient, when discussion with a primary care provider (or the equivalent for the environment and National Society) and/or when immediate transport to definitive medical care (or the equivalent for the environment and National Society) is needed. These suggestions will vary for each region and National Society.

Update and retraining

An updated section on the scientific and experiential foundation of first aid education, course design, outcome assessment and principles is included in these guidelines (*see* Education). The science and experience of educational concepts continue to evolve. IFRC strives to continue to provide effective, relevant and tailored education to all learners.

While initial education is an important first step in assisting people and saving lives, keeping skills current and based on the latest information through regular retraining should be stressed. The form of updates and retraining may vary based on the type of first aid education acquired, the environment, the skills learned and the resources of the National Society. The level and type of retraining needed can vary based on the depth and breadth of the first aid education provided.

Target populations and their supporters

With all efforts in first aid education, injury and illness prevention and the advancement of public health, the needs of target and vulnerable populations, including those with access issues and functional needs, must be considered. The requirements of these segments of the population need to be considered both as targets for first aid education and training and as the recipients of first aid measures. As National Societies use these guidelines to create first aid educational programmes, it is important to design special programmes for people that typically are not reached by training. Examples include those with language, socioeconomic or educational limitations, as well as those living with a disability or any other impairment. Examples of how National Societies have overcome these challenges are included in the education chapter (*see* Education). In addition, when courses are designed and implemented, they should include information regarding special needs and vulnerable individuals that may be encountered by the care provider. If resources allow, courses that specifically target these populations should be designed.

Ethics

Ethics behind first aid are not found in scientific publications or in randomized controlled trials. They are found in greater principles, such as the Fundamental Principles of the Movement: Humanity, Impartiality, Neutrality, Independence, Voluntary Service, Unity and Universality. In serving these principles, we strive to treat the affected people in the most humane and ethical manner.

References

06. Education

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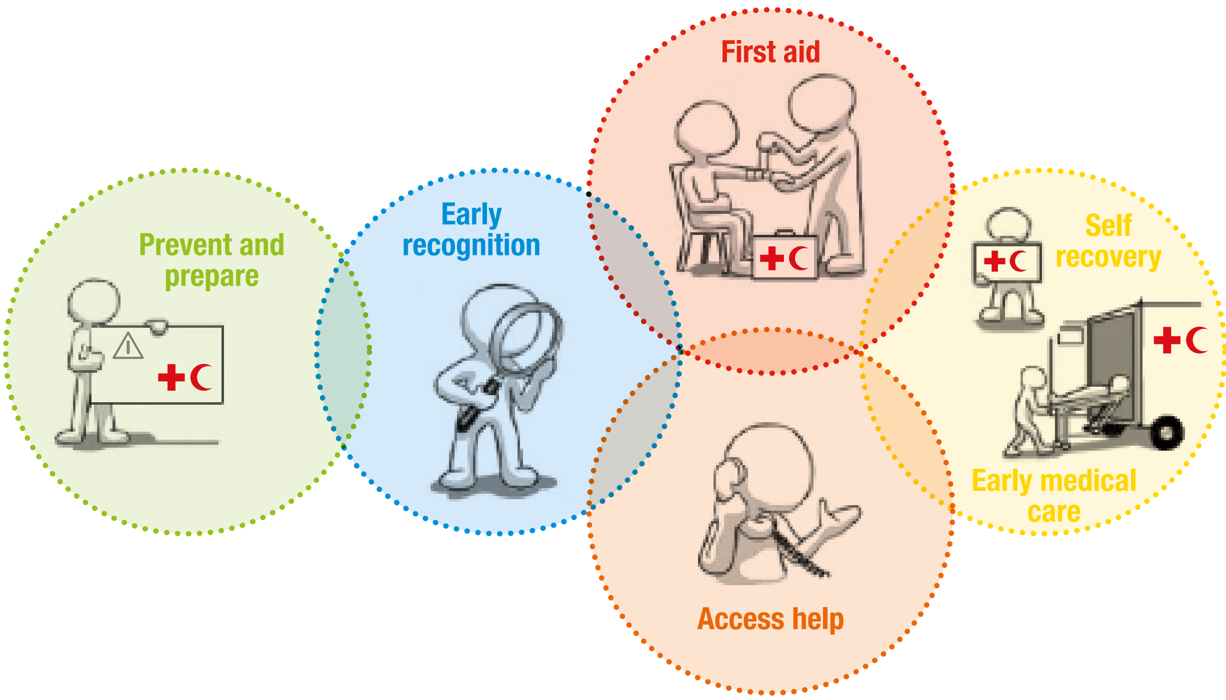
This chapter addresses effective and sustainable learner-focused first aid and resuscitation education, in both formal and informal settings.

Introduction

Central to the resilience of individuals and communities is the ability to respond effectively in a crisis. The Movement views first aid as one of the greatest humanitarian acts and first aid education as an integral part of building resilience. As such, it is the duty of the Movement to advocate for and provide effective first aid education that is accessible to everyone and engages the learner to ultimately respond to an emergency appropriately. The spectrum of education activities crosses the domains, represented in the chain of survival behaviours, *see* figure 2. The first domain encompasses prevention and preparedness. The second domain stresses early recognition of

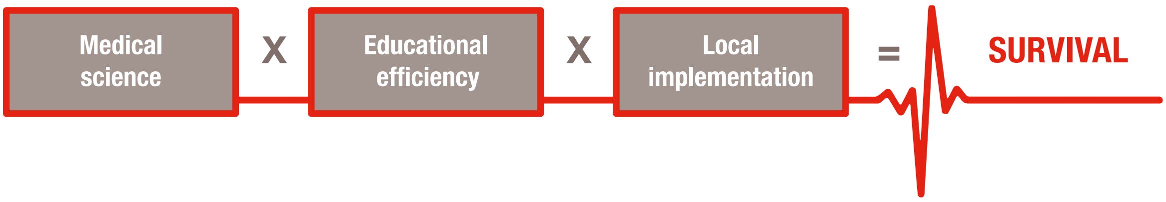
Figure 2. Chain of survival behaviours



dangers environmentally and with the ill or injured person. The third domain of response has two actions that can take place at the same time, providing first aid and/or calling for help, depending on the number of responders and resources. Last in the sequence is the domain of recovery that can be done with or without advanced care. Educational activities to develop these survival behaviours include awareness campaigns, training and certification, and just-in-time tools for disasters and crises. This chapter aims to empower and guide National Societies to be creative and flexible with their first aid education for first aid providers whilst always putting the learner and their empowerment to help at the centre of all educational activities. The aim of doing so is to fulfil the crucial aspects of educational effectiveness and local implementation.

The Utstein formula of survival provides a model for the Movement and governments to coordinate efforts that encourage mass uptake of helping behaviours. The three factors in the formula to increase survival are: medical science, educational efficiency and local implementation, which serve as a framework to build interventions. These factors exist in a multiplicative relationship that means all have to be present for survival to be optimized.

Figure 3. Utstein formula for survival[2]



The Movement, because of its size and impact, leads and contributes to each Utstein factor. Each factor is drawn on in the paragraphs that follow in this chapter, where the scientific foundation is shown to require appropriate educational methodologies and local implementation according to circumstance and context in order to be effective.

Starting in 2005, Red Cross and Red Crescent leaders invited and participated with other first aid experts to establish the Consensus on Science and Treatment Recommendations for first aid internationally, helping fulfil the medical science factor. This work continues to date, with new emphasis given to educational efficiency and implementation science, on which the guidelines in this document are based.

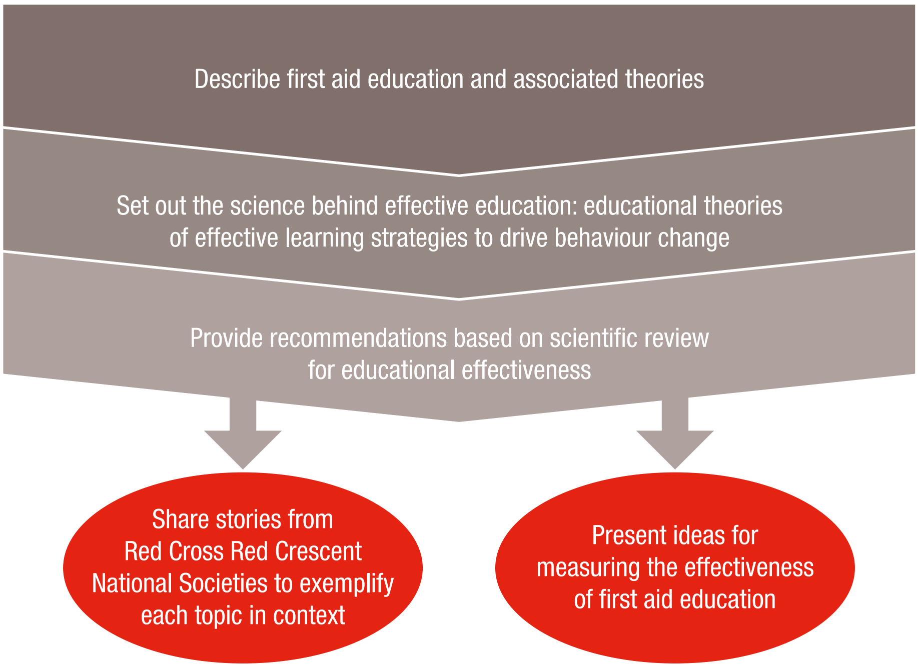
The IFRC works across borders to create global awareness for enhanced first aid education through partnerships within region offices and reference centres. Additionally, GFARC leads the collaboration effort in developing global communications and advocacy strategies to promote first aid throughout the IFRC based on up-to-date evidence. Current efforts to harmonize training of trainers and develop evidence-based practices focus on local implementation.

Recommendations in this chapter emerged from independent scientific review of questions, the 2015 ILCOR scientific review, and case studies supplied by experts within the Movement with the objective of finding robust evidence to support effective first aid education. Due to the specific nature and rigor of the process a low number of studies were found to be of sufficient for inclusion.

2 *Søreide, E. Morrison, LJ, Hillman K, Monsieurs K. Sunde K. Zideman, D. Eisenberg M. Sterz F, Nadkani VM, Soar J. Nolan JP. The formula for survival in resuscitation in Resuscitation. 84:1487–1493, 2013.*

Where evidence did not exist, but questions remained, educational experts in first aid across the Movement provided advice on good practices and the educational theories and methodologies available. Figure 4 illustrates the process used for creating educational guidelines.

Figure 4. Process for creating educational guidelines



Some key messages that are intrinsic to good education emerged from this process. These messages are not always explicit within the science, but rather they reflect a general finding that is aligned to scientific theory and experience of experts in the field. To make this more explicit, anecdotes and examples from National Societies are presented in this chapter for the benefit of first aid managers, as they design educational programmes. These anecdotes have been taken from a number of National Societies based on different programmes.

The key messages for those preparing first aid education

- **Create relevant contexts** for learners to want to engage with and make use of learner life experiences to support content.
- Ensure activities **engage the *learner*** and the ways that they can most readily learn, allowing the learner to demonstrate knowledge, skills, or behaviours gained.
- **Tailor multiple learning modalities** (such as technology, games, role play etc.) to develop knowledge, skills, and behaviours to increase learner accessibility and knowledge retention.
- Restrict content to what is ***necessary and relevant for the learner – and vary content according to their needs***.
- **Develop facilitators and coaches** with knowledge in first aid that is relevant to the learner.
- Allow the learner ***time to reflect and explore*** their own attitude to helping in different circumstances.
- **Identify learner outcomes (such as skills, knowledge and confidence) and ways of measuring effective education (such as using surveys).**

This chapter:
- Describes first aid education and associated theories.
- **Sets out the science behind effective education:** the context which describes what we mean by effective first aid education, drawing on educational theories of effective learning strategies to drive behaviour change.
- **Provides recommendations based on scientific review for educational effectiveness**.
- Shares experiences from National Societies to exemplify each topic in context.
- **Presents ideas for measuring the effectiveness of first aid education**.

What is effective first aid education?

The Movement is the world's leading first aid education provider, both in terms of educating the public and enabling trained volunteers to respond to and in emergencies in an organized manner. **Providing the most effective education challenges for National Societies to create interventions that increase the learner's knowledge, skills, confidence and their willingness to apply first aid competencies. These elements have the potential to influence behaviour change.** Interventions may take many forms including awareness campaigns, formal courses, and just-in-time training.

First aid interventions seek to "preserve life, alleviate suffering, prevent further illness or injury, and promote recovery".[3] Whilst trained volunteers are expected and expecting to respond, the purpose of educating the public is to develop their knowledge, skills and willingness and confidence to respond in an emergency. It should therefore be the purpose of all first aid education, no matter who the learners are, to equip them to:
- Recognize, assess and prioritize the need for first aid.
- Provide care using appropriate competencies, i.e. first aid knowledge, skills and behaviours.
- Recognize limitations and seek additional care when needed.

The effectiveness of the education a learner receives is therefore paramount to the efficacy of their response.

Educational foundations for first aid competencies encompass:
- *Knowledge:* awareness of signs and symptoms of the ill or injured person, risks to self and others from the environment, and evidence-based first aid treatments.
- *Skills:* appropriate psychomotor responses to address injury or illness, such as opening an airway or applying direct pressure on bleeding.
- *Behaviours:* series of responses to an emergency that indicate an awareness to the situation and a willingness to act, including:
  - early recognition in identifying emergencies and assessing risks;
  - gaining additional help if needed, and providing appropriate care using knowledge and skills;
  - accessing additional help by participating in the system of emergency response to the best of their abilities;
  - supporting recovery.

3 *Consensus on Science, ILCOR, 2015.*

These competencies can be developed independently. However, often developing these together can be beneficial. They can also contribute to helping the learner to form a positive and confident attitude towards applying their skills in a real emergency. *See* figure 2 for the illustration of survival behaviours.

Foundation for first aid education

Three components should be addressed at all levels of first aid education to leverage knowledge and skill development:

- A **cognitive** or brain-based component that recognizes an individual or community's learning history and builds from that point.
- A **social** learning component that identifies barriers and leverages relationships to inspire and support proper emergency action.
- An **environmental** component that helps individuals identify and use resources to help (e.g. laws, AED, emergency dispatch system).

Table 2. Summary of the key theories

Concept	Theory
Bystander effect and reluctance to help	People are less likely to help someone they do not know, or cannot identify with; they are more likely to help those they can empathize with and those they feel compassion for. Studies also show the bystander effect as a major barrier to helping, where the reasons for doing so can be broadly categorized as either diffusion of responsibility (there are so many people around, someone else is bound to help) or the need to behave in a socially acceptable way (i.e. if others are not helping, it must be inappropriate to do so). It has been proven that those made aware of the bystander effect are more likely to act. But there is also evidence that awareness of such issues may not be sufficient: sometimes people need to deliberate and discuss an issue to be able to determine how and if they should alter their own behaviour.
Understanding an individual's emergency response behaviour	Fishbein and Yzer's integrative model of behaviour prediction: Individuals, who are aware of an impending emergency or in the midst of one, will vary by demographic characteristics, culture, previous attitude towards an emergency, and exposure to other variables (e.g. media). First aid education must take these components into consideration to be relevant for short- and long-term behaviour change. Embedded in the integrative model of behaviour prediction are the theory of reasoned action and the theory of planned behaviour, where determinants of behaviour include attitude, subjective norms, and perceived control. For a general population as an audience, interventions must account for no or limited experience with providing first aid or being in emergencies. Perceived control figures into self-confidence and self-efficacy beliefs that factor in first aid behaviours. Self-confidence is a general term that can influence self-efficacy, which is self-appraisal of accomplishing a particular competency, which factors into intention and behaviour.
Developing a framework to support behavioural change	The transtheoretical model of behaviour change (TTM) provides a framework for first aid education by organizing activity in terms of stages for supporting behaviour change. An assessment of the learners before the design of an intervention helps inform obtainable goals in context to evidence-based first aid practices. TTM stages include pre-contemplation, contemplation, preparation, action, and maintenance for the adoption of behaviour. Issues of cost, reading ability, technology access, job requirements, etc. fall into consideration and motivation for moving through the stages of TTM.
Feedback and reflection	Hattie in visible learning advocates for learning to be at the forefront of teaching. Preparation for teaching appropriately, identifying learning goals, measuring achievement and collaboration between teacher and learner are key themes, each depending on adaptability and flexibility by the teacher to move at the pace of the learner and increase the level of challenge appropriately. Feedback and reflection allow for an effective understanding of what has been achieved by the learning experience.

A range of theories and models now exist around behaviours and how to influence them to assist those developing educational first aid programmes. Although not part of the formal review process, key theories are summarized in Table 2 to support methodologies behind effective education.

Who is the learner?

Although almost everyone can provide first aid to themselves or others, learner characteristics will help the educator (including trainer, content developer, etc.) to tailor the experience to meet the learner's objectives. Characteristics might include the types of situation in which a learner would respond (at home, in a public place, in school or work), demographics (age and gender), or access to resources. Additionally, some learners might be influenced by a requirement to have training for work, school, or a job. National Societies may already stratify first aid education by:

- *Lay public (including children)* – informally trained through public health campaigns, media or community or self-directed just-in-time learning.
- *Lay public with certificate* – complete an approved curriculum within a scope of practice (can also include first aid volunteers or educators).
- *Professional responder* – completes an approved curriculum within a scope of practice and has a legal duty to respond (can also include first aid volunteers or educators).

Those developing learning programmes should feel empowered to think broadly how best to influence learning at any level. For example, how learners respond to technology, how prepared they are when starting a course, what cultural norms need to be considered, or what might be the learners' ability to engage with materials or other learners?

Evidence review and recommendations

How a casualty fares in a medical emergency provides the strength of evidence on how best to support first aid education. Education designers use evidence-based guidelines, as presented here, to strengthen the first aid knowledge, skills, and behaviours to best serve the needs of an ill or injured person. Educational outcomes of the learner provide another source of evidence to be considered in the design of first aid education interventions and curriculum. This evidence review for education attempted to identify increases in first aid competencies (knowledge, skills, and behaviours) and willingness to help as outcomes of first aid education compared to those not receiving first aid education or another control group. The literature evaluated the effect of different independent variables:

- learning motivations
- learner modalities (using different learning formats, such as online, face-to-face etc.)
- scenario-based techniques

Using the evidence review process described in About this document, 2,909 articles were identified as potentially relevant to the outcomes of first aid and resuscitation education between 1968 and 2015. The rigor of the evidence review process, as applied to the learning outcomes, revealed in general an insufficient body of evidence to support strong recommendations. Small and underpowered studies limit the generalizability and confidence to create standards when interpreted alone. To strengthen the confidence and generalizability, IFRC utilized experts working around the world along with National Societies experience to develop these guidelines.

The limited evidence-base also represents an inherent challenge of working across individual learning preferences and cultural characteristics. National Societies can make use of evidence and experience that supports different learning modalities, or blends of approach, in order to ensure the most effective outcome for each learner. Educational methodologies are also continuously developing, as is the technology to support these developments. The Movement as a whole looks to modernize its educational delivery, aligning pedagogical models with the latest scientific evidence and best practice, to meet the needs of individuals and communities.

The Movement's integration with local communities and national leaders positions National Societies to learn and lead in first aid education. In times of conflict and other situations of violence the International Committee of the Red Cross (ICRC) provides first aid support, including education, to populations and Red Cross Red Crescent volunteers, as well as others likely to be present at the scene of emergencies (weapon bearers, demonstrators, religious groups and healthcare personnel among others). The overall goal of the Movement with regard to first aid education is that during emergencies, injured and acutely sick people benefit from humane, impartial, and effective first aid provided in a secure way by confident and skilled responders who are inspired by humanitarian values and principles.

For example, the timing, local resources, and unique circumstances that the ICRC finds itself working in when serving local populations in crisis and preparing for crisis, challenge a full and ideal implementation of each evidence-based guideline. These guidelines support the clinical and educational development by National Societies to prepare populations to meet the needs of the ill and injured. Based in these principles is the respect for local practices and experience, which can be a major resource in times of crisis, and should not be undermined by non-implementable options. Learning from and sharing these experiences will contribute to future first aid guidelines.

In a war setting or other situations of violence, standard first aid interventions are not always feasible or standard first aid equipment is not always available. However, local practices, taking into account the characteristics of the people and their circumstances, play an important role in such a context. For some of these practices, where evidence is available it has been included in the relevant section.

Research and evaluation of these local coping mechanisms and resources should be pursued to establish firm evidence of their efficacy. This is important, particularly as they can also be a strong influencing factor for a durable confidence and empowerment of people to intervene during emergencies, as well as an expression of the humanitarian values and principles of a Red Cross Red Crescent first aid support.

Putting emphasis on the learners' outcomes helps curriculum designers, policy makers, and funders decide how to most appropriately design an intervention. Outcomes should ideally be measurable and measured. These outcomes may include the willingness to help, applying pressure on external bleeding, or cooling a burn with water. To date, most measurement comes in the form of knowledge acquisition and limited skill demonstration. As a Movement, there is an opportunity to study first aid educational effectiveness and share the outcomes internally as well as with partners and governments. First aid education needs to be efficient and cost effective. Again, individual National Societies have the opportunity to measure first aid programme efficiencies (time, cost, resources) for their own benefit and to share the findings. This section brings together the science and uses real examples to illustrate implementation considerations.

The effectiveness of first aid education on casualty outcomes

As a foundation for this section, the question, "Does receiving first aid from a trained individual versus untrained individuals improve outcomes?", came up at the beginning of the review for both the IFRC and ILCOR processes. Although the question is basic, because of ethical considerations it is not experimentally studied and *in vivo* studies are difficult to manage from a logistical and validity standpoint.

Summary of scientific foundation

The 2015 ILCOR Consensus on Science and Treatment Recommendations and prior reviews by Red Cross Red Crescent National Societies identified increased survival rates and reduced time to resolution of symptoms for ill or injured persons after first aid training. Studies included formal first aid curriculum and public health campaigns. The American Heart Association and American Red Cross 2015 guidelines state, "First aid education can be accomplished through a variety of means, including online courses, classes and public health campaigns. First aid education can increase survival rates, reduce injury severity and resolve symptoms over a spectrum of approaches, including public health campaigns, focused health topics or courses that result in certification".[4]

Reviews of compression-only CPR training, for which further commentary is provided under Resuscitation, not only address the technique but educational principles. From an education perspective, the evidence to support teaching compression-only CPR is mixed.

Two observational studies documented the survival to hospital discharge for adults receiving bystander CPR (very-low-quality evidence) demonstrating no difference in neurologically intact survival of those receiving traditional CPR versus compression-only CPR, in a high-resourced community. In a single study of willingness to perform CPR compression-only training participants were not significantly different from conventional CPR training participants. While there was a belief that compression-only may have equivalent outcomes to traditional CPR and increased usage by lay bystanders, the evidence does not support this premise. While not supported by the evidence as a primary technique, this suggests alternatives to educators within certain settings.

Guidelines

- National Societies should use measurements of casualty outcomes to develop more effective educational programmes and advocacy. (**)
- First aid providers who are unable or unwilling to deliver conventional CPR, when treating an adult or child casualty in cardiac arrest should use compression-only CPR. (**)

4 *Circulation. 132: S574–S589, 2015. doi:10.1161/CIR.0000000000000269, page 575*

Motivation of the learner

In order to increase the number of first aid learners, it is logical to seek participants with a desire to learn. Whether a learner chooses to start a learning experience (such as a new parent or care giver) or is required to learn (such as for workplace training) could affect his or her commitment to learning and therefore also the willingness to absorb what is learnt. Hence, National Societies might look at learner motivation to stimulate both their publicizing and the effectiveness of their education. Understanding the impact of self-motivated learning helps to design effective educational interventions.

Summary of scientific foundation

Only one comparison study that directly measured impact of self-motivation was found. In CPR training, laypeople who were motivated to learn content because of family health concerns were compared to those required by their employer to learn. Results showed higher satisfaction with the course as well as higher intention to perform, if necessary, amongst the motivated learners. In another study, Lim et al. showed that first aid education tailored to a specific activity or relevance to the learner was effective for increasing willingness to help, but this study did not have a comparison group. ILCOR identified similar findings.

Guideline

- Although the evidence is very weak, it does suggest that self-determined learning taken in a relevant context could improve educational outcomes for the learner. (*)

Key messages

- **Create relevant contexts** for all learners to want to engage with and make use of life experiences to support content.
- Ensure activities **engage the *learner*** and the ways that they can most likely apply their competencies.
- Limit the quantity of content to what is ***necessary and relevant for the learner – and vary content according to their needs***.

Examples from National Societies on using motivation of the learner to improve effectiveness

Learner-led course development in Sweden

The Swedish Red Cross modified a first aid course to empower immigrants and support community integration. The project focused on large cities where there is exclusion and segregation and used project teams to facilitate focus groups and distribute surveys of residents to understand the best educational methodologies. The result was a first aid education intervention that is based on a participatory approach where all activities are planned and developed through involvement of the learners. A fundamental aspect of the project is to aspire to attract all participants to volunteer for the Red Cross, and through empowerment, encourage them to become community leaders in the future.

A family focused approach in Germany

The German Red Cross has tailored special first aid courses for parents, grandparents and all others who want to be prepared for emergencies where children are involved. Part of the focus is prevention of emergencies and accidents with children: where are critical places at home? How can I make my environment safe? Additionally, the curriculum of the course provides enough time for exchange of questions, experiences, best practices etc. among the participants.

Where possible, learners with this specific motivation are separated from those who are directed to learn first aid by their employer. Trainers have identified better learning by those motivated by their circumstance, although no firm data is as yet available.

What influences your motivation to learn first aid, a British answer

The British Red Cross undertook some market research to understand if people's circumstances influenced their motivation to learn first aid. The question asked to random members of the public was: *Does your personal circumstance influence your motivation to learn first aid?* The percentages below reflect how people rated their circumstance as having influence on their interest to learn first aid:

- Sixty-three per cent with children under-five years of age
- Twenty-seven per cent who care for other adults
- Nineteen per cent who play sport
- Twenty-seven per cent who interact with the public at work

The effectiveness of using different learning modalities

Organizations offering first aid training standardize many programmes, including training materials, timetables for training and pedagogy, in order to create common experiences and be able to claim common outcomes. Instructors have to comply with the assumption that this ensures common standards of delivery. However, self-directed learning (where the learner chooses what and when they learn using web-based programmes) is becoming more prevalent, and can offer National Societies the opportunity to achieve different strategic objectives, such as reaching as many people as possible with basic messages, or targeting specific population groups, such as parents of young children. Self-directed learning also opens up new opportunities in the market place by allowing organizations to offer different learning options and delivering education in ways that people may be more willing to invest in.

As the opportunities for self-directed learning becomes more prevalent with the rise of technology, and the availability or willingness of learners to attend face-to-face courses is reduced, it is important to question the relevance of standardization of courses. Identifying strengths and weaknesses of learning modalities helps National Societies make informed choices.

Summary of scientific foundation

Comparing outcomes of instructor led face-to-face learning to self-directed learning studies (e.g. web-based, gaming or video instruction), only six of 34 initially identified studies focused on skills and knowledge gain, and none measured confidence. Difference in outcomes between studies was also noted. In Sarac, poorer outcomes were shown in web-based instruction, with home mini-manikins used for self-skill development of CPR skills. In another study, Lippman, Livingston, and Craike, tested a two-day face-to-face course against one-day online self-directed theory with a day face-to-face learning. Results showed better BLS scores for the face-to-face cohort, but no significant difference between the two groups for first aid competencies. Charlier used gaming with traditional lectures, and the results supported a combined approach, with the lectures increasing knowledge, but the games supporting learner engagement and enjoyment. Three further studies showed no difference between face-to-face and online learning.

A study that looked at the opinions of secondary school students showed that where they found the course more interesting and assessed the course as being of higher quality, they were more likely to have achieved a greater level of knowledge on certain topics (such as recognition of cardiac arrest).

Regarding confidence, Oliver, Cooper and McKinney examined different educational activities within a face-to-face course, specifically with the intention of increasing learner confidence. Results showed that self-efficacy and willingness could be increased when tested against a standardized course, by incorporating non-clinical activities within a course, such as group discussion of the bystander effect, and helping behaviour qualities.

In addition to this evidence, ILCOR guidelines reflect the findings of this review. The guidelines state that "Training should be tailored to the needs of different types of learners and a variety of different teaching methods should be used to ensure acquisition and retention of resuscitation knowledge and skills. Self-instruction programmes with synchronous or asynchronous hands on practice (e.g. video, DVD, online training, computer giving feedback during training) appear to be an effective alternative to instructor-led courses for laypeople and healthcare providers learning BLS skills".

Guideline

- It is reasonable that National Societies identify learner characteristics and curriculum outcomes to develop varied and blended educational tools and modalities to support learner outcomes. (*)

Key messages

- **Measuring intended outcomes (knowledge, skills, behaviours)** across modalities is needed to justify investment in creating interventions.
- **Diversifying learning modalities** (such as technology, games, role play etc.) or increasing education tools for engagement provides choice to the learner or educator to develop knowledge, skills, and behaviours.
- **Ensure** modalities and their activities **engage the *learner***.
- **Develop facilitators and coaches** with competencies and resources in first aid education to meet learner needs.

Examples from National Societies on the use of different learning modalities

A new approach to learning: German Red Cross

The German Red Cross revised its first aid course for a layperson from 16 learning modules down to nine. The amount of medical information given to the learner was reduced following a review of content in terms of relevance and capacity to retain.

A series of role-plays and learning stations were added to help participants learn effectively to use their existing knowledge in coping with emergencies and accidents, allowing instructors to act more as facilitators rather than experts or teachers. New short film clips on accident-risks at home, in the workplace and in leisure time stimulated cooperative problem and solution discussions in small groups, where learners practice teamwork. New modern graphic learning cards were created to assist non-German speaking participants to access critical information. Early evaluations of the pilot programme indicate overall positive results with critical feedback only coming from a small group of instructors who favour the traditional medical and trainer-centred learning model.

The learner-led approach: British Red Cross

The introduction of *Everyday First Aid* by the British Red Cross in 2012 allowed learners to choose first aid skills which were most relevant to them rather than following a standardized programme. This allowed more time for learners to practice skills that they thought they would use most. Pre- and post-testing of all learners showed a significant increase in confidence by learners who followed this flexible approach versus learners following a standardized administer first aid approach.

Use of story telling: Canadian Red Cross

The Canadian Red Cross made effective use of story telling in their courses with Inuit women where books and instructor-led courses were less effective. Adapting to the local culture and using techniques familiar to the learners helped the Canadian Red Cross to engage and be engaged by learners. For example, one participant was present when there was an avalanche and many people died. The woman told the story of how she tried to rescue a baby. The trainer was able to use this story and adapt his teaching of CPR to reflect the emotion and trauma that the woman had felt in the situation. This powerful tool engages the learner and facilitator to mutually build confidence while learning the skills and knowledge to improve health.

Blended learning, using online and face-to-face courses: Swiss Red Cross

The Swiss Red Cross implemented a blended learning concept first aid course. The theoretical and knowledge part of the course can be learned online. Afterwards in the classroom, the students learn and practice all first aid skills using realistic cases in a supportive learning environment to develop appropriate behaviours. They receive instant feedback from other students instead of right or wrong approach by instructors.

The results of this approach are:
- More motivated students to learn and practice first aid.
- Higher quality participation in practical skill demonstration.
- Higher learner confidence in knowledge and skills.

Use of the phone app in courses: Argentine Red Cross

The Argentine Red Cross incorporated the smartphone first aid app into every first aid course and encourages learners to share the app with their family and friends. One learner reported how she had shown her son the app, and he had then used it just a week later to help his father who was suffering from a diabetic emergency. He remembered what he had learned, and then checked the app when the emergency happened.

Course length: One of the most frequently asked questions by governments and designers is **what is the best length of time for a first aid course?** No evidence directly addresses this question because of the variability in learner preferences, ability, experiences, venues, content, and instructor skills that affect learner outcomes. The individual needs of the learner or learner group will dictate the course content and hence the time. Educational theory supports a curriculum that accounts for the needs of the learner and the outcomes that need to be demonstrated. For example, understanding how much time the learner is prepared to spend learning should inform strategies and amount of content that can be addressed.

National Societies that develop curricula for unique audiences are encouraged to measure learning outcomes and the varying modalities in order to ascertain the most efficient modalities and timing.

Retention and retraining: Similarly, due to the variability of outcomes, learners, and content no studies allowed for generalizing the amount of first aid competencies retained or when to retrain.

Willingness to help tends to increase immediately after education and begins to decrease as time passes. Refreshers, including web-based or phone app tools, offer ways to maintain knowledge and willingness to help. For resuscitation training, high frequency, low dose training (i.e. video reminder every two-weeks) demonstrated an increase of willingness to perform CPR.

Scenario-based and simulation learning

Scenario-based and simulation learning approaches are widely used independently in many first aid learning situations because of the practical approach and opportunity to observe learning outcomes. Combined, there is an assumption that placing learners in a realistic scenario with associated simulated stimulus (such as blood, smoke, devices, etc.) during their experience will support a deeper learning and understanding of a concept. For this review, scenario-based and simulation learning was defined as the introduction of a simulation device or modification in methodologies to include simulated scenario with learners using role-play and moulage.

Summary of scientific foundation

Two studies focused on the development of emergency management behaviours of medical students. Wyatt, Archer and Fallows focused on the use of the high fidelity mannequin, which was valued by the learners. Vincent identified a rise in confidence in the learners that “patients would consider them an effective first responder”.[5] Both studies were descriptive and did not compare outcomes.

Guideline

- National Societies may benefit from combining scenario-based learning and simulation learning for professional responders who need to demonstrate competency proficiencies. (*)

5 *Vincent, D.S., Burgess, L., Berg, B. W., Connolly, K.K. Teaching Mass Casualty Triage Skills Using Iterative Multimanikin Simulations in Prehospital Emergency Care. Volume 13: 241–246, Page 244, 2009.*

Key messages

- **Create relevant scenarios** for learners to want to engage with and make use of learner life experiences to support content.
- Identifying and exploring learners' barriers to helping can be useful to instil confidence and develop helping strategies to use in the future.
- Before planning activities, explore with learners the types of barriers that they feel might prevent them from stepping forward to help in an emergency. Consider ways to break down these barriers. For example:
  - include structured role plays
  - use casualty simulation
  - practice interventions in difficult spaces such as inside a car instead of a classroom.

Examples from National Societies on the use of scenario-based and simulation learning

Wilderness and remote first aid: American Red Cross

When helping people prepare for emergencies in which they are alone or help is delayed, a systematic response enables people manage dangerous situations. The Wilderness and Remote programme builds a learner's capacities through scenarios that utilize role-playing and moulage. Scenarios last from ten to 15 minutes, allowing the full set of first aid competencies to be practised. The key is in providing the opportunity to reflect on the experience emotionally and practically, followed by another chance to improve. The stress from the experience gives instructors and students feedback on the integration of knowledge, skills and behaviours.

The skill and the will: British Red Cross

The British Red Cross introduced new activities to their skill-based training, which were designed to boost learner confidence. One of these activities, entitled *You are not Alone* helps the learner to understand the chain of survival and their role within it. The exercise uses a picture of an accident scene. The learner places her or himself (using a picture, or their name, or just a label saying you) at the centre. The group of learners then talk together about what happens when the person at the centre calls for emergency medical services (EMS), and together the group learns how they become integral to a network of people and helpers who will work together to save the casualty.

First aid education for children

Children count for a significant part of the population who can benefit from first aid education. Their abilities and opportunities to learn emergency response or healthy behaviours directly or indirectly span various disciplines and educational formats. Understanding their abilities to develop first aid competencies can help National Societies prepare effective programmes within and outside the school.

Summary of scientific foundation

The Belgian Red Cross CEBaP recently analysed 5,822 articles to identify what first aid competencies could be developed in school-aged children based on their grade level. General conclusions were not explicit due to the variability of data. Through a multidisciplinary expert panel of primary and secondary educators, first aid education practitioners, physician and child psychologist, consensus was reached in development of appropriate first aid competencies at each grade level. The matrices in the article serve as tools for programme justification and design by grade level.

Guideline

- National Societies should endeavour to create educational programmes for children, according to their cognitive, social, and behavioural abilities, as described by the educational pathway provided by the CEBaP. (**)

Measuring outcomes

It is evident from the high volume of research reviewed for this chapter that there is a paucity of data measuring outcomes for effective first aid education globally.

Guideline

- National Societies are urged to find ways to test the effectiveness of their first aid education, either by measuring the change in self-efficacy of all learners pre- to post-learning, or by undertaking empirical studies in areas where they train to measure the health outcomes of communities. (Good practice point)

Key message

- Identify learner outcomes (such as skills, knowledge and confidence) and ways of measuring effective education (such as using surveys).

Examples from National Societies on measuring outcomes

Consistent evaluation: British Red Cross

Below is a case study from the United Kingdom to illustrate the process in place to achieve consistent evaluation of first aid education. It measures learner outcomes and importantly how effective the educator has been.

The British Red Cross uses learner self-assessment to measure willingness and confidence to give first aid before and after learning on a ten-point scale. This is based on Bandura's guidance around constructing and developing efficacy scales. Such self-assessment scales have been successfully and widely used in healthcare for pain assessment and management.

Learners are asked to rate their willingness and confidence on a zero to ten scale before and after learning. This gives a baseline and end measure of confidence and willingness. A learner's baseline on how they feel gives an indication of their learning potential that the education needs to fulfil. We call this *potential for change*. How much we are able to help learners achieve can tell us how effective we have been in achieving our education outcomes.

The percentage amount of a learner's potential fulfilled through learning can be used as an indicator of the effectiveness of the education provided at helping the learner to achieve the outcomes.

Assume a learner started at two and ended at eight. The potential was 80 per cent (two out of ten). The change was 60 per cent of the scale (six out of ten). The learner moved up six points. That means that the education was 75 per cent effective (60/80=75).

These metrics can be used to examine performance of the educator. Using baseline and change distributions, it is possible to build a picture of the effect upon the confidence and willingness of learners that they achieve through the education provided. Average effectiveness metrics can be corrected by the relative standard error from the change distributions, giving a workable operational tool to support development.

Evaluation based on Kirkpatrick: German Red Cross and the Swiss Red Cross

The German Red Cross and the Swiss Red Cross based their evaluation of first aid courses on the model of Kirkpatrick. The main idea of the model is that there are four levels of evaluation:

1. Reaction: Do the participants accept the training? How do they rate it?
2. Learning: Do the participants gain knowledge and skills in the training? (The skill)
3. Behaviour: Does the training have an effect on the behaviour of the participants? (The will)
4. Results: Is there a measurable effect in the environment, the company or the community where the participants live?

Unfortunately, the evaluation of first aid trainings often remains on the first level. In cooperation with two universities, the German Red Cross has designed two studies, which aim to gain insights in the second level: learning.

The first question is: "Do participants of first aid courses have more knowledge after the course?" The German Red Cross designed an online questionnaire and encourages the participants to answer it directly after the course. They want to know if the knowledge gained is enduring. Therefore, they ask the participants again after three and six months to fill out the questionnaire.

The second question is: "Do participants of first aid courses have more skills after the course?" To answer this question, the German Red Cross designed a small evaluation instrument, which consists of a questionnaire and a case study is introduced at the beginning of the course. These two elements are repeated immediately after the course, to compare the results.

Conclusions

More research is needed to provide a stronger evidence-base for the best ways of improving the effectiveness of first aid education. National Societies are strongly encouraged to measure the effectiveness of their first aid education programmes by using some of the suggestions given in this chapter. As first aid educators, the primary goal is to change the behaviour of rescuers to meet the first aid objective, for example to limit the heat damage and pain of a burn. To do this, educators must understand the local context and resources, striving for the practices best supported by the science. The choice of an educational intervention, or ultimately the clinical intervention, relies on the critical thinking process by local stakeholders (communities and care providers and their leaders and authorities) based on essential parameters, such as the durability and maintainability, accessibility, affordability, safety and the efficiency of solutions. Re-evaluation of the best treatment should be made following lessons learned from emergency situations encountered, the evolution of the context, and education adapted as appropriate.

Despite the lack of scientific evidence, National Societies have come up with ingenious and highly effective strategies for both making first aid education more appealing to learners and making it better. These strategies can be traced back to the educational theories that are listed in this section. IFRC urges National Societies to consider the key messages set out here and to utilize these when developing first aid education programmes. For National Societies needing to identify rationale or evidence to promote first aid education across a population, the IFRC report Law and first aid: Promoting and protecting life-saving action is a major resource available for use. It documents the impact of Good Samaritan Laws, and first aid education at the school, for obtaining driver-license, and workplace, citing national experiences providing examples to use within advocacy efforts.

Key messages for those preparing first aid education:

- **Create relevant contexts** for learners to want to engage with and make use of learner life experiences to support content.
- Ensure activities **engage the *learner*** and the ways that they can most readily learn, allowing the learner to demonstrate knowledge, skills, or behaviours gained.
- **Tailor multiple learning modalities** (such as technology, games, role play etc.) to develop knowledge, skills, and behaviours to increase learner accessibility and knowledge retention.
- Restrict content to what is ***necessary and relevant for the learner – and vary content according to their needs***.
- **Develop facilitators and coaches** with knowledge in first aid that is relevant to the learner.
- Allow the learner ***time to reflect and explore*** their own attitude to helping in different circumstances.
- **Identify learner outcomes (such as skills, knowledge and confidence) and ways of measuring effective education (such as using surveys).**

References

07.
General approach

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Introduction

Certain elements are common when caring for any casualty. Although there is supportive evidence for the use of these elements in first aid, these guidelines do not specifically address this. When creating educational programmes, it is important to observe the following when caring for any casualty. Although the elements of response are often carried out in the sequence outlined below, in reality, tasks may occur simultaneously. For example, the prevalence of cellular phones allows hand-free activation of EMS while initiating care.

The steps below should be observed when approaching a casualty:

1. **Assessment**
   a. Scene survey: primary survey – safety, personal protection, accident mechanism
   b. Casualty survey: airway, breathing, circulation, disability, exposure (ABCDE)

If necessary, start immediate life-saving interventions: open the airway, support breathing, give CPR and control serious bleeding.

2. **Positioning the casualty**

3. **Call for help, EMS or further help** if not already done during primary assessment
   a. Call first – for help
   b. Call fast – emergency service, once assessment has been made

4. **Secondary survey:** (ABC) DE; eventually carry out further assessment using simple questions or more sophisticated schemes like SAMPLE (*see* below) history and vital signs, depending on training level of the first aid provider.

5. **Additional first aid** as the situation requires.

Implementation considerations

Depending on the setting and the level of the participants not all the steps should be addressed in a first aid training course. Educators should address the needs and abilities of the learners to ensure that effective and relevant strategies can be developed depending on circumstances.

Assessment

For all emergency care including first aid, providers should first survey the *scene* to assess for:

Safety

First aid providers must be aware of their personal safety and take universal precautions that may vary based on specific circumstances. The risks may come from:

- **The environment**

In certain instances, the surroundings may not be safe due to: electric cables, fire, risk of explosion, dangerous goods or the casualty may be in an unsafe location, such as in or near water or ice. Special attention should be paid to closed or confined spaces as there might be a possibility of lack of oxygen and/or emission of poisonous gases or the limited possibility to escape, if needed. Taking this into consideration, the first aid provider should decide whether he or she:

  - should go ahead or wait for technical rescue teams (e.g. fire brigades, EMS, mine rescue)
  - should only enter with the assistance or escort of technical rescue teams
  - should only enter for a short time to move the casualty (preferably with technical assistance) to a safer place in order to provide care more effectively
  - feels it is safe for the casualty to remain in their current location.

- **The casualty**
  - The casualty may be aggressive due to alcohol or drugs.
  - There might be a risk of infection due to contact with body fluids: this is a common threat (*see* General principles).

Mechanisms to assess accident or illness

This is informative for the first aider to understand what injuries might be expected. This can apply not only to traumas but also to other acute events (e.g. injuries may be very different if a person faints on the bed versus if they fall on a stone floor).

All casualties should be thoroughly assessed to assure that all first aid needs are identified. For an assessment to be effective, it is helpful to follow a standard approach that is easy to remember and that follows the priorities of identification and treatment.

This allows:
- Prioritizing the needs by taking care of the most time-sensitive problem first; and
- Providing care once needs are clearly identified.

The common mnemonic is ABCDE:
A: Airway
B: Breathing
C: Circulation: check for any external bleeding
D: Disability: mental status and peripheral nervous system
E: Expose the casualty for further assessment and treatment

If any problem during the ABCD survey is identified in addition to immediate care required, EMS should be activated. When resources and situations permit, further assess the casualty by taking his or her history and performing a detailed head-to-toe physical examination. Any additional problems identified should be treated.

There are typical symptoms identified in the initial assessment that allows the first aid provider to prioritize the likely causes of an emergency. Managing the situation as identified by the mnemonic is beneficial for the casualty. In addition, all casualties should be assessed for shock and its causes (*see* Shock).

Implementation considerations

ABCDE is widely used as a general survey mnemonic. Following its use, it should be stressed that AB and C may implicate immediate actions before proceeding to the next letter. For example, if the airway is not patent, immediate opening is required for assessing B, as no breathing can be expected through a blocked airway (*see* Resuscitation). D and E may be assessed only if AB and C are acceptable, eventually after proper interventions. While ABCDE is a popular mnemonic, based on the local language, alternative approaches to track the priority of assessment and management may be needed.

During education or training, explanations should be tailored to the audience and/or level of first aid required. For example, in a suspected case of cardiac arrest, assessment of C may be dropped as lay learners are taught to look for signs of circulation to assess for cardiac arrest. If there is no normal breathing it may be presumed that the casualty is in cardiac arrest (*see* Resuscitation).

If resources permit, along the ABCDE pathway, a short medical history may also be taken. However, if resources do not permit, the history should follow ABCDE. In an advanced training, participants can be taught additional schemes and mnemonics, like SAMPLE, which helps to remember other important elements:

- **S:** Signs and symptoms
- **A:** Allergies
- **M:** Medication
- **P:** Past medical history
- **L:** Last meal
- **E:** Event

This and other mnemonics exist and may be taught depending on the level of learner.

Casualty positioning

Summary of scientific foundation

A formal scientific evidence review was carried out for this topic, however no published evidence was found relating to turning a casualty from prone (front) to supine (back) position. The following guidelines are therefore based on expert opinion.

Guidelines

- First aid provider should approach the casualty from the side of his or her face. In this way, the casualty is not forced to move his or her head. (Good Practice Point)
- An unresponsive casualty should be rapidly assessed for breathing. If normal breathing is not quickly identified in the position found, place the casualty, gently, in the supine position. If the person is breathing normally, he or she should be placed in the side lying recovery position. (Good Practice Point)
- If the casualty is pregnant, the left side lying recovery position is preferred. (Good Practice Point)

Implementation considerations

In certain circumstances, the casualty should remain in the position in which they are found until professional help arrives.

In other situations, the casualty's position may need to be changed. This may be because the casualty needs to be moved away from danger or since the first aid provider needs to call for additional help, in order to get equipment or to better assess and/or treat the casualty. The following general rules should be observed:

- If the area is unsafe for the first aid provider or for the casualty, he or she should be moved to a safer place, if possible (*see* Assessment, Safety and Environment).
- If the person is face down and unresponsive (prone position), the first aid provider should turn the casualty face up (supine position) to check breathing (*see* Resuscitation).
- If the casualty is unresponsive and breathing normally but might have a spinal injury, it is preferable not to move him or her.
- If the injured casualty is unresponsive and has difficulty breathing because of bleeding, copious secretions or vomiting, or if you are alone and have to leave to get help, the casualty should be placed on their side with their airway open (recovery position).
- If the casualty is conscious and breathes with difficulty, the best position for effective breathing is to seat him or her upright or leaning slightly forward.

Call for help, EMS or further help

While first aid is vitally important, it is only one aspect of the continuum of care. All first aid education should include:

- **How to call for additional help.** In certain countries you can call a pre-determined national number(s), while in other cases approaches to getting further help may be less standardized. In European countries a common emergency call number 112 has been introduced. In the United States and Canada the number to call is 911. Other countries have different numbers. The request for further help may include – apart from EMS – fire brigade, police, other medical services, poison control centre etc.
- **Call for further help or render care first?** In certain situations, first aid may not be necessary or may not be needed immediately but rather contact with a casualty's routine healthcare provider may be warranted. If the condition warrants further help, the decision whether to provide care first or summon help first may vary based on the National Society, environment, level of

first aid training and the specific condition being treated. However, with the increased use of cellular phones, it may not be necessary to decide on summoning help first since the first aid provider can put the cellular phone on the speaker while care is rendered.

- If the first aid provider is alone with a casualty having circulatory arrest, the *call first* principle should be followed (*see* CPR – be aware of the differences between an adult or a child/infant arrest). Otherwise *call fast* is recommended, meaning that call should be started as soon as possible when the emergency is recognized. In many cases, it is possible to start an emergency call, and place the phone in hands-free mode, allowing the first aid provider to talk to emergency services and provide care for the casualty simultaneously.
- If there are several casualties at the scene (multiple casualty incident), it may be appropriate to call EMS at first just to inform them about a potentially critical situation, and to repeat the call after having more detailed information.

Medication administration

Generally, a layperson, or even a skilled first aid provider, is not authorized to prescribe or give medication. In some countries, these legal restrictions are evolving. Depending on the scope of practice, target audience for programmes, medical oversight, and the extent and depth of educational programme offered, medication administration may be appropriate and used in selective first aid situations.

In some countries, there may be specific medications and/or conditions for which a layperson is allowed to administer medication (e.g. an epinephrine auto-injector or naloxone). Different countries have different rules regarding what medications a first aid provider may administer with or without a physician's prescription. For example, in certain countries any first aid provider can give aspirin, while in others this is prohibited. Therefore, it is crucial that these rules are verified based on the local context to ensure compliance with the law before undertaking any activity.

The following are examples when a first aid provider may administer medication. This will depend on the country, regulations, local medical protocols, context and responsibilities and capacity of the individual National Society:

- The situation is well-defined (e.g. decompression sickness by a scuba diver, acute chest pain, asthma, etc.), the need for the medication is time sensitive and the first aid provider has the knowledge and experience to:
  - recognize the situation
  - understand the contraindications to and dangers of administering a certain medication
  - administer the medication exactly as prescribed.
- The casualty is suffering from an exacerbation of a known chronic condition (e.g. allergy or asthma) and a physician has prescribed a certain medication for the condition. If the medication is available, and the casualty would like (or is supposed) to administer it, there may be instances where the first aid provider may assist with this.

First aid providers under the following circumstances may typically administer medication:

- Help the casualty to administer his or her prescribed drugs for:
  - chest pain suspected cardiac origin: aspirin, nitroglycerin
  - bronchial asthma: bronchodilator
  - anaphylactic reaction: epinephrine
- For specially trained first aid providers, to administer certain medicines upon his or her discretion, if local regulations allow (including situations listed above):
  - decompression sickness, for scuba divers: oxygen
  - narcotic overdose: naloxone

Oxygen while considered a medication, in many areas follows different regulations and can be administered by a first aid provider. If local regulations permit, first aid providers may be trained in the use of oxygen and allowed to administer it for conditions where there is known or presumed hypoxia (*see* Use of oxygen).

This list is not complete and universal; it may differ based on local regulation.

08.
First aid for medical conditions

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Allergic reaction and second dose of epinephrine for anaphylaxis

Introduction

Allergies are relatively common, but an emergency situation can arise in a small proportion of people when they develop a life-threatening anaphylactic reaction. An anaphylactic reaction is distinguished from a routine allergic reaction by the presence of life-threatening signs, such as:

- breathing difficulty (shortness of breath, wheezing, airway swelling)
- circulatory symptoms (fall of blood pressure, collapse, shock)

These life-threatening signs usually develop in parallel to allergic reactions:

- skin signs (hives, swelling, including the face)
- gastrointestinal symptoms that are more common when ingesting a substance to which the person has an allergy (cramps, diarrhoea)

Anaphylactic reactions may dramatically lead to death. In an anaphylactic reaction, epinephrine (given intramuscularly, using an auto-injector) can be lifesaving. Inappropriate use of an auto-injector (in a case of misdiagnosis, incorrect route of administration, inadvertent intravenous administration, or administration of an excessive dose of epinephrine) may result in adverse reactions. Guidelines in this section are updated from evidence reviewed in 2011.

Summary of scientific foundation

Many people with a history of anaphylaxis carry a lifesaving epinephrine auto-injector. Studies have shown with proper training, parents can correctly use an auto-injector to administer epinephrine to their child. Unfortunately, all too often neither the person concerned nor the family members know how to use an auto-injector correctly.

Knowing when to use an auto-injector depends on being able to recognize and assess the signs and symptoms of anaphylaxis. Evidence from seven studies demonstrates that it is difficult to do so, even for medical providers. But one study demonstrated that parents of children who have had multiple anaphylactic reactions can recognize the signs and symptoms more accurately, leading to the use of an auto-injector, but training and experience are required.

Evidence from one small, retrospective chart review, a patient survey study and expert opinion suggests that some patients suffering an anaphylactic reaction may require a second dose of epinephrine if the first dose is not effective in relieving symptoms. To support this, one retrospective study demonstrated that anaphylactic reactions are biphasic 20 per cent of the time, with a mean of ten hours between the onset of symptoms. There have also been four studies that have documented adverse reactions, including fatalities, due to misdiagnosis of an anaphylactic reaction, inappropriate route of administration, or administration of an excessive dose of epinephrine.

References

Guidelines

- First aid providers should **NOT** be expected to recognize the signs and symptoms of anaphylaxis without training and experience. (**)
- First aid providers should be trained and experienced in recognizing the signs and symptoms of anaphylaxis. (**)
- Epinephrine should be used intramuscularly to treat anaphylaxis. (**) Unless the physician prescription is different, for adults, and children over 30kg body weight, epinephrine is recommended in a dose of 0.3mg intramuscularly. For children between 15kg and 30kg body weight, an epinephrine dose of 0.15mg is recommended.
- Use of an epinephrine auto-injector for a person with symptoms of anaphylaxis, for whom it is not prescribed, may be considered with appropriate training. (*)
- For a person with symptoms of anaphylaxis and treated by but did not respond to epinephrine, and arrival of EMS is not expected within five to ten minutes, a second dose may be considered. (*)
- First aid providers should call EMS when anaphylaxis or severe allergic reaction is suspected or recognized in a person. (Good Practice Point)
- Epinephrine should be given only when symptoms of anaphylaxis are present. (Good Practice Point)
- First aid providers should be familiar with the epinephrine auto-injector so that they can help someone having an anaphylactic reaction self-administer the epinephrine. (Good Practice Point)
- First aid providers may be permitted to use an auto-injector if the casualty is unable to do so, provided that a physician has prescribed the medication and local law permits. (Good Practice Point)

For Breathing difficulties and Shock *see* relevant sections.

Implementation considerations

The use of epinephrine for anaphylaxis depends on local laws, regulations and processes, including liability protection. National Societies may need to vary their methodologies for implementation according to the educational opportunities in the national context.

Regarding the use of an auto-injector, the following points have to be taken into account:

- There are different types of auto-injectors, for instance:
  - Some have an injection needle at the end (just need to remove the protecting cap, stick the needle through the skin into the muscle and press the plunger).

   - In others the needle is not visible: After removal of the protecting cap the tip of the device should be placed against the skin and the device should be pressed down; allowing the needle to go through the tip and the skin into the muscle. The user should hold the device pressed down for about ten seconds to allow the entire dose to be administered.
- The usual place for injection is the middle of the outer side of the thigh.
- The injection can go through clothes, if the anaphylactic reaction is very serious, and the clothes are not thick.
- Do not use the auto-injector if the medicine inside is cloudy or discoloured, or if the expiry date has passed.
- For disposal of the auto-injector follow the usual rules for drugs and disposable medical devices.

First aid providers not trained in using an auto-injector may not be able to quickly learn how to use it properly. There may not be time to read the instructions for use.

Usual side effects of epinephrine (some of these may be the consequence of the anaphylactic reaction too):
- faster (pounding) sometimes irregular heartbeat
- throbbing headache
- excitement, anxiety, or fear
- weakness or shakiness
- dizziness
- paleness
- nausea and vomiting
- sweating

Poisoning

Introduction

A large number of poisonous substances are found at home and workplace. Poisoning with carbon monoxide and carbon dioxide can also occur in a domestic and workplace environment. It is important to understand the toxic nature of chemical substances in the environment and the proper protective equipment and emergency procedures in case of toxic exposure. Most frequently, exposure occurs through inhalation or ingestion of poisonous material, though some agents can be absorbed through the skin as well. Most countries have a poison control centre (or equivalent institution), which serves as an excellent resource for advising on the treatment of ingestion of, or exposure to, a potential poison. It is important to inform the poison control centre of the nature and time of exposure and the name of the product or toxic substance.

Summary of scientific foundation

This subject was reviewed by the Consensus on Science in 2010 and the CEBaP re-evaluated the available literature for this edition of the guidelines. Carbon monoxide and carbon dioxide intoxication was neither scientifically evaluated in the Consensus on Science in 2010 nor in 2015. The United Kingdom Public Health Authority and the Canadian Centre provided additional sources of information given in this publication for occupational health and safety.

External contact

Water irrigation

Irrigation of the skin and eye after exposure to caustic agents can reduce the severity of tissue damage and has been a mainstay of first aid treatment. Evidence from multiple studies examining alkali and acid exposure of both the eye and skin showed that outcomes were improved when water irrigation was rapidly administered in first aid treatment. In one non-random case series of immediate (first aid) versus delayed (healthcare provider) skin irrigation, the incidence of full-thickness burns was lower and length of hospital stay was decreased by 50 per cent with immediate and copious irrigation of skin chemical burns. Evidence based on animal studies also supports water irrigation to reduce exposure of the skin and eye to acid. In a study of rats with acid skin burns, water irrigation within one minute of burn prevented any drop in tissue pH, whereas delayed irrigation allowed a progressively more significant fall in tissue pH.

Internal contact

Left side lying

It was shown that the left decubitus position resulted in a statistically significant decrease of acetaminophen uptake (measure of gastric emptying), compared to the right decubitus position in one randomized controlled trial in which an acute overdose was simulated (ingestion of 80mg/kg acetaminophen in the form of 160mg paediatric tablets).

Dilution with milk or water

There are no human studies on the effect of treating oral caustic exposure with dilution therapy. Five animal studies demonstrate histological benefit to animal tissue representative of the esophagus when diluent was administered after exposure to an alkali or acid. One in vitro chemistry study demonstrated no benefit from the addition of large volumes of diluent to either a strong base or a strong acid.

Syrup of ipecac

Studies examining clinically relevant outcomes found no advantage to administering syrup of ipecac to a suspected casualty of poisoning. Additional studies demonstrated adverse effects, such as intractable emesis and delayed activated charcoal administration, when syrup of ipecac was given. One non-clinical, but epidemiologic study showed that administration of syrup of ipecac is not associated with decreased use of healthcare resources. Syrup of ipecac is no longer recommended for any toxic ingestion.

Activated charcoal

There is limited evidence in favour of first aid administration of activated charcoal (medical charcoal) ingestion after poisoning: it was shown that activated charcoal resulted in a statistically significant reduction in drug viability, compared to no activated charcoal.

Evidence of very low quality has shown that activated charcoal resulted in a statistically significant increase in complications such as vomiting, compared to no activated charcoal.

Carbon monoxide

Carbon monoxide is a non-irritating, colourless and an odourless gas and may be very difficult to detect. It is a flammable gas and it may react violently with other substances and sources of energy, which might also cause explosions. Frequent sources of carbon monoxide are gas combustion engines, fires, furnaces and space heaters, especially in poorly ventilated spaces. Carbon monoxide binds to red blood cells more strongly than oxygen can, thus reducing the amount of oxygen that can be carried by the blood to reach important organs such as the heart and brain.

Typical symptoms of carbon monoxide poisoning are headache, nausea, vomiting, muscle weakness (especially in lower limbs), unconsciousness and seizures. Unlike other conditions that decrease oxygen in the blood the person poisoned by carbon monoxide is almost never pale or blue (cyanotic). The skin colouring will often be bright pink or flushed red.

Carbon dioxide

Carbon dioxide is a colourless, tasteless, odourless gas that is present in the earth's atmosphere. It is non-flammable and non-toxic. It is produced naturally by all living organisms and removed from the body in air breathed out. It is constantly being produced and removed from the environment by oceans and plants in a process known as the carbon cycle. Human activities such as burning coal, oil and gas lead to the production of carbon dioxide; hence it can enter the environment from emissions from factories or power stations that burn fossil fuels. Motor vehicles and burning of oil and gas in homes for heating also produce carbon dioxide and is a major contributor to global warming.

Large amounts of carbon dioxide are produced during fermentation process in wine cellars, silos or cesspools, especially if they are not properly ventilated. It is heavier than air and floods the cellar or confined spaces and can dilute the oxygen concentration in air below the level necessary to support life.

Low concentrations of carbon dioxide cause increased respiration and headache. In high concentrations, it may cause asphyxiation – so it is not really a classical intoxication, but people may die due to the lack of oxygen in the carbon dioxide filled atmosphere. Symptoms may include loss of mobility or consciousness, dizziness, drowsiness and nausea. Besides, skin contact with frozen carbon dioxide (dry ice) may cause frostbite.

References

Guidelines

- For all poisoning
  - In giving first aid to a casualty, the first priority is the safety of the first aid provider, meaning that any direct contact with gases, fluids or any other material possibly containing poisons should be avoided. (Good Practice Point)
  - If life-threatening conditions exist, call EMS for further help. (Good Practice Point)
  - If non-life threatening conditions exist, call the poison control centre for guidance. (Good Practice Point)

- For ingestion poisoning
  - Activated charcoal should be used as a first aid measure only if directed by the poison control centre or equivalent agency. (**)
  - Ipecac syrup must **NOT** be used by a layperson as a first aid treatment in cases of acute poisoning. (**)

- For casualties who have ingested a caustic substance, administration of a diluent by a first aid provider is **NOT** generally recommended. (*) But in remote areas where further care is delayed and when advised to do so by a poison control centre, EMS or local equivalent, giving a diluent (milk or water) may be appropriate. (*)
- The casualty should preferably be laid on his or her left side. (*)

- For gaseous poisoning
  - *Flammability warning:* In rooms which are potentially filled with carbon monoxide exposure to all sources of ignition such as naked flames, electrical equipment, oxidizing chemicals and the smoking of tobacco products should be prevented. (Good Practice Point)
  - Move the casualty out of the area with gas immediately, but only if this can be done without endangering the first aid provider (Good Practice Point). In most cases the rescue has to be carried out by a professional rescue service.
  - Only trained first aid providers should administer oxygen to casualties of carbon monoxide and carbon dioxide poisoning. (Good Practice Point)

Implementation considerations

For exposure to a toxic substance, the preferred action is to call and follow instructions of the poison control centre or EMS if these resources are available. The decision on which entity to call is based on whether or not the casualty displays life-threatening symptoms. If life-threatening symptoms are present, the first aid provider should call EMS since their assistance will be required to manage the symptoms. For all other situations, the poison control centre is the best first resource.

In general, the first step is to stop or limit further effect of the poison by stopping continued exposure.

- In the case of inhalation of a toxic gas, the casualty should be removed from the area, but this should be done only if the first aid provider's safety can be maintained.
- In the case of external or internal contact with a toxic material:
  - dry chemicals or powders should be removed before the casualty is rinsed
  - body surface should be rinsed, the (caustic) toxin should be diluted
  - poison in the stomach or bowel may be removed or bound (usually done by healthcare professionals).

Personal protective equipment (e.g. gloves and glasses) should be worn during removal of toxins.

Mouth-to-mouth resuscitation should be avoided in the presence of toxins such as cyanide, hydrogen sulphide, corrosives or organophosphates. Preference is to use the bag-valve-mask (BVM) device by those who are trained to do so.

National Societies will need to determine whether education on providing assisted ventilation should include the use of a barrier device and/or the use of a BVM resuscitator. This decision should be based on the level of the provider being trained, resources, medical direction, infection control standards, the approaches of local emergency services, public health input and national circumstances (i.e. ethical considerations, customs, local practices, etc.).

First aid providers and healthcare students frequently mix up identification of intoxication by carbon monoxide and carbon dioxide. Hence, specific efforts need to be made to help the learner understand the difference.

First aid education covering the topic of poisoning should include advice to learners that a qualified and registered engineer should regularly service all cooking and heating appliances that use fossil fuels (such as gas, oil and coal).

Learners should be alerted to the benefits of carbon monoxide detectors and carbon dioxide alarm installation.

Breathing difficulties

Difficulties in breathing can be a subjective complaint or can be accompanied by a very high (more than 20 per minute in adults and adolescents; more than 30 in children, 40 in infants and 60 in neonates) or very low (less than 10 per minute in adults and adolescents; less than 15 in children, 25 in infants and 40 in neonates) breathing rate, and/or visible efforts and/or noisy breathing. Among the many causes of breathing difficulties the most important are upper airway obstruction (*see* Resuscitation), chest injury, heart failure, chronic obstructive lung disease, bronchitis, (bronchial) asthma, Croup (children and infants) and bronchiolitis (young children and infants).

Asthma

Introduction

The incidence of acute severe asthma (and death as a consequence of it) is increasing, especially among urban populations and in industrialized nations. Many people with asthma have been prescribed and can self-administer bronchodilator medication. Inhaled bronchodilator medications are safe with few untoward effects. According to some studies, albuterol and salbutamol treatment does not significantly change the heart rate, blood pressure and serum potassium. Only one study proved a statistically significant change in heart rate with different treatment regimens of albuterol and salbutamol. These guidelines have been updated to reflect new evidence.

Summary of scientific foundation

The position of the patient may relieve dyspnea (difficult or laboured breathing, feeling of shortness of breath, tightness in the chest and the feeling of suffocation). Most of the dyspneic patients (including those having acute asthma attack) prefer being in an upright, and not a supine position. One study showed limited evidence favouring a seated position leaning forward. It was shown that being seated leaning forward resulted in a statistically significant increase of the number of patients with perceived relieved dyspnea, compared to standing.

Bronchodilators improve respiratory function and peak flow and reduce respiratory distress. There are many studies of bronchodilator use; one randomized, double-blind study showed that bronchodilators significantly improved airway function. Another study in children has shown that early administration of bronchodilators in the emergency setting reduces severity of attack and the subsequent need for hospitalization. Additionally, studies have demonstrated that those trained with a basic level can effectively recognize an acute asthma attack and administer albuterol to acute asthma patients. The improvement of peak expiratory flow rate demonstrates the efficacy of albuterol treatment for bronchial asthma in the pre-hospital setting.

References

Guidelines

- People with breathing difficulty may be moved to a position of comfort, with loosening of any restrictive clothing. (*)
- First aid providers may help the person to sit upright leaning forward. (Good Practice Point)
- It is reasonable that first aid providers are familiar with the commonly used bronchodilator inhalator devices to assist a person in using these devices if he or she experiences breathing difficulties. (Good Practice Point)
- A first aid provider carrying a bronchodilator inhaler and specifically trained to use it may administer bronchodilator upon his or her discretion, if local regulations allow this. (*)
- A first aid provider may assist a casualty to administer his or her bronchodilator inhaler if local regulations allow this and they have received the specific training to do so. (*)
- If the person has no bronchodilator or the bronchodilator is not effective, or the person is experiencing severe breathing difficulties (change in mental status, poor perfusion, slow breathing, the first aid provider should activate EMS and continue to observe and assist the individual until help arrives. (Good Practice Point)
- In certain cases, a specifically trained first aider can give supplementary oxygen to the person having breathing difficulties. (Good Practice Point)

See Use of oxygen

Implementation considerations

The use of a bronchodilator or inhaler for asthma depends on local laws, regulations and processes, including liability protection. National Societies may need to vary their methodologies for implementation according to the educational opportunities in the national context.

Administration of bronchodilators or use of inhalers by first aid providers requires training and specific competencies in bronchoconstriction recognition, metered dose inhaler or nebulizer use (depending on the method being used) and availability of equipment.

Chest pain

Introduction

Chest pain can be a symptom of a range of conditions (heart, lung, chest wall, etc.). For first aid providers, one of the most important considerations to take into account is heart attack (myocardial infarction). Smoking, high blood pressure, diabetes and being overweight are key risk factors that can result in a heart attack. Usually, myocardial infarction is caused by atherosclerosis acutely complicated by thrombosis (blood clot) in the heart vessels. Antithrombotic treatment is desirable as soon as possible. Complications of a heart attack include shortness of breath, shock and cardiac arrest. Cardiac arrest can follow a heart attack and can be caused as a result of a number of reasons including rhythm disturbances, mainly pulseless ventricular tachycardia or ventricular fibrillation (VF). Immediate CPR using AED provides the best chance for survival. Guidelines in this section are updated from evidence reviewed in 2011.

Summary of scientific foundation

For preventing mortality and improving the long-term outcome, antithrombotic treatment with aspirin should be given as soon as possible. First aid providers can carry out this task.

Evidence from two large randomized trials clearly demonstrates that administration of aspirin within the first 24 hours of onset of chest pain in patients with acute coronary syndromes reduces mortality. Evidence from a retrospective registry shows an association between early pre-hospital administration of aspirin and lowered mortality in patients with acute myocardial infarction. A retrospective study demonstrates that pre-hospital administration of aspirin is safe; this study not only suggested that pre-hospital aspirin might facilitate early reperfusion but also the value of administering aspirin early during acute myocardial infarction.

There are no studies evaluating the safety and efficacy of having first aid providers or a layperson administer aspirin to people with chest pain. But one could extrapolate from studies with EMT-basic whose ability to diagnose the etiology of chest pain would be no different than that of a first aid provider. Based on this extrapolation and expert opinion, this practice appears to be safe and effective.

References

Guidelines

- A person experiencing chest pain must be assisted with taking their prescribed aspirin. (**)
- If the person experiencing chest pain, believed to be cardiac in origin, has not taken an aspirin, the first aid provider should give him or her a single oral dose of 150–300mg chewable or soluble aspirin and instruct them to chew it whilst waiting for professional assistance to arrive, unless there is a contraindication, such as an allergy or bleeding disorder. (**)
- The first aid provider may assist the person experiencing chest pain to get into a comfortable position (usually semi-sitting based on local protocols) and ask him or her to refrain from physical activity. (*)
- A first aid provider may administer oxygen to a hypoxic person experiencing chest pain if he is trained and if oxygen is available. Use of oxygen should not delay other actions. (*) *See* Use of oxygen
- The first aid provider should call for EMS as soon as a heart attack is suspected. (Good Practice Point)
- The first aid provider should assist the person with administration of his or her prescribed nitrate. (Good Practice Point)
- If trained, first aid provider may administer a nitrate to the person experiencing chest pain. (Good Practice Point)

Implementation considerations

Warning signs of a heart attack may include the following:[6]

Chest discomfort
Most heart attacks involve discomfort in the centre of the chest that lasts more than a few minutes or that goes away and comes back. It can feel like uncomfortable pressure, squeezing, fullness, burning or pain.

6 http://www.heart.org/HEARTORG/Conditions/HeartAttack/WarningSignsofaHeartAttack/Warning-Signs-of-a-Heart-Attack_UCM_002039_Article.jsp#.VtF50ZMrLow

Discomfort in other areas of the upper body
Symptoms can include pain or discomfort in one or both arms, the back, neck, jaw or stomach.

Shortness of breath
Can be with or without chest discomfort.

Other possible signs
These include paleness, breaking out in a cold sweat, nausea or light-headedness.

Some heart attacks are sudden and intense, but many start slowly with mild pain or discomfort. Often, affected people are not sure what is wrong and wait too long before getting help. Even if a first aid provider is not sure it is a heart attack, he or she should *not wait more than five minutes* before calling the emergency response number to request for rapid treatment and transport to the emergency room. Rapid access to treatment for a heart attack decreases heart muscle damage, and improves chances of survival and function after the attack. EMS teams and systems are organized to revive someone whose heart has stopped.

While traditionally chewable baby aspirin has been recommended, in some cases non-enteric coated aspirin or any form of aspirin may be used. The important point to highlight in educational materials is that the casualty must chew the aspirin. By doing so, any form of aspirin will be absorbed and take effect in a short timeframe.

The administration of aspirin, nitrate and oxygen by first aid providers for chest pain depends on local law, regulations and processes, including liability protection. National Societies may need to vary their methodologies for implementation according to the educational opportunities in the national context. (*see* Medication administration).

Stroke

Introduction

Stroke is an acute disturbance of cerebral circulation (commonly, diminished circulation; less frequently, bleeding), being the second leading cause of death in people over the age of 60, and the second leading cause of disability (loss of vision, speech or partial or complete paralysis).

Early admission to a stroke centre greatly improves the prognosis for the casualty, highlighting the need for first aid providers and the lay public to be able to quickly recognize stroke symptoms and activate EMS or initiate transport to a stroke centre. The goal is for the casualty to receive definitive treatment in time to benefit from newer therapies. In most cases, this means receiving thrombolytic (dissolving of a clot) treatment within three to five hours of the onset of stroke symptoms. In cases caused by bleeding, occasionally a surgical intervention is of benefit. While the goal is to provide treatment within three hours, the sooner the better is the rule. There are new procedures available at only a few stroke centres, such as mechanical clot removal that can be effective even past three hours. Guidelines in this section are updated from evidence reviewed in 2011.

Summary of scientific foundation

An accurate, concise and rapidly deployable method to evaluate individuals experiencing stroke-like signs and symptoms is desired and has been attempted through the use of various stroke assessment tools since the mid-1980s. In evaluating the available stroke performance instruments, two specific questions were addressed:

- Is the screening tool FAST (face, arms, speech and time) an effective stroke assessment tool for first aid providers?
- What is the most effective stroke assessment tool presently available for first aid providers?

To address the question, whether there was a stroke assessment tool which could be used by a first aid provider, the American Red Cross Scientific Advisory Council focused on stroke scales that utilized validated and reliable items including the Cincinnati Pre-hospital Stroke Scale (CPSS), the Los Angeles Pre-hospital Stroke Scale (LAPSS) and FAST.

An abbreviated three-item Out-of-Hospital National Institute of Health Stroke Scale was developed from the National Institute of Health 15-item stroke diagnostic tool. The model utilized facial palsy, arm difference and dysarthria presented as 100 per cent sensitive in predicting stroke potentially eligible for intervention with 92 per cent specificity. Due to dysarthria and aphasia being confusing, a single item was created and identified as abnormal speech. The presentation of an abnormality with facial palsy or motor arm and combined with abnormal speech presented a scale with 100 per cent sensitivity and 88 per cent specificity. The scale identified the potential for use by other medical personnel and the general public to assist with recognition of a stroke. The National Institute of Health Stroke Scale identified and provided reliability and validity for 15 individual functional assessment items. A rapid stroke identification instrument that combined the CPSS and LAPSS into FAST was created in 2003 by modifying the assessment of language and deleted the blood glucose level assessment. The primary assessment designed for administration to seated individuals to detect unilateral motor weakness and included facial weakness, arm weakness and speech disturbances.

Another study in 2005 sought to determine the ability of individuals to identify deficits and accurately report their findings to an investigator. Utilizing the stroke items of facial weakness, arm weakness and speech deficits portrayed by stroke survivors possessing unresolved symptoms, participants correctly administered the CPSS directions in an average of 94 seconds – 96 per cent, 99 per cent and 98 per cent respectively. There was an overall ability of adults to correctly administer the CPSS being 98 per cent. Facial weakness specificity was 74 per cent with a sensitivity of 94 per cent. Arm weakness sensitivity was 92 per cent and specificity 72 per cent. Speech deficit specificity and sensitivity were both 96 per cent. Findings concluded the ability to expedite pre-hospital triage of stroke symptoms by untrained laypersons in a timely manner.

In summary, studies demonstrated that training first aid providers to use stroke-assessment systems enable them to recognize stroke earlier, by which the interval between stroke onset and arrival at hospital providing definitive treatment is decreased and outcome is improved. According to these studies, without training for using stroke assessment system, 76.4 per cent of lay people can recognize signs and symptoms of stroke. However, after such training, 94.4 per cent are able to recognize stroke, reliably over three months following the training.

References

Guidelines

- Using a stroke assessment system by first aid providers is strongly advised. (**)
- For a person showing stroke signs and/or experiencing stroke symptoms, first aid providers should:
  - call EMS as soon as possible. (Good Practice Point)
  - help the person into a comfortable position (based on local protocols), ask him or her to refrain from physical activity, and regularly check consciousness and breathing. (*)
  - if the person is unresponsive but breathing normally, the first aid provider may place him or her in recovery position, or may maintain patent airways by head tilt – chin lift manoeuver. (*)
- Utilization of FAST is appropriate by the first aid provider and general public. (Good Practice Point)

Implementation considerations

In terms of first aid, the most important actions are to:
- Recognize the warning and/or early signs of stroke.
- Note their time of onset.
- Immediately call the EMS for expert help.

The possibility or probability of stroke can be recognized easily by identifying the following warning signs:
- Sudden numbness or weakness of the face, arm or leg, especially on one side of the body: the probability of stroke is strongly supported if the person, when asked to:
  - show the teeth, the corner of their mouth is dropped
  - lift both arms with palms turned upwards while eyes are closed, one arm is drifted or dropped
- Sudden confusion, trouble speaking or understanding: the probability of stroke is strongly supported if the person, when asked to:
  - repeat a simple sentence, speech is unclear or slurred, or the words do not come easily
- Sudden trouble in seeing with one or both eyes.
- Sudden trouble in walking, experiencing dizziness, loss of balance or coordination.
- Sudden, severe headache with no known cause.
- Seizure of a non-epileptic person.

Simple stroke assessment systems (e.g. CPSS or FAST) are easy to use and concurrently have high sensitivity to recognize stroke. Specificity can be increased if the first aid provider can measure blood glucose level (to exclude hypoglycaemia) and uses a more advanced stroke assessment system (e.g. LAPSS, Ontario Pre-hospital Stroke Scale (OPSS), Recognition of Stroke in the Emergency Room (ROSIER), Kurashiki Pre-hospital Stroke Scale (KPSS)).

Stroke-like symptoms that are mild and temporary may indicate a transient ischemic attack (TIA), which is a warning or mini stroke that results in no lasting brain injury. The short duration of the symptoms and lack of permanent brain injury are the main differences between TIA and stroke. Nevertheless, recognizing the possibility of a TIA is important because it allows early treatment to reduce the risk of a major stroke.

See Unconsciousness and Seizures, which can be complications of stroke.

Dehydration and gastrointestinal distress

Introduction

Dehydration can be a consequence of a wide range of health impairments (vomiting and diarrhoea, heat stress, fever, etc.) or vigorous exercise and hard physical work, particularly in hot and humid environments or cold environments with strenuous activity and/or due to wearing excessive clothing. These not only lead to a significant loss of water in the form of sweat and loss of other body fluids but also a loss of electrolytes that are essential for many normal physiological body functions. The consequences for the body can range from cramps to alternations in mental function, shock that can be life-threating and even lead to death if untreated, especially in small children and older people.

Other common symptoms of gastrointestinal distress may include abdominal pain, nausea and/or vomiting, diarrhoea and at times fever.

Summary of scientific foundation

This topic was reviewed in 2010, and for the 2015 equivalent, the task force of the Consensus on Science conducted an extensive literature search that resulted in a much larger number of included studies in which several beverages compared with water were investigated. The CEBaP re-evaluated some aspects as well.

In the 2015 ILCOR First Aid-systematic review of 12 studies evidence shows that ingestion of five per cent to eight per cent carbohydrate-electrolyte solutions facilitate rehydration after exercise-induced dehydration and they are generally well tolerated. In the absence of shock, confusion, or inability to swallow, it is reasonable for first aid providers to assist or encourage individuals with exertional dehydration to orally rehydrate with carbohydrate-electrolyte drinks. Other beverages such as, coconut water, milk, lemon tea and Chinese tea with caffeine, have also been found to promote rehydration after exercise-associated dehydration, but they may not be as readily available. If these alternative beverages are not available, potable water may be used, or alternated with commercial carbohydrate-electrolyte drinks.

The overall scientific merit of many articles in the literature related to exercise or environmental-induced dehydration is generally weak. But there are well-reported studies on the method and treatment of gastrointestinal-based dehydration. Most studies had a small number of participants, typically six to eight adult men. An exercise model in an environment with elevated temperature typically results in dehydration, with a target level of less than two per cent. This level of dehydration is typically less than the level that makes a particular person symptomatic. Two studies have shown that oral strategies of fluid resuscitation are as effective as intravenous routes for people with dehydration. In a model of mild exercise and heat-induced dehydration, ten studies have demonstrated that carbohydrate or electrolyte solutions are more effective than water in restoring intravascular volume after experimental, exercise-induced dehydration. One study suggested that a 12.5 per cent carbohydrate solution containing glucose and fructose resulted in a more rapid fluid delivery than solutions containing only glucose. One study demonstrated that hypertonic glucose solutions could be more effective in maintaining hydration status after sweating. Another study indicates that sodium content is more important than total osmotic content to increase plasma volume while at rest. In yet another study, it was observed that milk is more effective than water for fluid replacement in the dehydrated individual. The volume of fluid administered needs to exceed the volume of estimated sweat loss or other losses by 150 per cent. A recent World Health Organization monograph on oral rehydration therapy states, "Dehydration from diarrhoea can be prevented by giving extra fluids at home, or it can be treated simply, effectively and cheaply in all age groups and in all but the most severe cases by giving patients by mouth an adequate glucose electrolyte solution called Oral Rehydration Salts (ORS) solution".[7] The literature has also shown differences in composition between commercially prepared sports electrolyte solutions and oral rehydration solutions.

There is limited evidence showing that at least three of the following clinical signs are predictive for the diagnosis of dehydration due to acute diarrhoea (best combination sensitivity and specificity): decreased skin elasticity, poor overall appearance, no tears, abnormal respirations (deep and rapid), dry mucous membranes, sunken eyes, abnormal radial pulse (weak and impalpable).

References

Guidelines

- In cases of dehydration, first aid providers should rehydrate the person using ORS. (**)
- Either a commercially prepared ORS or a pre-prepared salt package for oral rehydration that complies with World Health Organization recommendations for ORS solutions should be used for rehydration. (**)
- First aid providers could use three per cent to eight per cent carbohydrate-electrolyte drinks for exertion-related dehydration. (*)
- If three per cent to eight per cent carbohydrate-electrolyte drinks are not available or not tolerated, alternative beverages for rehydration include water, 12 per cent carbohydrate-electrolyte solution, coconut water, two per cent milk, tea, tea-carbohydrate-electrolyte, or caffeinated tea beverages. (*)
- In the absence of pre-prepared solutions, a homemade solution may be used for dehydration. (Good Practice Point)
- If symptoms of gastrointestinal distress appear suddenly, are serious or are accompanied by dehydration (or the latter appears alone), emergency treatment should be sought. Even mild cases of gastrointestinal distress may require a medical examination although the need is not necessarily urgent. (Good Practice Point)

Implementation considerations

The types of fluids available for oral rehydration vary from country to country. Therefore, it is important for educational materials to reflect the locally available prepared solutions and how to make a solution in the absence of pre-prepared ones. Oral rehydration fluids are generally used to manage diarrhoeal dehydration and differ from sports drinks, which are primarily designed for perspiration loss during exercise.

To prevent dehydration:

- Give advice to prevent dehydration, e.g. do not expose head and body to excessive heat, especially if not used to the warm climate (e.g. a tourist from

7 http://www.who.int/maternal_child_adolescent/documents/fch_cah_06_1/en/

a country with moderate temperatures on holiday in the tropics).
- Wear a hat (especially small children and babies).
- Wear cool clothing that allows air circulation.
- Drink enough water during the day; increase normal liquid intake by at least one to two litres for adults.
- Avoid extensive sport activities around noon and mid-day.
- Protect skin with high protection sunscreens.
- Give the body time to adapt to the environment, especially for people not used to a hot and humid climate.

This should be included in the curriculum information of symptoms of dehydration and gastrointestinal distress – especially in regions where diarrhoea is a common public health problem. Also highlight that while dehydration is common when hot, people living in cold environments can also suffer from it due to strenuous activity or work or wearing excessive clothing.

Symptoms of dehydration include:
- pale and dry skin
- dry mouth and tongue
- weakness
- delayed capillary refill
- change in mental status (as dehydration becomes more severe)

Symptoms of gastrointestinal distress include:
- nausea or vomiting
- diarrhoea
- abdominal pain
- signs of dehydration
- fever

If symptoms appear suddenly, are serious or are accompanied with dehydration (or in the case of dehydration only), emergency treatment should be sought. Even mild cases of gastrointestinal distress may require a medical examination although the need is not necessarily urgent.

Steps to follow when preparing packaged ORS to manage dehydration:
- Wash hands with water and soap.
- Follow preparation directions on the ORS packet.
- Put one litre of safe water in a clean pot.
- Empty packet of ORS into the water while stirring.

In the absence of pre-prepared packets, a homemade solution can be made using (other alternatives also exist):
- half teaspoon of salt
- six teaspoons of sugar
- one litre of water

See Shock

Seizures

Introduction

When injury, disease, fever, poisoning or infection disrupts the normal electrical functions of the brain, the electrical activity of the brain may become irregular. This irregularity can cause a loss of body control, muscle twitching, loss of consciousness and/or staring off. This is known as a seizure. Chronic seizures are called epilepsy, which is usually treated with medication. Some children and infants have seizures that are caused by a sudden rise in temperature. Guidelines in this section are updated based on evidence reviewed in 2011.

Summary of scientific foundation

No evidence could be found concerning a specific posture or putting objects in the mouth of somebody with seizures.

Guidelines

- First aid providers may place a person experiencing a seizure on the floor to prevent him or her from being injured. (Good Practice Point)
- Once the seizure has ended, first aid providers should assess the airway and breathing and treat accordingly. (Good Practice Point)

Implementation considerations

Preceding symptoms:
- The person may experience unusual sensation or feeling (such as a visual or olfactory hallucination) called aura.

When assessing the person experiencing a seizure, look for:
- sudden, uncontrollable, rhythmic muscle contractions (i.e., convulsions)
- decreased level of responsiveness
- irregular or (temporarily) no breathing
- drooling
- upward rolling of the eyes
- rigid body
- loss of bladder or bowel control
- biting the tongue or inside the cheek
- staring off

To provide care:
- Reassure the person that you are going to help.
- During the seizure:
  - remove nearby objects that might cause injury;
  - protect the person's head by placing a thinly folded towel or clothing beneath it. Do not restrict the airway while doing so;
  - do not hold or restrain the person;
  - do not place anything between the person's teeth or put anything in his or her mouth. The person will not swallow his or her tongue.

When the seizure is over, be sure that the person's airway is open, and check for breathing and injuries.

Comfort and stay with the person until he or she is fully conscious.

Some people have seizures frequently despite being on medication. As a result they may not go to the hospital since for them it is a normal seizure occurring at regular frequency. If you are unsure of the person's usual care plan, call EMS.

Call EMS (national number or the local emergency number) immediately if:
- A seizure lasts longer than five minutes or is repeated.
- The person does not regain consciousness after five to ten minutes.
- The person has diabetes or is injured.
- The person has never had a seizure before.
- Any life-threatening condition is found.

Medical check is required if the person has a known seizure disorder but the seizure is a different type or is occurring more frequently.

Fever

Introduction

When the body temperature exceeds 38°C or 100.4°F, a person has fever. The first aid provider may take action to bring down the temperature of the person suffering from fever to increase his or her comfort. However, first aid providers should also be alert to possible causes of the high temperature and refer the person to a healthcare professional in situations highlighted below. This section is new and draws on the results from evidence reviewed in 2015.

Summary of the scientific foundation

Scientific evidence from one systematic review shows that paracetamol helps relieve fever after two hours of taking it in comparison to physical methods or placebo. This effect has not yet been seen one hour following the intake of paracetamol, in comparison to physical methods to decrease fever. There is no difference in adverse events when comparing paracetamol with physical methods or placebo. Evidence is of moderate quality due to imprecision.

Two randomized controlled trials showed that tepid water sponging resulted in a statistically significant decrease of fever two hours following the intervention, when compared to placebo. However, a significant difference at one hour could not be demonstrated, nor was there a significant difference in discomfort, using tepid water compared to placebo. A difference between tepid water sponging and paracetamol could not be demonstrated.

One randomized trial showed that cold water sponging resulted in a statistically significant decrease of temperature after 30 minutes compared to paracetamol, but this was not observed again. To the contrary, results showed that paracetamol significantly decreased the temperature after 90 to 120 minutes. Moreover, evidence indicates that cold water sponging resulted in a statistically significant increase of discomfort, compared to paracetamol. Evidence is of low quality due to risk of bias and imprecision.

One systematic review showed that combining tepid water sponging with paracetamol results in a statistically significant decrease, when measured at one and two hours following the combined interventions, compared to intake of paracetamol alone. Yet, tepid water sponging combined with paracetamol leads to an increase of adverse events, compared to paracetamol alone. Furthermore, alcohol or ice water combined with paracetamol increased the number of children with a poor comfort score. Evidence is of low quality due to risk of bias and imprecision.

No evidence was found to support or refute drinking water as a treatment for fever.

References

Guidelines

- If the person is suffering from fever, paracetamol or acetaminophen should be given to him or her. (**)
- Paracetamol or acetaminophen can be combined with sponging with tepid water (from 29°C to 33°C) as long as it does not cause the person to get upset or to start shivering. (**)
- Do not use cold water for sponging as this results in more discomfort. (**)
- Do not use cold water for sponging as this can have the opposite reaction, i.e. heat the body more. (Good Practice Point)
- The infant, child or adult should be referred to a healthcare professional as soon as possible, if the (Good Practice Point):
  - infant under two months of age has fever
  - children up to two years of age has fever higher than 39° C or 102.5° F
  - person is over 65 years of age
  - person suffering from fever has cancer, weakened immune system, sickle cell disease, medications which affect immune system
  - fever does not decrease
  - fever is accompanied by a rash
  - fever is accompanied with persistent cough
  - fever is accompanied with abdominal pain
- The person requires immediate care, in cases of:
  - fever with change in mental status
  - fever with difficulty breathing
  - fever with headache or stiff neck
  - fever with severe abdominal pain
  - fever with any signs of shock
- Persons with fever should rest and drink fluids to replace the loss of fluids due to sweating. (Good Practice Point)
- Persons with fever should dress lightly and one should avoid covering them with excessive blankets or coverings. (Good Practice Point)

Implementation considerations

When giving paracetamol to children a dose of 8mg to 15mg per kilogram every four hours is recommended (with a maximum of 100mg per kilogram per day), or 10mg to 15mg per kilogram of acetaminophen every four hours (with a maximum single dose of 650mg).

It is not necessary to keep the person suffering from fever extra warm, even though he or she may be feeling cold. Do not rinse him or her with cold water as this has the opposite effect. The blood vessels in the skin will constrict and the body will not be able to give off heat. Shivering can be caused by cold water, and result in more heat being produced.

People with fever, and additional signs, medical problems or symptoms may either need immediate medical care or be seen by a healthcare provider. The guidelines listed above include the additional signs, symptoms and medical conditions to look out for.

In some areas (e.g. where malaria is prevalent), people with fever should be referred to a healthcare professional, even if the fever is not accompanied with any other symptoms. This should be specified during trainings based on the context.

The implementation of these guidelines for the use of paracetamol or acetaminophen for fever depends on local laws, regulations and processes, including liability protection. National Societies may need to adapt their methodologies for implementation according to the educational opportunities in the national context.

Diabetes and hypoglycaemia treatment

Introduction

Diabetes can damage blood vessels. A person with diabetes can suffer from serious complications such as Heart attack or Stroke. For those (either diabetics or non-diabetics) who experience extreme alterations in blood sugar level – hyperglycaemia or hypoglycaemia – can face serious consequences. Other conditions, especially in children, can lead to low blood sugar which can be life-threatening and lead to immediate complications such as seizure or unconsciousness.

Summary of scientific foundation

In the 2015 Consensus on Science, this topic was reviewed and evidence was sought for which dietary forms of sugar compared with standard dose (15g to 20g) of glucose tablets should be used when providing first aid to someone suffering from hypoglycaemia. Four studies were identified, which compared glucose tablets, sucrose, fructose, orange juice, jellybeans, Mentos and milk. Most of these studies gave a low level of evidence.

In addition, the American Red Cross Scientific Advisory Council has also reviewed the topic. This review found several studies that compared various forms of ingested sugar and in varying amounts to determine what forms work best to normalize blood glucose levels without causing rebound hyperglycaemia or necessitating a second dose of sugar. These studies have led to the development of guidelines and recommendations for treatment of hypoglycaemia. For adults, 15g to 20g of sugar or carbohydrate is needed to raise blood glucose levels in diabetics with hypoglycaemia. Glucose tablets are the preferred treatment for hypoglycaemia where the patient is awake, able to respond and swallow. Many diabetics carry glucose tablets with them and they are commercially available in 4g tablets, so four or five tablets should suffice. Less effective but acceptable forms of sugar include dissolved (liquid) glucose, glucose gel (swallowed), orange juice (12oz), sugar cubes or granular table sugar (four teaspoons), and honey (four teaspoons). There is evidence that foods or liquids high in fructose (such as fruit juice or dried fruit) or containing gelatine or fat may not be as effective in raising blood sugar levels as glucose or sucrose. Buccal absorption of glucose – that is, glucose placed inside the cheek or under the tongue and not swallowed – is limited and not recommended. For children, 15g of sugar is recommended. Again, glucose tablets are the preferred treatment, but recent studies show that 15g of sucrose-containing candies are an effective treatment in addition to the alternatives listed above.

There is a ten to 15 minute delay between ingesting sugar for hypoglycaemia and return of blood glucose levels and improvement of symptoms. If symptoms persist 15 minutes following ingestion of sugar for hypoglycaemia, the dose of sugar may be repeated.

No evidence was found on the effect of using glucose tablets on both risks of complication and during hospital length of stay.

References

Guidelines

- First aid providers should use 15g to 20g glucose tablets for treating symptomatic hypoglycaemia in conscious individuals. (**)
- First aid providers should use 15g to 20g glucose tablets for treating symptomatic hypoglycaemia in conscious children and infants. (**)
- Glucose may be repeated if symptoms persist after 15 minutes. (**)
- If glucose tablets are not available, various forms of dietary sugars such as skittles, mentos, sugar cubes, jellybeans and orange juice can be used to treat symptomatic hypoglycaemia in conscious individuals. (*)
- If uncertain whether the symptoms displayed are for hypoglycaemia or hyperglycaemia, it is reasonable to treat for hypoglycaemia. (Good Practice Point)

Implementation considerations

The curriculum of the first aid course should focus on the fact that hyperglycaemia may evolve gradually and can be asymptomatic over a period of hours or even days. Hypoglycaemia is usually sudden and life-threatening with typical symptoms (appearing frequently in this sequence):
- hunger, headache
- agitation, tremor
- psychotic behaviour (often resembling drunkenness)
- loss of consciousness
- seizures (eventually)

Recognizing the possibility of hypoglycaemia is most important because the person requires rapid treatment. The brain needs sugar to survive, and if it is deprived of sugar, it can result in seizures and brain damage. If it is possible to keep the person conscious and he or she can eat and drink, self-treatment (ingestion of sugar-containing food or drink) is possible, perhaps with the assistance of a first aid provider. If the person becomes very disturbed or unconscious, and eating or drinking becomes dangerous because of the possibility of aspiration, calling the emergency response number for immediate emergency services is of vital importance. A key point to keep in mind is that treating hypoglycaemia will rarely worsen hyperglycaemia and may prevent or treat life-threatening conditions. If unsure whether the person is suffering from hyperglycaemia or hypoglycemia, treat for hypoglycaemia. Additional sugar for a hyperglycaemic event is unlikely to cause harm, but fair to treat hypoglycemia can have serious long-term consequences. *Also see* Unconsciousness and altered mental status, Seizures and Stroke.

Use of oxygen

Introduction

Giving oxygen to a person with an acute illness or injury is generally accepted and practiced, although there is no evidence for its general usefulness. While recognized that in most situations normal oxygen levels are desired, not all emergencies lead to hypoxia (a dangerous condition in which the body, or parts of it, are deprived of oxygen). In addition, supplemental oxygen may lead to supra-physiological oxygen level in blood, which according to some studies, for certain conditions, has shown harm due to additional tissue injury (e.g. neonatal resuscitation, myocardial infarction, certain stroke states, etc.). Oxygen inhalation is not regarded as a routine first aid element but under certain circumstances it can be administered by a specifically trained first aider. Evidence for this topic was reviewed in 2015.

Summary of scientific foundation

No evidence was found either for or against routine administration of supplementary oxygen by first aid providers. However, giving supplementary oxygen for relief from decompression sickness is supported by evidence.

Supplemental oxygen resulting in hyperoxemia (SpO2 more than 94 per cent) in STEMI patients (STEMI is a shorthand medical term for ST-segment elevation myocardial infarction) appears to increase myocardial injury and myocardial infarct size. However, hypoxemia is also associated with worse outcomes. Measuring oxygen saturation requires a transcutaneous pulse oximeter, and special training is required to use this device.

For the home care of patients with advanced cancer, oxygen administration brought no benefit for normoxic patients but relieved the symptoms in dyspneic and hypoxemic patients.

Following exposure to carbon monoxide, it may be useful to administer oxygen, as soon as possible, until emergency medical care is available.

References

Guidelines

- The use of supplementary oxygen should be limited to first aiders with specific training in oxygen administration. (**)
- Giving supplementary oxygen by a specifically trained first aider is reasonable for first aid in scuba divers suffering from decompression illness. (*)
- Giving supplementary oxygen by a specifically trained first aid provider for patients with advanced cancer having dyspnea and/or hypoxaemia may be reasonable. (*)
- Giving supplementary oxygen by a specifically trained first aider might be useful as soon as possible for spontaneously breathing patients after carbonic monoxide exposition until emergency medical care is available. (*)
- When oxygen is given, it is ideal to taper oxygen supplementation to keep SpO2 just more than 94 per cent (at sea level) if the first aid responder has been trained in transcutaneous pulse oximetry. (*)

Implementation considerations

The implementation of these guidelines depends on local laws, regulations and processes, including liability protection. National Societies may need to vary their methodologies for implementation according to the educational opportunities in the national context. Consideration must also be given to maintenance of equipment, storage and care of compressed gas cylinders and local regulatory testing and inspection. It is desirable to train first aid providers during special courses on how to use oxygen, if their potential activity and equipment is relevant.

Shock and optimal position for shock

Introduction

Shock is a general term used to describe a lack of blood reaching the major organs and tissues, thus depriving them of oxygen. Here the most common types of shock – hypovolemic, cardiogenic, distributive (most commonly due to sepsis or anaphylaxis) and obstructive are addressed. The causes are broad and include blood loss, injury, heart infarction, anaphylaxis, obstruction of major blood vessels and toxins. People experiencing shock may complain of feeling weak, fatigue, dizziness, and/or may have altered (excited, depressed or unresponsive) mental status. First aid providers may also observe cool, clammy, pale or ashen skin, rapid heart rate and respiration.

Where specific causes of shock are identified in the initial assessment, the first aid provider should focus on managing those causes (especially stopping the bleeding) and supporting circulation. There are many presentations of shock where first aid will be insufficient to managing the cause, and higher level of care is likely to be required. To support circulation, positioning of the patient can be an important task for first aid provider.

Evidence for this topic was reviewed in 2015 and guidelines have been updated.

Summary of scientific foundation

A formal scientific evidence review was carried out for shock position in 2015. The remainder of this topic is of importance in first aid education and the following guidelines are offered based on expert opinion.

Although the evidence is weak, there is potential clinical benefit of improved vital signs and cardiac function by placing individuals with shock into the supine (lying on back) position, rather than by moving them into an alternative position.

The use of passive leg raising (PLR) may provide a further but transient improvement of circulation for those with no evidence of trauma. The clinical significance of this transient improvement is uncertain. The optimal degree of elevation has not been determined, with studies of PLR ranging between 30 degrees and 60 degrees elevation. No study however, has reported adverse effects due to PLR. These recommendations place an increased value on the potential, but uncertain, clinical benefit of improved vital signs and cardiac function, by positioning a person in shock in the supine position (with or without PLR), over the risk of moving them.

Other positioning is dependent on the further vital signs and first aid procedures that may be needed.

References

Guidelines

- For a person experiencing or threatened by shock, body temperature should be maintained by preventing heat loss. (**)
- First aid providers should place the person in shock in the supine (lying on back) position. (**)
- First aid providers should position the person who is unresponsive and breathing normally on his or her side while ensuring that his or her airway is open (recovery position). (**)
- First aid providers may raise the non-injured person's legs 30 degrees to 60 degrees (PLR) if it makes him or her feel better; this may improve the vital signs for a few minutes. (*)
- First aid providers should activate EMS if the person seems to be threatened by shock or shows signs and symptom of shock. (Good Practice Point)
- For people in shock caused by known heart infarction, different positioning (like supine position with slight elevation of the upper body) should be considered. (Good Practice Point)
- If the person is having breathing difficulties and will not tolerate being supine, first aid providers may help the person to get in a position being most tolerable or comfortable for him or her (usually semi-sitting or sitting position leaning forward). (Good Practice Point)

Implementation considerations

When teaching first aid it is important to stress that the major first aid-level intervention is to assess responsiveness, and check for normal breathing. For people who are unresponsive and not breathing normally, start CPR. If this is not the case, the person suspected to be in shock requires proper positioning, control of bleeding, and protection from cooling down.

While the supine position is listed in the guidelines, it is usually not tolerable for those displaying breathing difficulties. In this case, first aid providers should help the person to get in a position being most tolerable or comfortable for him or her (usually semi-sitting or sitting position leaning forward). Should breathing become abnormal with change in level of consciousness, the person should be assessed accordingly, and if needed, resuscitation should be started with the person in the supine position.

Further interventions generally require medical knowledge, skills and equipment as required. There is limited effective treatment at a first aid level. An important exception is giving epinephrine in anaphylactic shock.

Unresponsive and altered mental status

Introduction

An unconscious person does not respond to verbal and/or physical stimuli. The first aid provider needs to act effectively to establish the cause and whether or not the person is breathing, in order to decide on the best course of action. Evidence for this topic was reviewed in 2015 and guidelines have been updated accordingly.

Summary of scientific foundation

A review of the literature on how to approach unconscious patients does not show any apparent high quality prospective studies directly looking at this question. The science regarding the various common causes of altered level of consciousness informs us on a few keys to the approach. The first aid provider should focus on looking for manageable causes, activating EMS or transport to higher level of care, and positioning the patient for safety.

References

Guidelines

- If the person is unconscious, first aid providers should initially ensure a patent airway and determine if normal breathing is present. (**)
- First aid providers should start CPR if needed. Be aware that sometimes a person in cardiac arrest may initially present a short seizure-like activity. (**)
- Consider other causes such as poisoning, diabetic emergency, hypoglycaemia, head injury etc. (*)
- First aid provider should put the person in recovery position and call for EMS. (*)

Implementation considerations

A person can get unconsciousness suddenly (e.g. as a consequence of cardiac arrest, stroke, hypoglycaemia, toxins, head injury, electrocution) or gradually (e.g. as a consequence of intoxication, poisoning or progressive hyperglycaemia). Altered mental status may precede unconsciousness, and the first aid provider may be able to intervene earlier when altered level of consciousness is identified.

When the person is unconscious, his or her airway can be obstructed. The airway needs to be opened and airway patency maintained by placing the person in semi-prone (recovery) position (*see* Shock).

Fainting

Introduction

Fainting is described as a transient loss of consciousness, caused by a fall in the blood supply to the whole brain, where consciousness is rapidly regained. As this is a relatively common occurrence in public places, first aid education often covers this topic. This topic is new and guidelines have been developed to cover this subject.

Summary of scientific foundation

An evidence review was carried out. There are no specific studies identified regarding first aid management for fainting.

References

Guidelines

- If the person is breathing normally but remains unresponsive, maintain a patent airway by considering head tilt – chin lift, or recovery position. (**)
- If there is abnormal or no breathing, resuscitation should be started immediately. (**)
- An unresponsive person should be rapidly assessed for breathing/signs of circulation and perfusion (if trained to do this assessment). (Good Practice Point)
- If the person is face down and unresponsive (prone position), the first aider should turn his or her face up (supine position) to check breathing. (Good Practice Point) (*See* Resuscitation).
- The first aid provider should activate EMS for a person who loses consciousness as causes can vary from not serious to being life-threatening. (Good Practice Point)
- First aid providers should consider that any person who loses consciousness might have low blood sugar, stroke, seizure or other serious conditions. (Good Practice Point)

Implementation considerations

There are some causes of altered level of consciousness that may be identified by the first aid provider, and treated accordingly (*See* Diabetes and hypoglycaemia, Stroke, Concussion, Poisoning). While it is recognized that it is common to faint, by default always alert EMS.

Croup

Introduction

Croup is a respiratory condition, usually triggered by an acute viral infection of the upper airways. The infection causes swelling of the throat and upper airways that interferes with normal breathing and produces a typical barking cough, stridor (squeaking noise) and hoarseness. Symptoms often worsen at night. This topic is new and evidence has informed the development of the guidelines.

Summary of the scientific foundation

Humidified air is a well-known self-care treatment for children with croup. Evidence from one systematic review and a randomized controlled trial in children with croup demonstrated that humidified air does not significantly decrease heart rate, respiratory rate, croup score and hospital admission or increase oxygen saturation. This evidence is of low quality due to risk of bias and imprecision.

No evidence could be found on a specific posture for children with croup.

References

Guidelines

- The child may lie in any position that is comfortable for him or her and ideally enables easy breathing. (Good Practice Point)
- If there is a significant shortness of breath, EMS should be activated, otherwise the child should be taken to a healthcare provider or medical doctor. (Good Practice Point)

Implementation considerations

Traditionally, humidified air or steam is used to treat children with croup. However, no evidence could be found for this intervention. Furthermore, the use of steam can lead to accidental burns.

09. First aid for injuries

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Foreign body airway obstruction

Introduction

Foreign body airway obstruction (FBAO) is one of the most common life-threatening emergencies that is seen and can be treated by a layperson. There is evidence available for various techniques that a first aid provider can use to treat the person, depending on their age, size and consciousness. New evidence has been reviewed in 2015 on this topic.

Summary of scientific foundation

Airway obstruction by a foreign body, either organic (e.g. nuts and carrot) or inorganic (e.g. a magnet) is a common cause of respiratory emergency especially in young children and is associated with a high rate of airway distress and chronic complication. Morbidity associated with foreign body obstruction underlines the importance of preventive and first aid measures.

The 2010 ILCOR review specified that the few available studies only addressed which method of removal of FBAO should be used first for a conscious person. More than one technique may be needed to relieve the obstruction and studies show increased success when moving to another technique. However, there have been reported intra-abdominal or thoracic severe complications associated from the use of abdominal thrusts even when administered correctly, such as: traumatic vascular injuries, rib fractures, ruptures of abdominal organs, rupture of the diaphragm. Other reported injuries of vascular structures consisted of aortic stent graft displacement, rupture of the aortic valve, acute aortic regurgitation, and acute aortic thrombosis in both an aneurysmal and non-aneurysmal aorta.

For an unconscious person, the 2010 ILCOR guidelines suggests giving CPR to generate higher airway pressures instead of abdominal thrust for removing solid FBAO. The use of the finger sweep for relieving FBAO in unconscious adults and children younger than one year may be effective but can potentially cause harm to the individual and the first aid provider.

Since the 2011 International First Aid and Resuscitation Guidelines, no major clinical investigations have been published regarding the method of removal of FBAO. Only some case reports, an animal study, a review and one retrospective observational study were found.

Four case reports describe complications after sub-diaphragmatic thrust manoeuvre: a fatal hemoperitoneum due to a hilar laceration of the spleen, a gastric perforation in a patient with nasopharyngeal cancer, a paediatric diaphragmatic rupture and an extensive cervico-mediastinal emphysema caused by a sharp foreign body.

One animal study compared airway and intrapleural pressures generated by abdominal, anterior chest, and lateral chest thrusts. Lateral chest thrusts produced the greatest pressures, followed by abdominal thrusts, and then anterior chest thrusts and at autopsy. None of the animals received organ damage. Further research, especially in humans is needed before considering any change in the guidelines.

One meta-analysis of published papers about foreign bodies in the airways provides an estimate of the distribution of injuries caused by the foreign body in children according to gender, age, type of foreign body, site of obstruction, clinical presentation, diagnostic or therapeutic procedures and complications over a 30-year period from 1978 to 2008. Hundred and seventy-four articles are included in the analysis. FBAO most commonly occurs in young children (20 per cent of children being between the age of zero and three years). Organic foreign body, particularly nuts, are the most documented and the greatest pooled proportion has been recorded for magnets. Non-specific symptoms or a complete absence of symptoms are not unusual, justifying mistaken or delayed diagnosis. Acute and chronic complications seem to occur in almost 15 per cent of patients. The result of this study testifies the relevant morbidity associated with foreign body inhalation in children, stressing the importance of preventive and first aid measures.

In 2014, one study determined the outcome of FBAO of 138 unresponsive or unconscious people according to the initial actions taken before the arrival of EMS. This study shows that bystanders administered chest compressions for only a quarter of the people experiencing choking and that chest compression is essential for improved outcomes of an unresponsive or unconscious person.

In 2015, the American Red Cross Scientific Advisory Council completed a review of the treatment of FBAO. Five studies suggest that abdominal thrusts are effective. The most noteworthy work among these was the article by Soroudi et al. They reviewed the San Diego County (California) pre-hospital database for all adults treated in the out-of-hospital setting with an airway obstruction. They identified 513 cases. Of the various techniques used to relieve the airway obstruction, the sub-diaphragmatic thrust manoeuver was used most commonly. The success rate of the sub-diaphragmatic thrust manoeuver was 86.5 per cent. Day et al. published a study with unclear details that supports the sub-diaphragmatic thrust manoeuver as superior to back blows. This manuscript bundled several research manoeuvres together. In four healthy human volunteers, the sub-diaphragmatic thrust manoeuver produced more airway pressure than back blows. The pressure lasted for a significantly longer interval. Three studies support the benefits of chest thrusts for obstructed airways. Langhelle et al. demonstrated that in a crossover study with 12 cadavers, significantly higher airway pressures were delivered with chest compressions as compared to abdominal thrusts. In 1976, Guildner and colleagues conducted a study with six healthy, anesthetized volunteers. They demonstrated that chest thrusts produce more pressure and airflow than abdominal thrusts. There is also a case report of chest thrusts successfully removing a foreign body airway obstruction where abdominal thrusts had failed. Two studies support the use of back blows for obstructed airways. Ruben and Macnaughton reported on a study with patients scheduled for elective surgery. They demonstrated that sternal thrusts and back blows resulted in fairly similar airway pressures but that these pressures were higher than the sub-diaphragmatic thrust manoeuvre. Gordon et al. conducted a study on ten dogs, four baboons and six humans. They found that airway pressure was highest with back blows while air flow was highest with abdominal or chest thrusts.

References

Guidelines

- Chest thrusts, back blows or abdominal thrusts are equally effective for relieving FBAO in conscious adults and children older than one year. (**)
- In adults and children older than one year old, the unconscious person should receive chest compressions for clearance of the foreign body. (**)
- Unconscious infants up to one year old should receive either a combination of back blows followed by chest compression, or chest compressions alone for clearance of FBAO. (**)
- Combination of back blows followed by chest compression may be used for clearance of FBAO in conscious infants up to one year old. (*)
- The finger sweep could be used in unconscious adults and children older than one year with an obstructed airway if solid material is visible in the airway. (*)
- There is insufficient evidence for a different treatment approach for an obese adult or pregnant woman with FBAO. (*)
- In the case of a conscious person, the first aid providers must be able to recognize signs of a complete airway obstruction (the person is unable to speak, has a weakening cough, is struggling or unable to breathe) and sign of a mild obstruction (the person is able to speak, cough and breathe). (*)
- The person with a mild airway obstruction should remain under continuous observation until he or she improves since severe airway obstruction may develop. (Good Practice Point)
- Although injuries have been reported with the abdominal thrust, there is insufficient evidence to determine whether chest thrusts, back blows or abdominal thrusts should be used first in conscious adults and children older than one year old. (Good Practice Point)
- These techniques should be applied in rapid sequence until the obstruction is relieved; more than one technique may be needed in conscious adults and children older than one year old. (Good Practice Point)

Implementation considerations

Signs of choking include:
- coughing, either forcefully or weakly
- clutching the throat with one or both hands
- inability to cough, speak, cry or breathe
- making high-pitched noises while inhaling or noisy breathing
- panic
- bluish skin colour
- losing consciousness if blockage is not removed.

It is important to note that while these are signs of choking, the first aid provider should not interfere unless the airway is completely obstructed, because the body's mechanism to clear the obstruction may be more effective than other techniques.

A person whose airway is completely blocked cannot cough, speak or breathe. Sometimes, the person may cough weakly or make high-pitched noises, which indicates he or she is not getting enough air to stay alive. First aid providers must act at once. If a bystander is available, have him or her call for EMS while beginning to give care.

FBAO is an uncommon but potentially treatable cause of accidental death. Often, there is an opportunity for early intervention while the person concerned is still responsive. The most common cause of choking in adults is airway obstruction caused by food. In infants and children, reported cases of choking occur while eating or with non-food items such as coins or small toys. It is important to ask the conscious person if he or she is choking.

In all cases, recognition of airway obstruction is the key to successful outcome. It is important not to confuse this emergency with fainting, heart attack, seizure, an anaphylactic allergic reaction or other conditions that may cause sudden respiratory distress, cyanosis or loss of consciousness. Foreign bodies may cause either mild or severe airway obstruction.

FBAO usually occurs while the person is eating or drinking. People at increased risk of FBAO include those with reduced conscious levels, drug and/or alcohol intoxication, neurological impairment affecting swallowing and cough reflexes (e.g. stroke, Parkinson's disease, cerebral palsy, dementia), respiratory disease, poor dentition and older age.

For adults and children older than one year

If the individual shows signs of mild airway obstruction:
Encourage continued coughing, but do nothing else. Aggressive treatment, with back blows, abdominal thrusts and chest compression, may cause potentially serious complications and could worsen the airway obstruction. A person with mild airway obstruction should remain under continuous observation until he or she improves since a severe airway obstruction can develop.

If the person shows signs of complete airway obstruction and is conscious:
Activate EMS. Apply up to five back blows as follows:
1. Stand to the side and slightly behind the person;
2. Support the chest with one hand and lean the person well forward so that when the obstructing object is dislodged, it comes out of the mouth rather than further down the airway;
3. Give up to five sharp blows between the shoulder blades using the heel of your other hand; and
4. Check to see if each back blow has relieved the airway obstruction. The aim is to relieve the obstruction with a blow or a slap, not to necessarily give all five.

If five back blows fail to relieve the airway obstruction, give up to five abdominal thrusts as follows:
1. Stand behind the person and put both arms around the upper part of the abdomen;
2. Lean the person forward;
3. Clench your fist and place it between the belly button and the base of the ribs (umbilicus and xiphisternum);
4. Grasp this hand with your other hand and pull sharply inwards and upwards;
5. Repeat up to five times; and

6. If the obstruction is still in place, continue alternating five back blows with five abdominal thrusts.

If at anytime, the person becomes or is found unconscious:
1. Support the person, while carefully lowering him or her to the ground;
2. If EMS have not arrived or been called, call them immediately; and
3. Begin CPR at the compression part of the sequence.

The finger sweep:
Avoid use of a blind finger sweep. Manually remove solid material in the airway only if it can be seen.

For obese adults and pregnant women:
1. Chest thrusts should be used for obese adults if the first aid provider is unable to encircle the person's abdomen;
2. If the person choking is in the late stages of pregnancy, the first aid provider should use chest thrusts instead of abdominal thrusts; and
3. Chest thrusts are similar to chest compressions but sharper and delivered at a slower rate.

For infants up to one year of age

If the infant shows signs of mild airway obstruction:
Continue to watch the infant, but do nothing else. Aggressive treatment with back blows and chest compression may cause potentially serious complications and could worsen the airway obstruction.

If the infant shows signs of complete airway obstruction and is conscious:
Activate EMS. Apply up to five back blows as follows:
1. Lay the infant face down along your arm with the head lower than the body. Support the infant in a head downward, prone position, to enable gravity to assist removal of the foreign body;
2. A seated or kneeling first aid provider should be able to support the infant safely across his or her lap;
3. Support the infant's head by placing the thumb of one hand at the angle of the lower jaw, and one or two fingers from the same hand at the same point on the other side of the jaw. Do not compress the soft tissues under the chin;
4. Give up to five sharp blows between the shoulder blades with the heel of your other hand; and
5. Check to see if each back blow has relieved the airway obstruction. The aim is to relieve the obstruction with a blow or slap, not to necessarily give all five blows.

If five back blows fail to relieve the airway obstruction, give up to five chest thrusts as follows:
1. Turn the infant into a head downward, supine position. This is achieved safely by placing the free arm along the infant's back and encircling the back part of the head with the hand. Support the infant along your arm, which is placed down (or across) your thigh;
2. Find your landmarks, two fingers below the nipple line;
3. Give chest thrusts (compress approximately one-third of the depth of the chest). These are similar to chest compressions but sharper and delivered at a slower rate;
4. Repeat up to five times; and

5. If the obstruction is still not relieved, continue alternating five back blows with five chest thrusts.

If the infant becomes unconscious or is found unconscious:

1. Support the infant, while carefully lowering him or her to a firm surface;
2. If EMS have not arrived or been called, immediately call them;
3. Open the airway;
4. Give two to five rescue breaths. During the first attempts at rescue breaths, if a breath does not make the chest rise, reposition the head before making the next attempt; and
5. Begin CPR at the compression part of the sequence.

The finger sweep:
In general, finger sweeps are not used in infants. Solid material in the airway can be manually removed only if it can be seen.

Aftercare and referral for medical examination:
After successful treatment for FBAO, foreign material may nevertheless remain in the upper or lower respiratory tract and cause complications later. Infants with a persistent cough, difficulty swallowing or the sensation of an object being still stuck in the throat should be referred for a medical examination. Another reason for medical examination is the possibility of serious internal injuries resulting from abdominal thrusts or injury to the airway from the object that was lodged and removed.

Burns

Introduction

Immediate cooling of burn wounds (chemical, electrical, etc.) with cold tap water is a common remedy and is supported by several studies. After immediate cooling, burn wounds can be treated with wound dressings.

Summary of scientific foundation

The published evidence for the optimal method, duration and temperature of cooling was reviewed by the Consensus on Science in 2015. The CEBaP reviewed evidence regarding substances that should be used.

A decrease of pain when burns were actively cooled could not be demonstrated in one randomized controlled trial with 24 patients and an observational study with 48 patients. However, a statistically significant reduced depth of burns was shown in two observational studies, with 45 and 695 patients respectively. In two other studies (one randomized controlled trial and one observational study), a significant effect on the depth of the burn was not demonstrated. In addition, a statistically significant decrease in length of hospital stay and percentage of burns requiring hospital admission was shown in two observational studies with 244 and 125 patients. In a third observational study, no reduction in the need for advanced medical care after scald burns could be demonstrated. In a fourth observational study with patients, no benefit was shown in reducing the re-epithelialization time for patients who received 20 minutes or more of cooling versus those who did not.

Very low quality evidence from a single observational study showed no benefit in reducing re-epithelialization time for patients who received 20 minutes or more of cooling versus those who did not.

In summary, evidence is available for immediate cooling of burns to relieve pain, reduce oedema, infection rates, and the depth of burns. Furthermore, immediate cooling of burns may decrease the number of patients that require hospital admission.

However, there is no scientifically supported recommendation for the specific cooling temperature, the method of cooling (e.g. gel pads, cold probes or water) or the duration of cooling. The use of ice to treat burn injuries is not beneficial and can cause tissue damage.

There is limited evidence from one experimental study in favour of keeping a blister intact as it might decrease the likelihood of infection.

A systematic review of four intervention studies about treating burns with aloe vera (Maenthaisong et al. 2007) and a systematic review of nine intervention studies about honey for burns (Jull et al. 2008) revealed that these products may reduce the healing time.

References

Guidelines

- Burns should be cooled with cold water as soon as possible for a minimum of ten minutes. (**)
- As clean water is available in many areas of the world, clean tap water should be used. (Good Practice Point)
- Ice and ice water should **NOT** be applied to burn wounds. (Good Practice Point)
- After cooling, it is recommended that burn wounds should be dressed with a sterile dressing dependent on the local burn treatment policies. (Good Practice Point)
- In cases of minor burns that will not be seen by a medical health professional, honey or aloe vera may be applied to the wound. (*)
- **NO** remedies should be applied before a medical practitioner has reviewed the wounds. (Good practice point)
- Care must be taken when cooling large burns or burns in infants and small children so as not to induce hypothermia. (Good Practice Point)
- A first aid provider should **NOT** burst the blister(s). (*)

Implementation considerations

The main educational message is to cool the burn. If cold water is not available, other locally available methods of cooling should be applied only if they will not insulate the burn. Further research is needed on the application of locally available cooling substances and dressings. For substantial burns medical advice should be sought.

Bleeding

Introduction

Control of bleeding is a core first aid skill. There is evidence to support various first aid interventions that can be used in different circumstances to control bleeding. The aim of the first aid provider is to stop the bleeding as quickly as possible. Guidelines have been updated in response to new evidence reviewed by ILCOR in 2015 and the American Red Cross Scientific Advisory Council.

Summary of scientific foundation

Direct pressure

In 2010, the Consensus on Science focused on the control of bleeding regarding the question of the efficacy of direct pressure as measure to control haemorrhage.

Although bleeding is a common first aid emergency and control of haemorrhage can be lifesaving, only two studies reported the efficacy of direct pressure to control haemorrhage in the pre-hospital or field hospital settings. In both studies the pressure was applied by trained medical personnel. One case series described a technique of haemorrhage control by trained paramedics. Haemorrhage control was achieved by wrapping an adhesive elastic bandage applied directly over a collection of 4×4-inch gauze pads placed on the wound surface. The roll was wrapped around the body surface over the bleeding site until ongoing haemorrhage ceased. The pressure effectively stopped bleeding in all cases with no complications. In a second case series from a field hospital, the efficacy of direct pressure applied by trained providers with an elastic bandage to control haemorrhage in 50 successive casualties of traumatic amputations was compared with the effectiveness of tourniquets used for 18 previous casualties with traumatic amputations from mine explosions. Less ongoing bleeding, higher survival rates, and higher admission haemoglobin were observed in the 50 casualties in whom bleeding was controlled with direct pressure versus in the 18 earlier casualties in whom bleeding was controlled with a tourniquet.

Four studies from cardiac catheterization experience and one animal study document that direct pressure is an effective and safe method of controlling bleeding.

Four systematic reviews compared vascular closing devices with manual compression in case of bleeding. These studies could not demonstrate a statistically significant difference in the risk of groin hematoma, groin bleeding, femoral pseudo-aneurysm, lower limb ischemia and/or arterial stenosis, blood transfusion, arterial complications, the need for vascular surgery and the total complication rate. However, one systematic review found a decreased risk of groin infection and an increased time to haemostasis with manual compression, compared to vascular closure devices. In these studies a trained medical personnel applied the pressure.

Ice, elevation, pressure on proximal pressure points

In 2015, the Consensus on Science investigated if the application of ice, elevation of extremity and/or application of pressure over proximal pressure points, compared with direct pressure alone, changed overall mortality, haemostasis, major bleeding, complications, and hospital length of stay.

Very low quality evidence from one randomized controlled trial was identified showing a benefit with cold therapy compared to compression. One study shows a benefit in the reduction of femoral hematoma formation in post percutaneous coronary intervention patients receiving cold pack (vasoconstriction) compared to sandbags (compression).

Very low quality evidence from one randomized controlled trial shows a benefit in cold compression dressings compared to non-cold compression dressings in orthopaedic surgery. Lastly, one randomized controlled trial of very low quality evidence showed a reduction in complications with cold therapy compared to compression.

Tourniquets
Tourniquet application was first reviewed in the Consensus on Science of 2010 and due to the still controversial discussion of potential benefits and/or harm, especially in the use of tourniquets by first aid providers to control bleeding, it was reviewed again in 2015. It was investigated if among adults and children with external limb bleeding the application of a tourniquet compared with not applying a tourniquet, does change haemostasis, overall mortality, vital signs, functional limb recovery, complications, blood loss, incidence of cardiac arrest.

One human controlled study (low quality evidence) was found enrolling 70 patients showed benefit where 83 per cent of those who had a tourniquet applied achieved haemostasis compared with 61 per cent of those who did not have one applied. There was very low quality evidence from six human case series, enrolling a total of 750 patients, demonstrating that 74.7 per cent of the casualties who had a tourniquet applied achieved haemostasis.

Low quality evidence from three human studies with a comparison group enrolling 1,768 patients showed no difference, where 12 per cent of patients who had a tourniquet applied died compared with nine per cent of patients who did not have one applied. In addition, very low quality evidence from one human case series enrolling 903 patients showed benefit, where ten per cent of the casualties who had a tourniquet applied died.

Lastly, one human study (low quality evidence) with a comparison group enrolling 165 patients showed benefit to tourniquet application, where 6 per cent of patients who had a tourniquet applied had complications compared with 9 per cent who did not have one applied had complications. Very low quality evidence from four human case series studies enrolling 846 patients documented that complications from tourniquets occurred in 4.3 per cent of the casualties. A bias might be considered as these studies were mainly made in war or war-like environment.

Haemostatic agents
In the Consensus on Science of 2015, it was investigated if in patients with severe external bleeding the application of topical haemostatic dressings plus standard first aid, compared with standard first aid alone, changes overall mortality, vital signs, haemostasis, complications, blood loss, major bleeding, incidence of cardiac arrest.

Very low quality evidence from one human case series showed that 7.7 per cent of the casualties with haemostatic dressings died (there was no comparison group). In addition, very low quality evidence was found in seven animal studies showing that 29.1 per cent of the casualties who received haemostatic dressings died, compared to 65.8 per cent of those who did not receive haemostatic dressings. Four human case series (very low quality evidence) with 130 patients receiving haemostatic dressings showed that haemostasis occurred in 90.8 per cent of participants. Very low quality evidence from three animal studies showed that haemostasis occurred in 74.2 per cent of animals receiving haemostatic dressings Very low quality evidence from one human case series study showed that 73 per cent of participants achieved haemostasis in less than three minutes when a haemostatic dressing was applied.

References

Guidelines

- First aid providers must control external bleeding by applying direct pressure. (**)
- The use of pressure points and elevation is **NOT** recommended. (*)
- When direct pressure fails to control life-threatening external limb bleeding or is not possible (e.g. multiple injuries, inaccessible wounds, multiple casualties), tourniquets could be considered in special circumstances (such as disaster, war-like conditions, remote locations or in instances where specially trained first aid providers are providing care). (*)
- Localized cold therapy with or without pressure may be beneficial in haemostasis for closed bleeding in extremities. (*) Caution is advised when applying this recommendation to children due to a potential for hypothermia.
- The out-of-hospital application of a topical haemostatic agent to control life-threatening bleeding not controlled by standard techniques and in situations where standard techniques could not be applied could be considered with appropriate training. (*)

Implementation considerations

First of all, first aid education should focus on direct pressure as the primary way to control bleeding.

Tourniquets had previously fallen out of use in public first aid programmes in many regions due to limited evidence of its benefits in the use by layperson first aid providers and the perceived risk of harm. Recent military and to a certain extent civilian experience following terrorism events have shown fears of harm may be unwarranted and there may be benefit in using tourniquets.

The decision to include the use of tourniquets in the laypersons' first aid course curriculum must be based on the situation of the local health system, especially the availability of a well-developed emergency care system.

It may be reasonable to include only one hemostatic adjunct (tourniquet or hemostatic agent) in a National Society's programme based on availability.

The inclusion of topical haemostatic agents in the curriculum should be based on the availability of these substances and the question if laypersons are legally allowed to use them.

If tourniquets and/or topical haemostatic agents are included in first aid education, training in the application techniques and proper assessment of severe bleeding are required. Learners should be aware that these techniques should only be applied in life-threating situations where direct pressure could not be applied.

See Shock

Amputation

Introduction

Amputation is the removal of a limb, or a part of the limb. In partial amputation, the body part remains partially attached to the body. Amputation does not always lead to the loss of the amputated body part. Adequate first aid improves the chances of recovery. Evidence was reviewed for this new topic in 2015.

Summary of the scientific foundation

No evidence was found to support keeping the amputated body part on ice. Freezing of the amputated part damages it.

Guidelines

In case of complete amputation:

- If the body part is completely amputated, it is recommended that the part is wrapped it in a sterile compress or bandage. First aid providers should put the body part in a clean watertight plastic bag and seal it firmly. A second plastic bag containing water and ice can be used: put the bag with the body part in the bag of ice or water and make sure there is no direct contact between the body part and the ice. (Good Practice Point)
- Make sure the person concerned takes the amputated body part with him or her to the hospital. (Good Practice Point)

Implementation considerations

In case of amputation, the priority should be to stop the bleeding (*see* Bleeding). It is important not to further damage the amputated body part.

Although no studies were identified showing the effect of keeping the body part on ice, this may be done to preserve the body part. To prevent tissue damage from direct contact with ice, the body part should be wrapped in a plastic bag before putting it in a bag with water and ice.

Amputation care kits containing material and instructions to properly store and transport amputated body parts are available in the market.

Concussion

Introduction

Head injuries can range from being severe and cause loss of consciousness and airway control to brief loss of consciousness. In other cases a person suffering from a head injury can remain conscious. Head injuries without loss of consciousness are common in adults and children. Due to the complexity of symptoms and signs, first aid providers can find it difficult to identify a concussion. This can lead to a delay in the casualty receiving proper concussion management and post-concussion advice and treatment. Evidence for this topic was reviewed in 2015, first by the Consensus on Science and thereafter by the American Red Cross Scientific Advisory Council. The guidelines have been updated based on the findings of this review.

Summary of scientific foundation

In 2015, the published evidence for this topic was reviewed by the Consensus on Science. However there was only one pre-hospital study that used the simplified motor score compared to the Glasgow Coma Score (GCS) to grade concussion, showing no difference between both scores to diagnose concussion.

Regarding likelihood of differentiating between head injury with and without concussion (brain injury), a very low quality observational study was identified with 19,408 patients in a trauma registry using a secondary analysis of rescoring pre-hospital GCS showing no significant difference between a simple derived motor score versus the GCS score to determine brain injury.

For the critical outcome of change in time to recognition of the deteriorating patient, for the important outcomes of survival to 30 days with good neurologic outcome, and for the likelihood of a poor neurologic outcome no evidence was found.

However, since these tools require a two-stage assessment, before competition and post-concussion, this assessment cannot be recommended for layperson first aid providers.

The Scientific Advisory Council of American Red Cross stresses that first aid providers must recognize that no two minor traumatic brain injuries, known as concussions (mTBI) are identical in either the cause or presentation. The degree of the resulting signs and symptoms from the physical trauma can be very different and difficult to visualize by a first aid provider depending upon a variety of factors. The diagnosis of a mTBI should involve the assessment of a range of domains including, but not limited to the person's symptoms, signs, behaviour, balance and coordination, sleeping patterns, cognition and analytical abilities and response to physical exertion, with each assessment tool adding additional information regarding the status of the injured person by independently evaluating differing aspects of cerebral functioning. However, while assessment tools such as neuropsychological, neurocognitive, balance and coordination testing are commonly used and provide the greatest amount of objective measures regarding a person's cognitive function and recovery after a concussive injury, individual variations in test scores and the necessity of baseline assessment makes it difficult for first aid providers to administer these tools and interpret the results.

To help recognize a concussion, first aid providers should look for two signs. First, the person sustaining an mTBI usually experiences a forceful bump, blow, or jolt to the head or body that results in rapid movement of the head and brain. Second, first aid providers should look for any change in the person's physical, cognitive, emotional or sleeping patterns. Refer to Table 3 below for the signs and symptoms. Note that these signals may or may not appear immediately, and that some people do not recognize or admit that they are having problems, particularly athletes in the middle of a match.

A concussion may be subtle and difficult to diagnose. Any casualty who has sustained trauma to the head, and experiences any of the signs or symptoms highlighted in the table below should be removed from activity and referred to a qualified healthcare professional, experienced in evaluating and managing concussion.

Table 3: Signs and symptoms of a concussion

Physical	Cognitive	Affective	Sleep
Headache	Difficulty thinking	Irritability	Drowsiness
Nausea or vomiting	Foggy	Sadness	Sleeping more/less
Balance	Difficulty concentrating	Anxiety	Difficulty sleeping
Dizziness	Decreased processing	Heightened emotions	
Double or blurry vision	Difficulty remembering	Nervousness	
Sensitivity to light or noise	Difficulty recalling events		
Tinnitus	Feeling sluggish		
Fatigue			
Not feel right			
Loss of consciousness			

References

Guidelines

- Any casualty who is suspected to have sustained trauma (forceful bump, blow, or jolt to the head or body that results in rapid movement of the head and brain), along with any of the signals listed in table above must be presumed to have sustained mTBI or concussion. (**)
- Any person having sustained mTBI or concussion must be removed from activity (for instance sport or other recreational activities) and referred to a qualified healthcare professional, experienced in evaluating and managing concussion. (**)
- If the person has altered mental status including being unconscious, change in airway or breathing, seizure, change in vision, neuralgic deficits anywhere in the body or bleeding out of the nose, ear or mouth, EMS must be activated. (Good Practice Point)
- If a casualty with a suspected concussion has had an initial sports concussion assessment tool assessment (SCAT3), healthcare professionals may use this assessment for recognition of concussion during further care. (Good practice point)

See Unresponsive and altered mental status and Wounds and abrasions

Implementation considerations

Although no evidence-based tool can be provided for the use in first aid, the curriculum of a first aid course should include causes and symptoms of head injuries. If a National Society develops specific programmes for those involved in sport they should consult the local experts in concussion to determine if the first aid providers should be taught specific screening tools.

Cervical spinal motion restriction

Introduction

In cases of cervical spinal injury it has been common for medical emergency teams to apply cervical collars to the neck and lay the person on a long backboard to immobilize the spine with the intention to restrict spinal motion and to avoid further injuries. There is little evidence to support or refute this practice and it is difficult for first aid providers to screen for appropriate casualties or apply it well without adverse effects. New evidence reviewed in 2015 has been used to support the guidelines presented here.

Summary of scientific foundation

In the Consensus on Science of 2015, all available evidence focused on the use of cervical collars and/or sandbags relevant for casualties with blunt traumatic cervical spine injuries. In a non-randomized study with 5,138 motorcycle crash casualties, a significant benefit on neurological injury when applying a cervical collar could not be demonstrated. In one non-randomized study with 18 children with head injuries and 13 additional non-randomized studies, all including cadavers or healthy volunteers, a statistically significant decreased cervical spine motion was observed when using cervical collars. However, in four studies with patients a statistically significant higher intracranial pressure was found, while in two studies this result could not be demonstrated. No effect on tidal volume and comfort could be found in two additional studies.

In case of applying soft collars, three studies with healthy volunteers or cadavers showed a statistically significantly decreased cervical spine motion with application of soft collars. The same was found in a non-randomized study looking at the effect of sandbags with tape.

With regard to spinal immobilization using a backboard and straps or equivalent device the most recent reviews were the 2010 Consensus on Science from the International First Aid Advisory Board and the American Red Cross Scientific Advisory Committee review updated in 2015. They found that there are no published studies that support or refute the benefit of spinal immobilization with backboards or straps by first aid providers. One retrospective, non-randomized and probably underpowered study of spinal immobilization by emergency medical technicians using immobilization devices failed to show any neurological benefit compared with no spinal immobilization. Two retrospective studies examined data from before the era of routine spinal immobilization and compared them to the era after the introduction of routine spinal immobilization and determined that secondary spinal injury occurred in three per cent to 25 per cent of patients suffering a spinal injury. A published review of the literature estimated that 0.03 per cent to 0.16 per cent of patients may be helped by spinal restriction. The conclusion found from this 2010 review was there is insufficient evidence for or against spinal immobilization. It is reasonable to recommend spinal motion restriction, in people with risk factors for cervical spine injury.

The American Red Cross Scientific Advisory Council scientific review updated in 2015 found that for such a common and iconic practice in pre-hospital medicine and first aid there remains a lack of rigorous scientific evidence referable to pre-hospital care providers with regard to cervical spine protection. The trend of evidence in the past two reviews is:

1. Continued questions on the need for and efficacy of modern spine immobilization techniques with low quality evidence on the questions on the efficacy of rigid versus soft collars in preventing further injury and/or restricting spine movement; and
2. Low quality evidence that cervical collars can increase intracranial pressure and worsen some cervical spine injuries. There is no work on lay first aid providers but studies on EMS providers do exist. There is no useful scientific work on head blocks as an immobilization tool.

References

Guidelines

- First aid providers may suspect a spinal injury if an injured person displays any of the following risk factors: (*)
  - over 65 years of age
  - driver, passenger, or pedestrian, in a motor vehicle, motorized cycle, or bicycle crash
  - fall from a greater than standing height
  - tingling in the extremities
  - pain or tenderness in the neck or back
  - sensory deficit or muscle weakness involving the torso or upper extremities
  - not fully alert or is intoxicated
  - other painful injuries, especially of the head and neck
  - children with evidence of head or neck trauma
- For layperson first aid providers the routine application of cervical collars is **NOT** recommended (*).
- First aid providers should **NOT** strap the head or neck. (*)
- In the case of suspected cervical spine injury it is recommended to manually support the head in position limiting angular movement until experienced healthcare provision is available. (Good Practice Point)

Implementation considerations

Cervical spinal motion restriction is defined as the reduction or limitation of cervical spinal movement, using a cervical collar or sandbags with tape combined with long backboard. Other definitions may be applied in some countries or by other organizations.

Since incorrect application of a cervical collar could result in further injury and evidence is available on adverse events (e.g. raised intracranial pressure) when applying such a collar, it is decided not to recommend routine application of a cervical collar by a lay first aid provider. In addition, in the EMS community, there has been recent evidence of harm from unnecessary application of a long backboard. Correct application would require training, regular practice and the ability of the first aid provider to distinguish between high- and low-risk individuals.

Chest and abdomen injuries

Introduction

Involvement of a first aid provider in severe traumatic injuries of the abdomen or chest is not a very common situation, but they should be able to recognize open chest and abdominal wound injuries as a potentially life-threatening injury and provide correct first aid. A new review was undertaken for this topic by ILCOR and the evidence is reflected in the guidelines presented here.

Summary of scientific foundation

For the first time, literature on the question of first aid for open chest wounds was worked on in 2015 by the Consensus on Science.

One animal-based study (very low quality evidence) showed benefit in the question of respiratory oxygen saturation, tidal volume and vital signs by using a non-occlusive device. No evidence could be found in the critical outcome of survival, cardiac and respiratory arrests.

CEBaP searched for scientific evidence on the management of abdominal wounds and did not find any evidence on the questions repositioning externally herniated internal organs, applying pressure on the wound or which position a casualty should be put in.

References

Guidelines

- For open chest wounds, first aid providers may leave the wound free without applying a dressing. (*)
- If a wound dressing is necessary, non-occlusive wound dressings could be used (that is, one that does not seal the wound). (*)
- For chest and abdomen injuries, first aid providers should manage shock and place the person in a comfortable position. (Good Practice Point)
- For open abdominal wounds, first aid providers may place a sterile dressing on the wound. (Good Practice Point)
- First aid providers should not push back viscera (internal organs). (Good Practice Point)
- First aid providers should stabilize impaled objects. (Good Practice Point)
- If there is significant external bleeding, direct pressure to the chest wound with a hand and/or a dressing should be applied. Care must be taken that it does not become occlusive. (Good Practice Point)

Implementation considerations

The published literature indicates the importance of correct management of an open chest wound. First aid education on this topic should stress the importance of not using occlusive dressings to prevent the development of a potential life-threatening complication of a tension pneumothorax.

Previously, the standard treatment for a sucking chest wound was to place a three-sided occlusive dressing on the chest. However, if the wound is sealed, blood may clot and seal the wound and allow air to build up in the chest, which may lead to tension pneumothorax.

Extremity injuries

Introduction

While not always life-threatening extremity injuries have the potential for loss of the limb. In addition, extremity fractures are often painful and there may be associated bleeding. Such bleeding can be internal at the fracture site, or external in the case of open fractures; if large bones are involved, such as the femur, the associated bleeding can be life-threatening. Depending on the position of the extremity and the nature of the injury, there may also be challenges for moving the injured person. The goals of first aid of extremity fractures are to preserve the extremity, to limit pain and bleeding and to seek further medical assistance. CEBaP reviewed the evidence for this topic in 2015.

Summary of scientific foundation

CEBaP investigated various questions and could not find any evidence on benefits of application of a sling, splints or elevation for broken or dislocated limbs.

Some evidence was found on the question of whether compression compared to no compression is effective to improve health outcome for strains or sprains. There is limited evidence in favour of no compression. It was shown that no compression resulted in a statistically significant decrease of edema and pain (need for analgesics), compared to compression.

There is limited evidence in favour of ice or cooling. It was shown that ice or cooling resulted in a statistically significant decrease in recovery after seven days and pain after treatment, compared to no ice and cooling. However, a statistically significant increase of soft tissue swelling and ability to bear weight, using cold therapy compared to dummy therapy, could not be demonstrated.

In case of using a combination of ice and compression, a statistically significant decrease of pain in rest, while walking and while running, functional capacity and length of functional re-convalescence period, compared to no treatment, could not be demonstrated.

In 2015, the Consensus on Science's main focus was on the question of whether realignment of an angulated bone fracture prior to splinting compared with splinting as found would relieve neurological injury, vascular injury, splinting, pain, and time to medical transportation. Studies were identified for full review but all were excluded as they did not completely meet criteria for inclusion and no evidence was found.

No evidence was found for or against the realignment of angulated long bone fractures as a first aid procedure in terms of neurological or vascular injury, pain, or time to medical transportation outcomes. Neither any evidence was found for or against the application of a sling, immobilization with or without a splint as a first aid procedure among persons with a broken or dislocated limb compared to no application of a sling, immobilization, splint in change of functional recovery, pain, complications and time to resolution of symptom.

Guidelines

- A first aid provider could cool a sprained joint and soft-tissue injury. (*)
- First aid providers should assume that any injury to an extremity could include a potential bone fracture and manually stabilize the extremity injury in the position found. (Good Practice Point)
- There is insufficient information to make recommendations for straightening an angulated fracture. For remote situations, wilderness environments or special circumstances with a cool and pale extremity this may be considered by a trained first aid provider. (Good Practice Point)
- Ice or cooling should **NOT** be applied for more than 20 minutes. (Good Practice Point)
- First aid providers should assess for haemorrhage in all fractures and treat for shock in fracture involving long bones, especially femur, due to possibility of significant internal haemorrhage. (Good Practice Point)
- Based on training and circumstance, providers may need to move an injured limb or person. In such situations, providers should protect the injured person. This includes splinting in a way that limits pain, reduces the chance for further injury, and facilitates safe and prompt transport. (Good Practice Point)

Implementation considerations

As the evidence does not provide a clear treatment recommendation for a first aid provider caring for a patient with a severely angulated fracture, it is advised to get in touch with regional orthopaedic experts and rescue organizations to create guidelines for local use – especially in remote or mountainous areas with mountain rescue services.

There is insufficient information to make recommendations on optimal frequency, duration and initial timing of cryotherapy after an acute injury. Many textbooks are not consistent in their recommendations related to duration, frequency and length of ice treatment but understanding the meaning of phase change is important.

See Wounds and abrasions

Wounds and abrasions

Introduction

One of the most common injuries seen by first aid providers, especially in a family environment, is wounds and abrasions. First aid providers can often care for these at home, without needing emergency treatment. Simple evidence-based treatments can be used. It is also important for the first aid provider to recognize when a serious condition exists or evaluation by a healthcare provider is needed. Evidence for this topic was reviewed in 2015 and guidelines have been updated accordingly.

Summary of scientific foundation

In the 2010 Consensus on Science, this topic was reviewed and new evidence was added from reviews conducted by CEBaP.

Wound irrigation is often used in the pre-hospital and hospital setting to clean wounds. There is strong evidence from human and animal studies that wound irrigation using clean, running tap water is at least as effective as wound irrigation with normal saline and may be better. In a meta-analysis conducted by Cochrane, one small randomized human study and one human case series, irrigation with running tap water was more effective than irrigation with saline in improving wound healing and lowering infection rates. In a small-randomized human study, irrigation with tap water resulted in a wound infection rate equivalent to that observed after irrigation with normal saline. Although many of these studies were performed in healthcare settings, running tap water is generally readily available to first aid providers in the out-of-hospital setting. Evidence from seven clinical trials, one meta-analysis of simple traumatic lacerations in the emergency department, and six animal studies demonstrated that irrigation is beneficial. A statistically significant decrease of infection, using tap water compared to saline, could not be demonstrated. In one additional small study, irrigation solutions at body temperature were better tolerated than cold solutions.

In addition, these studies showed that tap water was equal to other irrigation solutions in terms of the occurrence of infection. One clinical trial demonstrated no benefit from soap and water applied to an open wound. Also, several studies and one isolated cell experiment demonstrated possible toxicity to cells when exposed directly to soap and water. This may have application for soap being used directly on an open wound. Significant literature also supports the benefit of soap and water for decreasing skin bacterial counts when applied to closed wounds. Two prospective, randomized controlled studies compared the effectiveness of triple antibiotic ointment with that of single antibiotic ointment or no ointment in conditions comparable to those seen in first aid situations. In one human volunteer study in which ointment was applied to intradermal chemical blisters inoculated with staphylococcus aureus, contaminated blisters treated with triple antibiotic ointment healed significantly faster and with a lower infection rate than blisters treated with either single antibiotic ointment or no ointment. Both triple and single antibiotic ointments were superior to no treatment in promoting healing of contaminated blisters.

Several of these studies were complicated by initial cleaning with antiseptic solutions that may have biased the results obtained for antibiotic ointment but that may also support the value of antiseptic solutions. In a study of 59 children in a rural day care centre, application of triple antibiotic ointment to areas of minor skin trauma (e.g. mosquito bites and abrasions) resulted in lower rates of streptococcal pyoderma (a skin infection) than in children who received applications of placebo ointment (15 per cent versus 47 per cent). Antibiotic ointment can eliminate coagulase-negative staphylococci underlying the skin surface, but its impact on wound contamination and healing cannot be extrapolated from these studies.

Results of three human and two animal studies showed significantly shorter healing time of abrasions treated with any occlusive dressing or topical antibiotic than with no dressing or topical antibiotic. While questionable whether the same would be true of actual injuries, there were studies reviewed of surgically created wounds that also supported the use of topical agents. Two of these studies demonstrated that triple antibiotic had better outcome than no ointment with regard to scarring and pigment changes. However, one does have to question whether similar results would be obtained with actual wounds versus surgically created wounds under sterile conditions.

References

Guidelines

- Superficial wounds and abrasions should be irrigated with clean water, preferably tap water because of the benefit of pressure. (**)
- First aid providers may apply antibiotic ointment to skin abrasions and wounds to promote faster healing with less risk of infection. (*)
- First aid providers may apply an occlusive dressing to wounds and abrasions with or without antibiotic ointment. (*)
- The use of triple antibiotic ointment may be preferable to double- or single-agent antibiotic ointment or cream. (*)
- If antibiotic is not used, antiseptic could be used. (*)
- There is some evidence that traditional approaches, including applying honey, are beneficial and may be used on wounds by first aid providers. (*)
- People with wounds that develop redness, warmth or become painful or with wounds where the person develops fever should seek assessment from a healthcare provider. (Good Practice Point)

Implementation considerations

The implementation of these guidelines in the use of topical antibiotic ointment depends on local laws, regulations and processes, including liability protection. National Societies may need to vary their methodologies for implementation according to the educational opportunities in the national context. Alternatives to an occlusive dressing should be discussed in training programmes.

Dental avulsion

Introduction

Dental injuries, particularly in children, are common problems seen by first aid providers. There is question regarding re-implantation and needed training. In the absence of re-implantation what is the best method for storage? This topic was reviewed in 2015 by ILCOR and new guidelines developed.

Summary of scientific foundation

Only three studies investigating the effect of avulsed teeth in a specific storage solution were identified. In addition, 11 studies with extracted teeth investigated cell viability as a surrogate marker for tooth survival after placing the whole tooth in a specific storage medium. In none of the studies outcomes such as infection rate, pain and malfunction were addressed.

In five studies evidence was found in favour of egg white, ricetral, coconut water, propolis, phosphate buffered saline, or Hank's balanced salt solution compared to milk, when looking at cell viability after 15 minutes to three hours of immersion in the solution. In one study evidence was found in favour of milk compared to saline when looking at cell viability after 45 minutes of immersion.

Evidence is of very low quality because of risk of bias, indirectness and imprecision.

References

Guidelines

- It is **NOT** recommended for first aid providers to re-implant an avulsed tooth. (Good Practice Point)
- The avulsed tooth should be held at the crown, not the root. (Good Practice Point)
- Do **NOT** try to clean the avulsed tooth since this could damage vital tissues remaining on the tooth. (Good Practice Point)
- The avulsed tooth may be placed in Hank's balanced salt solution. If not available the tooth may be placed (in order of preference) in propolis, egg white, coconut water, ricetral, whole milk, saline or phosphate buffered saline. (*)
- The person concerned should be referred to a dentist as soon as possible. (Good Practice Point)

Implementation considerations

Re-implantation of an avulsed tooth is a difficult procedure for first aid providers who are not trained for this. Therefore, it is important that a first aid provider brings the person concerned and the avulsed tooth to a dentist.

Based on evidence alone, it is not possible to decide which solution is better. However, based on the evidence evaluated, availability and feasibility, solutions listed in the guidelines above could be used for temporary storage of an avulsed tooth. Some of these solutions might not be available in some countries or at the accident scene, and thus the choice of the storage solution can be made based upon availability.

The implementation of these guidelines in the use of these solutions for dental avulsion depends on local laws, regulations and processes, including liability protection. National Societies may need to vary their methodologies for implementation according to the educational opportunities in the national context.

Note: The crown of a tooth is the area covered in enamel above the neck of the tooth. The root is found below the neck of the tooth (the bit below the gum).

Injuries due to chemical exposure

Introduction

In industry and at home chemical substances might cause burns and first aid providers should be able to provide the required care as well as protect themselves. Evidence exists for treatment in the form of irrigation, but also emergency services should be contacted urgently. Evidence for this topic was reviewed in 2015 and guidelines have been consequently updated.

Summary of scientific foundation

For 2015, the ILCOR First Aid Task Force looked at what solutions might be compared with water for the management of ocular injuries from chemicals or other substances. This use of water as a comparator made the literature search extremely difficult, and no human comparative trials were identified. Thus, animal studies were later introduced into the search strategy, and one comparative animal study met the inclusion criteria.

Other areas of skin exposure to caustic agents was not reviewed in the 2015 Consensus on Science, therefore the information from 2010 is given.

Saline versus water for eye irrigation
For the critical outcome of pH level, studied as maximum pH of the anterior chamber after alkali application (NaOH) to the cornea, one very low quality vivo observational animal study using the eyes of 16 rabbits was identified. This paper shows a statistically significant higher maximum pH when irrigating with 0.5l or 1.5l of 0.9 per cent normal saline versus 0.5l of tap water.

Dermal contact
Evidence from multiple studies examining alkali and acid exposure of skin showed that outcomes were improved when water irrigation was rapidly administered in first aid treatment. In one non-random case series of immediate (first aid) versus delayed (healthcare provider) skin irrigation, the incidence of full-thickness burns was lower and length of hospital stay was decreased by 50 per cent with immediate and copious irrigation of skin chemical burns. Animal evidence also supports water irrigation to reduce exposure of the skin to acid. In a study of rats with acid skin burns, water irrigation within one minute of burn prevented any drop in tissue pH, whereas delayed irrigation allowed a progressively more significant fall in tissue pH.

Internal contact
There are no human studies on the effect of treating oral caustic exposure with dilution therapy. Five animal studies demonstrate histological benefit to animal tissue representative of the oesophagus when diluent was administered after exposure to an alkali or acid. One in vitro chemistry study demonstrated no benefit from the addition of large volumes of diluent to either a strong base or a strong acid.

Guidelines

- In the event of chemical exposure, emergency services or poison control centre should be contacted as soon as possible. (Good Practice Point)
- The eye may be irrigated using copious amounts of clean water, preferably using an eyewash bottle, eyewash station or shower. (*)
- First aid providers may use continuous, large volumes of clean water for irrigation of chemical injuries where chemical exposure has occurred to other parts of the body. (*)

Implementation considerations

In first aid education, it should be stressed to learners that first aid providers have to protect themselves, when they irrigate skin or eyes. They should use gloves and take care that the diluted substance does not harm them.

While irrigating an eye take care that the other eye is not affected by the diluted substance, pressure is not too high and the first aid provider should carefully opens the lids. Also while irrigating any portion of the body education should be given as to how to irrigate without exposing other areas of the body.

People trained to use specific antidote solutions could use these on advice of the local poison control centre.

10. Environmental health problems

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The environment can have a dramatic impact on health and life, especially the young, older people and people with chronic illness. First aid education must guide learners on coping with environmental factors and needs to include local considerations and adaptations that may be needed for remote locations and wilderness situations.

Health problems caused by cold

Exposure of the body to cold can cause either direct harm to tissues, such as frostbite, or can lead to general hypothermia.

Frostbite

Introduction

Frostbite occurs infrequently but can have severe consequences. Local damage is caused to skin and other tissues due to extreme cold. Body parts furthest from the heart and those with large exposed areas are most likely to get frostbites. As the ambient temperature approaches 0°C (32°F), blood vessels on the surface of the skin start to constrict. The same response may also result from exposure to high winds. This vessel constriction helps to preserve core body temperature. In extreme cold, or when the body is exposed to cold temperatures for long periods, this protective strategy can reduce blood flow in some areas of the body to dangerously low levels. Evidence shows the benefits of rewarming, but also the dangers of refreezing. Evidence for this topic was reviewed in 2015 and guidelines have been consequently updated.

Summary of scientific foundation

In 2010, this topic was researched and analysed by the Consensus on Science and CEBaP carried out an evaluation specifically on hypothermia and bleeding. A scientific review showed that rapid rewarming with water baths between 37°C and 42°C (98.6°F and 107.6°F) for 20 to 30 minutes improved outcome. Multiple animal models and several case series in which the outcome showed reduction in tissue loss supported this. Of note, model studies of chemical heat-generating devices for hand and foot warming generated temperatures significantly above this range (69°C to 74°C; 156°F to 165°F). Lastly, two case series indicated caution regarding the danger of refreezing of tissue once warmed.

Several studies in which either topical anti-inflammatory application or general drug therapy was given did not find clear evidence of treatment benefit.

In 12 observational studies with patients with severe bleeding or trauma it was shown that hypothermia is a risk factor for mortality, blood loss and complications such as shock, coma, multiple organ dysfunction syndrome, adult respiratory distress syndrome, pneumonia, respiratory failure, systemic inflammatory response syndrome, sepsis, infections and cardiac arrest (very low quality evidence).

References

Guidelines

- People experiencing severe bleeding or major trauma should be kept warm. (**)
- When providing first aid to a person experiencing frostbite, rewarming of frozen body parts should be done only if there is no risk of refreezing. (*)
- Rewarming should be achieved by immersing the affected part in water between 37°C (i.e. body temperature) and 40°C (98.6°F and 104°F) for 20 to 30 minutes. (Good Practice Point)
- For severe frostbite, rewarming should be accomplished within 24 hours. (Good Practice Point)
- Chemical warmers should **NOT** be placed directly on frostbitten tissue since these can reach temperatures that result in burns and exceed the targeted temperatures. (Good Practice Point)
- After rewarming, efforts can be made to protect frostbitten parts from refreezing and to quickly transport the person for further care. (Good Practice Point)
- Affected body parts may be dressed with sterile gauze or gauze placed between digits until the person concerned can reach medical care. (Good Practice Point)
- The use of non-steroidal anti-inflammatory drugs for treatment of frostbite as part of first aid is **NOT** recommended based on potential side effects of these drugs (e.g. allergies, gastric ulcer bleeding). (*)

Implementation considerations

Since frostbites are infrequent even in alpine regions and first aid providers need to know what to look for, photos of frostbite should be used for teaching purposes.

Hypothermia

Introduction

Hypothermia can occur if the whole body is exposed to cold and is defined as a condition in which core temperature drops below that required for normal metabolism and body functions, i.e. 35°C (95°F). Evidence is available to support different warming techniques depending on the state of the person. Evidence for this topic was reviewed in 2015 and guidelines have been updated accordingly.

Summary of scientific foundation

One study supported the use of active rewarming using a heating blanket in non-shivering hypothermic patients versus using a metallic foil. One study supported the use of active rewarming devices over passive rewarming in non-shivering hypothermic patients. However, in another study, there was not much difference in the rate of rewarming in patients with mild hypothermia whether a blanket or one of the two active devices were used.

Guidelines

- A person experiencing hypothermia, who is responsive and shivering vigorously should be rewarmed passively with a polyester-filled blanket. (**)
- For a person suffering from hypothermia, who is not shivering, active warming should be started, with a heating blanket if available. (**)
- For passive rewarming, if a polyester-filled blanket is not available and the person is responsive and shivering, other options may be used, including any dry blanket, warm dry clothing or reflective or metallic foil or air bubble sheet. (*)
- For active rewarming, if a heating blanket is not available and the person is not shivering, other options may be used, including a hot water bottle, heating pads or warm stones adjacent to core areas of the body. Do **NOT** apply directly to the skin to prevent burning the person. (*)
- For all cases of hypothermia, EMS should be activated and the casualty's airway, breathing and circulation should be assessed. (Good Practice Point)
- In all cases, the person concerned should be treated gently, removed from the cold stress and have his or her wet clothing removed. (Good Practice Point)
- Care should then be taken to insulate the person and provide a vapour barrier if possible to minimize conductive or convection and evaporative heat loss, respectively. (Good Practice Point)

Implementation considerations

First aid education should include the following information:

- Safe behaviour in the mountains and while participating in winter and/or water sports to prevent hypothermia and frostbite.
- Safety in avalanche areas to reduce the risk of experiencing an avalanche by familiarizing learners with local warning signs and safe behaviours (e.g. do not risk going on closed ski slopes).
- How to call for emergency support in the mountains.
- Reminders that hypothermia may even occur in warm temperatures due to activity, wet clothing, etc.

If the whole body is exposed to cold, hypothermia can result, in which core body temperature drops below that required for normal metabolism and body functions, defined as 35°C (95°F). If exposed to cold and the body's internal mechanisms is unable to replenish the lost heat, core temperature drops. As body temperature decreases, characteristic symptoms occur such as shivering, tachycardia and tachypea, which are all physiological responses to preserve heat. Mental confusion may also be present. Later, a lack of coordination becomes apparent, as movements become slow and laboured and are accompanied by a stumbling pace and mild confusion. The person becomes pale, with lips, ears, fingers and toes possibly turning blue. In later stages, amnesia may start to appear as well as an inability to use the hands. The exposed skin becomes blue and puffy, muscle coordination becomes very poor, walking becomes almost impossible, and the person exhibits incoherent or irrational behaviour, including terminal burrowing or even a stupor.

Health problems caused by high altitude

Introduction

While not commonly thought of as a danger, high altitude can pose health problems. If persons, especially those with medical pre-conditions, go to a high altitude quickly (e.g. when using cable cars to reach the peaks of high mountains), they can develop acute mountain or altitude sickness. Symptoms can also develop in experienced and trained mountaineers when they reach very high altitudes, such as in the Himalaya region. Concurrent physical exertion or chronic medical conditions increases the danger of acute mountain or altitude sickness. An evidence review was undertaken for this topic and consequently new guidelines developed.

The collective term altitude illness includes acute mountain sickness (AMS), high altitude pulmonary oedema (HAPE) and high altitude cerebral oedema (HACE). These conditions represent the pathological effect of high altitude caused by acute exposure to low partial pressure of oxygen at high altitude.

Altitude illnesses occur when people at a high altitude do not have enough oxygen in their blood (hypoxia) because the barometric air pressure is too low. As altitude increases, air becomes thinner and less oxygen is inhaled with each breath. The most common altitude illness is acute mountain sickness. It commonly occurs in a person who has recently reached an altitude of around 6,500 feet to 8,000 feet (approximately 1,980 metres to 2,440 metres). If signs and symptoms of acute mountain sickness appear at lower altitudes, they may be the result of other conditions, such as dehydration or heat illness. Left untreated, acute mountain sickness may progress to more severe conditions, such as HACE or HAPE. HACE is caused by fluid accumulating in brain tissue. If untreated, it can result in death. HAPE is caused by fluids accumulating in the lungs. When too much fluid accumulates in the lungs, a person cannot breathe properly, and this can result in death.

In most cases of altitude illness, the symptoms are mild and can include the following:
- dizziness or light-headedness, fatigue, headache
- nausea or vomiting
- rapid pulse, increased heart rate shortness of breaththat worsens with exhaustion

In more severe cases of altitude illness, fluid collects in the lungs (pulmonary oedema) and causes extreme shortness of breath. Brain swelling (cerebral oedema) may also occur. This can cause confusion, coma and if untreated, death. Symptoms generally associated with more severe altitude illness include the following:
- bluish discoloration of the skin (cyanosis)
- chest tightness or congestion
- cough and coughing up blood
- confusion
- decreased consciousness or withdrawal from social interaction
- cannot walk in straight line or steadily

Summary of scientific foundation

CEBaP, in collaboration with an international Red Cross task force evaluated the available literature.

One low quality study could be found where limited evidence in favour of descending to 2,250 meters could be reported and one low quality study describes the improvement in AMS with the use 3L/minute oxygen for ten minutes.

References

Guidelines

- Casualties of AMS, HACE and HAPE should immediately stop ascent and/or descent. (**)
- For first aid providers trained in its usage, oxygen may be administered to persons experiencing AMS, HACE and HAPE. (*)
- Continuing ascent with symptoms is **NOT** recommended. (Good Practice Point)
- First aid providers may assist people with their prescribed medication for altitude illness, such as acetazolamide or dexamethasone, based on label instructions. (Good Practice Point)
- Specially trained first aid providers, where local laws and regulations permit, may give people suffering altitude illness medications such as acetazolamide or dexamethasone, based on local protocol. (Good Practice Point)
- First aid providers should keep people suffering from altitude illness from getting cold or overheated. (Good Practice Point)

Implementation considerations

If this topic is included in the curriculum contact should be made with local medical experts and mountain rescue units or alpine organizations to align on local guidelines.

Oxygen is considered as a drug in some countries and care has to be taken to follow the local legal procedures. If it is legally possible, care has to be given on proper training of oxygen use. Also, local law and regulations must be followed with regard to helping patients with prescribed medications.

Radiation emergencies

Introduction

A radiological emergency is declared when there is, or is perceived to be, a hazard due to radiation exposure from a source. As sources of radiation are used in various fields, including industry, medicine and research, radiological emergencies may occur anywhere and include:

- Uncontrolled (abandoned, lost, stolen or found) dangerous sources
- Misuse of dangerous industrial and medical sources (e.g. those used in radiography)
- Public exposure and contamination from unknown origins
- Malicious threats or acts
- Transport emergencies.

Radioactive material could, if not under control, give rise to exposure sufficient to cause severe deterministic health effects that can range from acute to chronic impairment, particularly if handled by a member of the public who is unaware of the hazard. Radiation exposure can lead to either external or internal contamination or the effects of exposure to ionizing radiation or both.

The responses to radiological and chemical emergencies are very similar. In both cases, our senses (e.g. smell or sight) may not be able to detect hazardous levels of the material.

Sealed sources may cause a risk of irradiation only (that is, the process of exposure to radiation). Non-sealed sources may cause a risk of irradiation and external and/or internal contamination through dispersion of radioactive elements.

Therefore, the initial response is often carried out based on secondary indications of the hazards such as labels, signs or placards indicating the presence of a hazardous material, the appearance of medical symptoms in exposed individuals or readings from specialized instruments.

Summary of scientific foundation

The literature review found no evidence regarding radiation emergency. The recommendations are based on expert opinion.

References

Guidelines

- Avoid touching suspected radioactive items. (Good Practice Point)
- Keep distance and do **NOT** approach suspected radioactive items or accident scenes. (Good Practice Point)
- Remove casualty from the scene as quickly as possible. (Good Practice Point)
- Avoid the smoke within 100 metres of a fire or explosion that involves a potentially dangerous radioactive source. (Good Practice Point)
- Keep hands away from the mouth and do **NOT** smoke, eat or drink until your hands and face are washed (to avoid inadvertent ingestion). (Good Practice Point)
- Exposure to sealed sources does not require decontamination. To limit exposure, stay away or place an appropriate shield (lead apron for example) between the source and the exposed persons. (Good Practice Point)
- Special trained forces should take care of the decontamination process but potentially contaminated persons should be instructed to remove any clothing themselves while awaiting such teams, which may be of benefit. (Good Practice Point)
- Medical specialists must examine all persons who might be exposed to radioactivity as soon as possible. (Good Practice Point)

Implementation considerations

National Societies will need to determine whether they include this topic in their first aid education. This decision should be based on the level of the first aid provider being trained, resources, medical direction, the approaches of local emergency services, public health input and national circumstances (i.e. ethical considerations, customs, local practices, etc.).

At any rate all participants should be familiarized as part of the hazardous substance unit to recognize the symbol of radioactivity and be aware of emergencies with potential radioactive danger.

11. First aid for animal-related impairments

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Animals can cause multiple health impairments, and first aid courses should consider this topic according to epidemiological aspects of the local area. For example, training on ticks and tick-borne encephalitis and borreliosis is needed only if these diseases have a real local impact. However, because there are many myths about snakebites, teaching proper first aid treatment might be useful to avoid potentially harmful and unnecessary first aid interventions, even if no dangerous snakes are common in the area.

Animal bites

Introduction

The management of animal bites includes prevention, local wound treatment and consideration of the introduction of infectious agents into the wound (e.g. clostridium tetani, the bacteria that causes tetanus, and *staphylococcus aureus*, which is responsible for most skin infections). Evidence is scant, but washing the wound and referral to further medical care can be beneficial.

Summary of scientific foundation

In the Consensus of Science of 2010, this topic was worked on and irrigation of bite wounds was supported by animal studies for the prevention of rabies and by one human study for the prevention of bacterial infection. Tap water, saline and soap and water solutions were among the irrigants that showed benefit, although no direct comparisons were made between these interventions. Despite multiple recommendations in review literature and common clinical practice, no evidence was found for povidone-iodine use in bites. In addition, the literature reviewed in the previous section for Wounds also supports wound irrigation to prevent infection. These studies are quite old and unfortunately no recent ones could be found.

References

Guidelines

- Human and animal bite wounds should be copiously irrigated to minimize risk of bacterial and rabies infections. (*)
- Bleeding from an animal bite should be treated as per the guidelines for Bleeding management. (Good Practice Point)

- The person should be taken for further medical care as soon as possible for surgical intervention, vaccination, or drug therapy as needed. (Good Practice Point)
- People suffering from animal bites who develop warmth, redness or pain around the area of the bite from the time of the bite until well after healing should immediately seek medical evaluation. (Good Practice Point)

Implementation considerations

An essential element of animal bite management is rabies prophylaxis. The need of prophylaxis depends on the animal involved and the local prevalence of rabies in different animal populations. Educational materials should reflect discussions with local public health authorities regarding the need for rabies prophylaxis.

Snakebites

Introduction

In many countries, bites by venomous snakes are a serious health problem. In addition, many people are extremely afraid of snakes and snakebites. Even in countries where only harmless snakes are found, people often panic after snakebite and may possibly provide first aid measures that can be harmful rather than beneficial. Evidence for this topic was reviewed in 2015 and guidelines have been consequently updated.

Summary of scientific foundation

In 2011, IFRC Evidence-Based Network worked on this topic and CEBaP re-evaluated the available literature.

Suction
Most data have shown that suction either provides no benefit or may be harmful. In the past, it was believed that suction removes the venom, studies have shown that is not true; at most and in only one study, an insignificant volume was removed (0.04 per cent). Both case series and animal studies have shown a lack of benefit, and an additional animal study demonstrated that in cases when suction was performed, the animal died more rapidly. In a human observational study, no benefit of suction for snakebites was noted. Further studies using devices have shown either visual evidence of tissue damage or the possibility of damage.

References

Compression or pressure immobilization
The use of compression (application of an elastic bandage, also called pressure immobilization) assisted by immobilization of an extremity with snakebite has been commonly taught to prevent systemic dissemination or further systemic dissemination of venom.

This approach of compression and immobilization is supported by two animal studies. One of these studies showed the benefit of a compression bandage at approximately 55mmHg of pressure. An animal model demonstrated that compression reduced lymphatic flow and the spreading of venom. In addition, there was limited evidence from two experimental studies to demonstrate a significant decrease of mock venom spread using elastic bandage and splint. On the other hand, there was limited evidence from four experimental studies in favour of using firm pad and non-elastic bandage. One experimental study also showed limited evidence to support no movement of the limb (immobilization with elastic bandage and splint) with decrease in transit of mock venom.

In addition to evidence concerning the effectiveness of compression, proof is available concerning the feasibility of the application of an elastic bandage by laypeople. In two randomized controlled trials it was shown that training resulted in a statistically significant increase of bandage application with optimal pressure range, compared to using only written instructions. However, in a third non-randomized trial it was shown that volunteers without the appropriate training did not succeed in a statistically significant higher correct bandage application or achievement of correct pressure, compared to medical volunteers.

References

Elevation
There are no controlled studies in either people or animals evaluating the practice of limb elevation after snake envenomation. The only evidence that could be identified was retrospective studies without a control that looked at supportive care after a snakebite, all of which used different techniques but did include elevation. All studies found that the casualties did well with simple supportive care (rather than antivenin) but none specifically looked at elevation alone or as compared with other interventions.

References

Cold application
There is one animal experimental study to compare the cold application and control. It did not demonstrate any statistical significance in terms of death rate and tissue injury score.

References

Tourniquet application
There are three observational studies that did not show any significant decrease in number of death, local edema, acute respiratory failure, acute renal failure, envenoming, necrosis and disability. In one study, it showed that the use of tourniquet could result in a statistically significant increase of duration of hospital stay.

References

Wound irrigation
There is no study published on the use of wound irrigation to manage a snakebite wound.

Guidelines

- Suction should **NOT** be applied to snake envenomation because it is ineffective and may be harmful. (**)
- Tourniquet should **NOT** be applied to snake envenomation because it is not effective and may result in prolonged hospitalization. (**)
- The extremity injuries may be kept still as much as possible or be immobilized by applying non-elastic bandage. (*)
- Specially trained providers may use compression for special situations such as remote locations and wilderness environments. (*)
- The casualty should limit physical activity. (Good Practice Point)

Implementation considerations

In previous first aid guidelines, compression or pressure immobilization has been recommended as a routine first aid treatment for snakebites, which was based on positive effects found in animal studies and studies with mock venom. However, in these guidelines, the evidence is described concerning feasibility of laypeople applying a compression bandage. Based on this additional evidence showing that laypeople cannot correctly apply a compression bandage, and the concern that wrong application could lead to unnecessary movement of the limb and further spread of the venom, pressure immobilization is not recommended.

Regarding first aid education, educators should contact local biological centres for advice on the types of snakes living in the area, including their venom capacity. Due to the fact that many people have very little knowledge about snakes and their potential risk it would be advisable to use pictures of the most common snakes in the region during the training course.

The following advice should be followed in regions where venomous snakes are found:
- Contact the local biological centre to find out where and how to get antivenin for casualties of poisonous snakebites and what specific treatment is needed.
- In the first aid training, include information on how to reach these centres and/or hotlines if available and where people can get additional information and advice.

Jellyfish stings

Introduction

Jellyfish (Cnidarians) are found in every ocean and sea. Despite most being harmless, some species may cause local and also systemic reactions. Contact with jellyfish can result in painful stings and allergic reactions. This problem is common on many beaches worldwide, where those participating in aquatic sports come in contact with jellyfish. In most cases, only minor, itching reactions (that often appear similar to burns) are caused, but very dangerous species, such as, the Portuguese man-of-war (Physalia physalis), box jelly (Carybdea alata), sea nettle (Chrysaora quinquecirrha) are found in some parts of the world. Envenomation (stinging) by jellyfish, stinging hydroids and stinging corals are caused by the simultaneous discharge of many thousands of microscopic stinging capsules called nematocysts. Each nematocyst contains a tiny dose of venom, and on contact with a person, fires into the skin.

The initial reaction to a jellyfish sting typically involves redness, itching, numbness and tingling where the person has been stung, as well as pustules or a rash forming in the pattern of tentacle exposure. Systemic effects can occur, resulting in muscle pain, vomiting, sweating, agitation, hypertension, chest and abdominal pain. Evidence for this topic was reviewed in 2015 and guidelines have been consequently updated.

Summary of scientific foundation

In 2010, this topic was reviewed by the Consensus on Science. The American Red Cross Scientific Advisory Council also reviewed this topic and CEBaP, in collaboration with an International Red Cross task force re-evaluated the available literature.

Topical agent

In general topical agents have been evaluated for preventing further nematocyst discharge and for reducing pain from acute jellyfish stings. Evidence has shown that certain topical agents, specifically vinegar in two animal studies and baking soda slurry in another study, prevent or decrease further nematocyst discharge.

Vinegar (active ingredient four to six per cent acetic acid) in water has also been shown to be an effective nematocyst inhibitor for the box jellyfish and the Irukandji species, which can be lethal. If the envenomation is thought to be due to the bluebottle (Physalia), vinegar may be beneficial.

Stings of most jellyfish found along the Europe's North Sea coast do not really respond to vinegar. A systematic review was held in 2012 looked at various treatments for envenomation by jellyfish and related organisms in North America and Hawaii. This review produced 19 pertinent primary articles and demonstrates variable response to treatment, often with conflicting results according to species studied. The review suggests that vinegar can cause pain exacerbation or nematocyst discharge in the majority of species. Further studies have shown that for bluebottle jellyfish (Physalia utriculus), vinegar triggers further envenomation from nematocyst.

There is limited evidence from one experimental study, showing neither for nor against using saltwater to rinse a jellyfish sting. A statistically significant decrease of pain, using salt water compared to fresh water, sting-aid or Adolph's meat tenderiser, could not be demonstrated.

Evidence is of low quality and results of this study are imprecise due to limited sample size and/or large variability of results.

Low evidence studies suggest that **methanol or ethanol, ammonia and acetic acid** may increase symptoms of pain sensation. **Topical lidocaine** (four per cent) may help with symptom relief and pain lasting more than a couple of days can be treated with **topical steroids**.

Hot or cold water immersion

A systematic review of treatment studies suggests that hot water or heat packs commonly decrease the symptoms of envenomation, predominately the perception of pain. The benefit of hot water to reduce pain after a jellyfish sting is supported by four studies. It was shown that hot water or a hot pack resulted in a statistically significant decrease of pain, compared to icepack, vinegar or papain meat tenderizer. However, a difference in pain cessation could not be demonstrated.

The benefit of cold water was demonstrated by only one study, but two studies reported no significant relief of pain due to cold.

Pressure immobilization
Evidence supports avoiding the use of pressure, which has been shown in two animal studies to cause further release of venom, even though all the nematocysts have been removed.

References

Guidelines

- Topical application of seawater, baking soda, vinegar or heat can be applied for nematocyst deactivation. Fresh water may cause further envenomation. The choice of agent must be individualized to the geographic area and species of jellyfish: (**)
  - For most jellyfish, remove tentacles and rinse in seawater. Fresh water may cause further envenomation;
  - For jellyfish species, sea nettle and mauve stinger, apply baking soda paste;
  - For box jellyfish stings douse in vinegar for 30 seconds; and
  - If jellyfish positively identified as *bluebottle or physalia utriculus*, do **NOT** use vinegar, as it triggers further envenomation.
- The hot water immersion should continue until pain is resolved or at least for 20 to 30 minutes. (**)
- Pressure bandages should **NOT** be used for the treatment of jellyfish stings. (**)
- Topical application of, aluminium sulphate, meat tenderizer or water should **NOT** be used for the relief of pain. (**)
- After treatment to remove and/or deactivate nematocysts, hot water immersion could be used to reduce pain. (*)
- Any adherent tentacles may be picked off with fingers or can be scraped off with a flat object, such as a credit card. The rescuer must wear proper protection. The stung area should be rinsed well with seawater to remove stinging cells that can be seen. (Good Practice Point)
- Stop the person from rubbing the sting area. (Good Practice Point)
- For areas with lethal jellyfish, first aid providers should immediately summon EMS, and assess and treat airway, breathing and circulation while providing other therapies. (Good Practice Point)

Implementation considerations

In developing first aid education on this topic, contact should be made with local marine institutes and water rescue associations to focus on the most common and/or most dangerous jellyfish in the region. First aid action for only these species should be included in the curriculum.

If this topic is included in first aid education the learners should be informed about the jellyfish in their region and on prevention methods, like taking care of specific signage or wearing protective suits. For teaching purposes, it is advisable to obtain photos of the jellyfish that inhabit the waters and basic biological information, e.g. where the jellyfish are found in the region and photos from jellyfish stings.

If local aquatic organizations recommend the application of pharmaceutical products (like steroid ointments, lidocaine gels etc.) ensure that use of these is in accordance with the in-country legislation..

Insect bites or stings

Introduction

Some insects are not harmful themselves but function as vectors for transmitting diseases such as malaria or tick-borne encephalitis. In addition any insect bite can cause a wound that can then become infected. Certain insect bites may also cause an allergic reaction even in people who have previously been bitten. The aim of the first aid provider is to remove the sting or insect from the person, whilst causing as little damage to the insect as possible in order to avoid further spread of the venom. Evidence reviewed in 2015 has informed the development of updated guidelines for this topic.

Summary of scientific foundation

CEBaP conducted a formal scientific evidence review on this topic.

There is limited evidence in favour of pulling with forceps compared to rotation with forceps to remove a tick. It was shown in one study that pulling the tick with forceps resulted in a statistically significant decrease of ticks with damaged mouthparts, compared to rotating with forceps. In one smaller study it was shown that pulling did not result in a statistically significant decrease of damaged tick mouthparts, compared to rotating. Evidence is of very low quality and results of these studies are imprecise due to limited sample size and large variability of results.

There is limited evidence in favour of rotating with a hook with slip tick removal device (commercial O'Tom Tick). It was shown in a non-randomized controlled trial that rotating with a hook with slip removal device resulted in a statistically significant decrease of damaged tick mouthparts, time to remove tick, ease with which tick is grabbed, force needed to extract tick compared to pulling with surgical forceps, or pulling with pro-tick remedy or rotating with pen-tweezers. In a second non-randomized controlled trial it was shown that rotating with a hook with slip removal device (tick twister) resulted in a statistically significant decrease of damaged tick mouthparts, compared to twisting with a lasso or pulling with forceps. No statistically significant difference could be demonstrated when comparing the tick twister with pen-tweezers or a card (tickpic). However, a statistically significant decrease of failure to remove the tick, by rotating with a hook with slip device compared to pulling with surgical forceps, pulling with pro-tick remedy or rotating with pen-tweezers, could not be demonstrated. Evidence is of very low quality and results of these studies are imprecise due to a lack of data.

A statistically significant decrease of damaged mouthparts and increase of self-detachment could not be demonstrated when ticks were removed after chemical treatment with gasoline, methylated spirit, petroleum jelly, 70 per cent isopropyl alcohol, or a hot kitchen match. Concerning the use of nail polish, there is conflicting evidence from two experimental studies. In one small study, a statistically significant decrease of damaged mouthparts could not be demonstrated when ticks were mechanically removed, after chemical treatment with nail polish. In another study, it was shown that using nail polish resulted in a statistically significant decrease of damaged tick mouthparts after mechanical removal compared to no chemical treatment with nail polish. The conflicting evidence could be caused by the different tick species used in the included papers. Evidence is of very low quality and results of these studies are imprecise due to a lack of data.

Most people who get stung by a bee develop a raised, inflamed mark known as a weal. There is limited evidence in favour of a quick removal of a bee sting. In one randomized controlled trial, a statistically significant increase of the weal area with time of removal was shown. Evidence is of low quality and results of this study are imprecise due a limited sample size.

No evidence was found on the use of suction, vinegar or applying ice to insect sting or bite.

References

Guidelines

- Use of gasoline, petroleum, and other organic solvents to suffocate ticks, as well as burning the tick with a match must be avoided. (**)
- In case of a bee sting, the sting should be removed as soon as possible. (**)
- To remove a tick, grab the tick as close to the skin as possible with a very fine forceps or tweezers and pull it gradually, but firmly, out of the skin. (*)
- In case a commercial tick removal device, such as a hook with slip device is available, the tick may be removed with the removal device according to the manufacturer's instructions. (*)
- The bitten area must be thoroughly disinfected with alcohol or another skin antiseptic solution. First aiders should avoid squeezing the tick during removal since this may inject infectious material into the skin. (Good Practice Point)
- If a rash, warmth or pain develops around the bitten area or the bite leads to fever, the person should see a physician in case antibiotics or vaccinations are needed. (Good Practice Point)
- The first aid provider should recognize signs of an allergic reaction or signs of anaphylaxis and treat. (Good Practice Point)

Implementation considerations

First aid providers should align with their local medical centres to find out which insect-related diseases are common in the region and what preventive measures are locally practised such as:

- use of repellent
- use of bednets
- wearing long sleeves and long pants, especially at dawn, when these insects are active.

First aid educators should seek advice from local medical personnel on how to prevent insect bite-related diseases, for example, vaccination for tick-borne encephalitis and pharmaceuticals for malaria prevention.

First aid educators should use pictures of insects commonly found in the area and associated medical problems these can cause, for example, borreliosis, to help learners with identification.

Additional information on tick-borne diseases may be helpful in educational materials. In Europe and North America, several species of *Ixodes* ticks are vectors for tick-borne infections. One major infection is Lyme borreliosis, or

Lyme disease that is caused by the bacterium *Borrelia burgdorferi*. Typical symptoms include fever, headache, fatigue and a characteristic skin rash called erythema migrans. If left untreated, infection can spread to the joints, heart and nervous system. Most cases of Lyme disease can be treated successfully with antibiotics.

Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, landscaping and integrated pest management.

The ticks that transmit Lyme disease can transmit other tick-borne diseases, including tick-borne encephalitis.

See Wounds and abrasions

12. Drowning and scuba diving decompression illness

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Drowning process

Introduction

Drowning is the third leading cause of unintentional injury death worldwide, accounting for nearly 400,000 deaths annually.[8]

First aid providers should be knowledgeable in this area. Drowning, is the process of experiencing respiratory impairment from submersion/immersion in liquid, usually water.

Drowning outcomes are classified as death, morbidity or no morbidity. The drowning process is the continuum that begins when the person's airway lies below a surface of liquid, at which time the individual voluntarily attempts to hold his or her breath. This may be followed by the person involuntarily allowing liquid into the airway. If there is no rescue and/or reverse of this cascade, the hypoxia increases and multi-system failure occurs.

In high-income countries care for a person rescued from submersion often involves a multiagency approach, with several different organizations independently responsible for different phases of the person's care, from the initial aquatic rescue to rehabilitative care.

Evidence for this topic was reviewed in 2015 and guidelines have been consequently updated.

Summary of scientific foundation

Airway management

In regard to airway management, the literature supports that opening the airway to allow oxygen to reach some functional lung tissue and minimizing aspiration obstruction of the airway is a significant challenge in drowning process resuscitation and that ventilation must begin as soon as possible. Both outcome data and expert opinion support the concept that there are unique aspects of establishing and maintaining an upper airway during the drowning

8 *Global Report on Drowning. Preventing a leading killer, WHO, 2014.*

process resuscitation, and that early rescue breathing, including in-water resuscitation is safe, effective and feasible for trained rescuers in open-water settings. It is extrapolated that this also would be a positive factor for drowning process resuscitation outcomes in pool settings.

References

Suction
The effectiveness of suction in submersion cases has not been well studied and there is consensus that resuscitation should begin before attempting to remove fluids from the airway or lungs. The sequence of events that occurs following water aspiration into the lungs is a pathophysiologically complex process. The aspiration of water includes laryngospasm, fluid shifts across the pulmonary alveolar membrane, destruction of surfactant, atelectasis, intrapulmonary shunting, and pulmonary oedema formation. Any attempt to remove the water from the airway is unnecessary and will delay CPR. The correction of a person's hypoxemia, can induce vomiting, and may cause visceral or vascular injuries. In addition, oropharyngeal suction will rarely remove anything but oropharynx liquids. Lastly, there is a general consensus that little, if any, fluid can be expelled from the lungs by drainage techniques, including suctioning, abdominal thrusts, or postural drainage; this is because after just a few minutes of submersion, water is absorbed into the circulation. This being said in some patients, vomitus or particulate matter blocks the airway, making resuscitation difficult. In these cases, although techniques vary, the vomitus or debris should be removed if it interferes with airway management.

References

Drowning process resuscitation
In the drowning process, resuscitation using upper abdominal thrusts may create a risk of precipitating gastroesophageal regurgitation and subsequent aspiration and may delay and complicate the start of effective CPR. An attempt to remove water from the airways using abdominal thrusts is unnecessary and potentially dangerous. Studies have shown that there is no need to clear airways from aspirated water. Only the majority of drowned persons aspirate a small quantity of water and it is rapidly absorbed into the central circulation. Therefore, it does not act as an obstruction in the trachea. So, procedures for foreign body airway obstruction must be used only if the airway is completely obstructed with a solid object. *See* Foreign body airway obstruction

Concerning positioning, evidence supports placing the person in as near a true lateral position as possible, with the head dependent to allow free drainage of fluids. The position should be stable, without pressure on the chest so that the person can be turned onto the side and returned to the back easily and safely.

The literature shows that rescue breathing in shallow water is safe and effective to provide by a single, trained first aid provider equipped with a flotation device and increases the person's chance of survival.

Evidence and physiological mechanisms support that during the drowning process resuscitation the casualty requires physiologic levels of oxygen; however, no research studies support a need for supplemental oxygen in the drowning process resuscitation to achieve normal oxygen levels. There are published studies that show that using exhaled air (16 per cent oxygen) or room air (21 per cent oxygen) for resuscitation achieves physiologically normal blood oxygen levels in the casualty. These studies, however, addressed many types of resuscitation cases and none exclusively that were of casualties of the drowning process. In addition, studies using supplemental oxygen in resuscitation have shown that casualties achieve supra-physiological blood oxygen levels. These and others studies have shown that these supra-physiological blood oxygen levels are associated with poorer neurologic outcome. Whereas these research studies did show a detrimental outcome with supplemental oxygen use in resuscitation, they used either prolonged oxygen administration or studied non-drowning process casualties. Despite the lack of research evidence, some experts have written that in drowning related cases higher concentration of oxygen may be required than the 16 per cent to 21 per cent usually given during rescue breathing or when using the BVM resuscitator without supplemental oxygen. The literature on resuscitation and rational conjecture supports that the priority needs in the drowning process resuscitation are establishing an airway and providing ventilation. In addition, other resuscitation studies and rational conjecture support that physiologic oxygen can be obtained with either expired air via a mask-to-mouth approach or via ambient air using a BVM-to-mouth approach. However, there are expert opinions supporting the need for lifeguards to provide supplemental oxygen in the drowning process resuscitation.

In 2015, ILCOR reviewed the evidence for prognostic factors that predict outcomes in relation to drowning incidents such as duration of submersion, age of the person concerned, salinity of the water, and water temperature compared with no factors.

For age, salinity and water temperature there are low quality or contradictory evidence for critical outcome of favourable neurologic outcome and survival.

For duration of submersion, the literature identified:
- For *short submersion intervals* (less than five to six minutes) a moderate-quality evidence for critical outcome of favourable neurological outcome and a low quality of evidence for the critical outcome of survival. All studies noted worse neurological outcomes in those with submersion durations exceeding five minutes. All studies noted worse survival chances among people with prolonged compared to short submersion durations.
- For *intermediate submersion intervals* (less than ten minutes) moderate-quality evidence exists for critical outcomes of favourable neurological outcome and low quality of evidence exists for the critical outcome of survival. All studies noted worse neurological outcome among patients with prolonged submersion durations compared with intermediate submersion durations.
- For *prolonged submersion intervals* (less than 15 to 25 minutes) low quality evidence exists for the critical outcome of favourable neurological outcome from three observational studies, and very low quality evidence exists for the critical outcome of survival from a single study. Submersion of less than 20 or 25 minutes is associated with better neurological outcome versus longer submersion duration for adults and hypothermic children. Cases with a submersion interval of less than 15 minutes had a higher overall survival rate.

The 2015 ILCOR review excluded exceptional and rare case reports that identify good outcomes after prolonged submersion in icy cold water.

References

Guidelines

- Airway management skills must be included in first aid training for drowning process rescue and resuscitation. (**)
- Drowning process resuscitation must include upper airway management and early rescue breathing as a priority. (**)
- In-water resuscitation consisting of airway and ventilation management should be done under the following circumstances: shallow water, a trained first aid provider with a flotation aid in deep calm water or two or more trained first aid providers. (**)
- Routine oropharyngeal suctioning should **NOT** be done in the drowning process resuscitation. (**)
- In case of submersion, suction and manual methods should be used when the airway is blocked by vomitus or debris that is preventing ventilation. (**)
- If resuscitation is required and cannot be effectively provided in the water, the casualty should be removed from the water and resuscitated by the fastest means available. (**)
- If effective airway and ventilation cannot be provided in the water, even a casualty with possible cervical spinal injury should be rapidly removed from the water. (**)
- Submersion duration must be used as a prognostic indicator when making decisions regarding search and rescue resource management or operations. (**)
- In case the casualty is in cardiac arrest, breaths may be given before compressions. (*)
- For an unconscious or recovering casualty, or while transporting him or her, he or she should be in as near a true lateral position as possible, with the head dependent to allow free drainage of fluids. Any pressure on the chest that impairs breathing should be avoided. (*)
- Supplemental oxygen for the drowning process resuscitation may be used, but doing so should never delay resuscitation, including opening the airway and providing ventilation and compressions as needed. (*)
- In-water resuscitation consisting of airway and ventilation management should **NOT** be attempted in deep water by a single first aid provider without flotation support. In this case, the priority should be rescue to shore. (Good Practice Point)
- Compressions should not be performed in water. (Good Practice Point)
- Compressions may be performed on the way to shore if the person can be placed on a solid object such as a rescue board. (Good Practice Point)

Implementation considerations

Water rescue

First aid provider and bystander action is essential if they witness a person drowning.

If possible, the first aid provider should attempt to save the person drowning without entering the water. Talking to the person, reaching with a rescue aid (e.g. stick or clothing), or throwing a rope or buoyant rescue aid may be effective if the individual is close to dry land.

First aid providers should enter the water only if it is essential and they have the required training, if they can use a floating device or boat or if they are not alone and it is safe (in case of drowning children for example).

Never dive head first in the water when attempting a rescue. You can lose visual contact with the person to be rescued and run the risk of a spinal injury.

Trained or professional rescue teams of the Red Cross Red Crescent National Societies should use special equipment to assist with search and rescue. Where the rescue takes time, the teams often seek guidance on the likelihood of survival. Submersion duration of less than ten minutes is associated with a very high chance of favourable outcome; submersion duration longer than 25 minutes is associated with a low chance of favourable outcomes.

Submersion in ice-cold water can prolong the window of survival and justify extended search and rescue activities.

In-water resuscitation

If the person is in the water, specifically trained first aid providers may undertake in-water ventilation before moving the individual to dry land or rescue craft if he or she is equipped and trained to do so. In-water ventilation has a higher survival rate, but the decision between ventilation or bringing the person to shore as quickly as possible without ventilation depends on many factors, such as, response of the individual to ventilation, sea conditions, distance to shore, support by crews and availability of rescue boat or helicopter.

If a rescue boat or helicopter arrives on the scene, a specifically trained first aid provider should continue in-water ventilation while support arrives to take over ventilation. This option seems to offer a higher survival rate.

Removal from water

If the person is in cardiac arrest, he or she must be removed promptly from the water and CPR should be started as soon as possible.

In other cases (a person who is not in cardiac arrest), trained or professional rescue teams should remove the person in a horizontal position during and after retrieval from the water. Spinal precautions while removing the person from the water, such as limiting neck flexion and extension, are unnecessary unless there is a history of diving in shallow water, or signs of severe injury in the water and it does not impede treatment of life-threatening conditions.

Resuscitation once retrieved from water

For lay people and basic first aid providers, the routine adult sequence of resuscitation may also be used for those who were drowning and not breathing normally after they have come out of the water.

First aid providers who are trained in treating drowning casualties (e.g. lifeguards) as professional rescue team of the Red Cross Red Crescent National Societies or feel comfortable altering the routine sequence, the following modifications to the adult resuscitation sequence should be made.

After recognizing the casualty is in cardiac arrest:

1. Give two to five initial effective rescue breaths before starting chest compressions;
2. If not already done, activate EMS but if alone (sole rescuer), perform CPR for approximately one minute before seeking help;
3. Continue to give CPR as to an adult or a child;
4. When an AED is available, dry the person's chest before fixing the AED pads and deliver shocks according to the AED prompts; and
5. Give high-flow oxygen (ten to 15 litres per minute) when it is possible with the BVM during CPR and through an oxygen mask with reservoir bag after return of spontaneous circulation.

Compressions
Some studies on compression in water have shown that compressions cannot be effectively performed in water. The first aid provider should use in-water ventilation only if the person cannot breathe normally.

Fluid in the lung and regurgitation of stomach contents
Resuscitation should begin immediately unless fluids obstruct the airway. The first aid provider must continue rescue breath or ventilation until the rescue team arrives on scene. During training, it is important to reinforce that fluids cannot be removed from the lungs and attempts to do so will only delay life-saving care.

If the casualty has regurgitation of stomach contents, turn the person immediately on their side, remove the regurgitated material as much as possible, put the casualty on their back and continue resuscitation. It is only if the airway is completely obstructed that it is necessary to treat the FBAO.

Positioning
- If the person is in cardiac arrest, they must be placed on their back to perform resuscitation.
- If the person does not respond and has normal breathing, they should be in lateral position if possible, with the head dependent to allow free drainage of fluids.
- If it is necessary to turn the person, the first aid provider should be aware of possible cervical spinal injury.

Oxygen
Normally, the first aid provider gives resuscitation without supplemental oxygen because an oxygen device delivery is not available.

If oxygen is available, even though hypoxia is not present in early phases of the drowning process, specifically trained first aid providers' may provide oxygen according to the supplemental oxygen use guideline. *See* Use of oxygen.

Cervical spine injury among drowning casualties

Introduction

Recognition of potential cervical spinal injury among drowning casualties is provided here as extrapolated evidence, with limitations. Since 2010, evidence remains unchanged. *See* Cervical spinal motion restriction.

Summary of scientific foundation

Most of the evidence is extrapolated from all spinal injuries, not just those related to drowning. The occurrence of spinal injuries in aquatic activities is low. Also, the consensus opinion is to recommend spinal motion restriction and immobilization for selected submersion casualties: those who have a history of high-impact or high-risk activity (e.g. diving, water skiing, assault, use of a motorized vehicle on location or beach with moderate to severe shore breaks) and individuals with clinical signs of injury or obvious neurologic deficit. While this was consensus opinion in 2010, there is still limited evidence to apply to the aquatic setting. One must also account for the:

- Risk first aid providers face while performing immobilization in an uncontrolled environment.
- Unstudied but likely movement of the spine during the immobilization application.
- Literature of the poor performance of spinal immobilization application by EMS providers.
- Recent evidence of harm to the patient from spinal immobilization.
- Movement in the pre-hospital community away from spinal immobilization.

Based on these considerations and lack of evidence, it would be appropriate for systems to choose not to perform spinal immobilization in the water but rather remove the person from water in an axial manner. Out of water care should be provided following spinal immobilization guidelines. It is also recognized that one may use a long backboard as an extrication tool for spinal immobilization.

References

Guidelines

- If effective airway and ventilation cannot be provided in the water, even the person with possible cervical spinal injury should be rapidly removed from the water. (**)
- Spinal motion restriction and immobilization during transport should be used only for a person whose injuries were sustained via a high-impact or high-risk activity (e.g. diving, water skiing, surfing, and being on beaches with moderate to severe shore breaks) or who have signs of unreliability (including intoxication) or injury. (*)
- If the person is at risk of cervical spinal injury, first aid providers should provide manual support of the head during initial assessment, provided such restriction does not prevent establishing a patent airway and effective ventilation. (Good Practice Point)

Scuba diving decompression illness

Introduction

Scuba diving has become a very popular sport in the last twenty years in many parts of the world. As with most sports activities, scuba diving can cause health problems. Neither did the Consensus of Science review this topic in 2010 nor was it scientifically evaluated in 2015. The Diver Alert Network (DAN), a specific medical network dealing with diving-related problems has provided the information presented in these guidelines.

Summary of scientific foundation

A large retrospective case study showed that scuba divers experiencing decompression injury require less decompression and have a greater likelihood of complete recovery if first aid includes normobaric oxygen.

Guidelines

- In case of decompression illness (*see below*), first aid providers should administer oxygen (if available), which may reduce the symptoms substantially. (**)
- First aid providers should call EMS immediately and indicate the likelihood of decompression illness so that transport of the person to a decompression chamber can be arranged as soon as possible since the only real treatment is recompression in this chamber. (**)
- Scuba diving is a special circumstance for which oxygen during resuscitation may be helpful. (Good Practice Point)

Implementation considerations

First aid providers should have information on local resources for diving emergencies and access to hyperbaric therapy, if indicated. **DAN can be reached 365 days a year, 24 hours a day, at +1-919-684-9111 (this is an international helpline)**. DAN provides assistance with managing injured scuba divers, help decide if recompression is needed, provide the location of the closest appropriate recompression facility and help arrange patient transport.

Decompression illness

Decompression illness results from a reduction in the ambient pressure surrounding a body. It encompasses two conditions: decompression sickness and arterial gas embolism (AGE). Decompression sickness is thought to result from bubbles growing in the tissue and causing local damage, while AGE results from bubbles entering the circulation, traveling through the arteries and causing tissue damage at a distance by blocking blood flow to the small vessels.

The main risk factor for decompression illness is a reduction in ambient pressure, but other risk factors include deep or long dives, cold water, hard exercise at depth and rapid ascents.

Decompression sickness

Decompression sickness is the result of inadequate decompression after exposure to increased pressure. During a dive, the body tissues absorb nitrogen from the breathing gas in proportion to the surrounding pressure. As long as the diver remains at pressure, the gas presents no problem. But if the pressure is reduced too quickly, the nitrogen comes out of solution and forms bubbles in the tissues and bloodstream. This commonly occurs as a result of violating or approaching too closely the diving table limits, but it can also occur when accepted guidelines have been followed.

Signs and symptoms usually appear 15 minutes to 12 hours after surfacing, but in severe cases, symptoms may appear before surfacing or immediately afterwards. Symptoms include the following:
- unusual fatigue
- skin itch
- pain in joints and/or muscles of the arms, legs or torso
- dizziness, vertigo, ringing in the ears
- numbness, tingling, paralysis
- shortness of breath

Arterial gas embolism

If a scuba diver surfaces without exhaling, air trapped in the lungs expands on ascent may rupture lung tissue (called pulmonary barotrauma), which releases gas bubbles into the arterial circulation. The bubbles are distributed throughout the body tissues in proportion to blood flow. Because the brain receives the highest proportion of blood flow, it is the main target organ where bubbles lodged in small arteries can interfere with circulation. Symptoms of AGE include the following:

- dizziness
- chest pain
- disorientation
- bloody froth from mouth or nose
- paralysis or weakness
- convulsions
- unconsciousness

Oxygen is recommended by most diving associations worldwide as a first aid measure in cases of decompression illness. Law in some countries makes it mandatory for professional diving operations to keep oxygen supply (e.g. diving training institutions, professional diving operations) – so the likelihood of oxygen being available is high at dive sites. Therefore, first aid providers should actively ask for it.

By contacting local scuba training providers and/or decompression chamber services, first aid learners should be informed about the national first aid guidelines for decompression illness, including the local procedures for care.

National Societies may also contact GFARC for water rescue and drowning prevention first aid training programmes.

13. Resuscitation

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Introduction

The recommendations in this section are based upon evidence gathered and examined by ILCOR and the resulting Consensus on Science and Treatment for BLS and use of an AED, reviews conducted by the American Red Cross Scientific Advisory Council, CEBaP and the 2011 IFRC Guidelines. The ILCOR document produced in 2015 includes treatment recommendations for both adults and children. ILCOR reviewed 23 topics leading to 32 treatment recommendations in the areas of early access and cardiac arrest prevention, early high quality CPR and early defibrillation.

Cardiac arrest

The evidence review indicates that survival after cardiac arrest relies on:
prompt recognition of cardiac arrest
- early access to help
- early high quality CPR
- early defibrillation

The guidelines highlight the importance of interactions between the:
- emergency medical dispatcher
- bystander who provides CPR
- deployment of an AED

Prompt recognition of cardiac arrest
Recognition of unconsciousness with abnormal or no breathing is essential to the recognition of cardiac arrest. In one study, agonal breaths were reported in 30 per cent of cases of cardiac arrest. In ten studies agonal breaths were mentioned as a factor with a negative impact on cardiac arrest recognition.

Early access to help
The first contact with the EMS is usually via an emergency call. The prompt recognition of cardiac arrest is critical to ensuring the:
- correct dispatch of a high priority response
- provision of telephone CPR instructions
- activation of a first aid provider with an AED

In an observational study, cases of cardiac arrest that were missed at initial telephone triage had much worse outcomes (five per cent survival compared with 14 per cent). The majority of dispatch centres use scripted protocols with questions to identify the person who is unconscious and not breathing or not breathing normally. Four before-after studies showed that the introduction of scripted protocols could help recognition of cardiac arrest. One study reported an increase in cardiac arrest recognition while three reported an increase in the rates of telephone assisted CPR after the introduction of scripted protocols.

Early high quality CPR

The willingness of bystanders to do CPR remains low in most communities. Dispatcher assisted telephone CPR instructions have been demonstrated to improve the willingness of the bystander to do CPR. Some studies evaluated the survival benefit of dispatch assisted CPR instructions and compared systems where such instructions can be offered to systems where they were never or infrequently offered. Other studies compared traditional CPR to chest compression, only CPR instructions delivered by telephone. Many studies were done in an attempt to answer the question around chest compression-only CPR versus full CPR for dispatcher use. The studies provided low quality evidence, but the ILCOR recommendation is that dispatchers provide chest compression-only instructions to callers for adults with suspected cardiac arrest with available evidence consistently in favour.

Starting CPR

There are only manikin studies on whether or not to start CPR with chest compressions or ventilations but evidence is of low quality. Therefore the recommendation to start CPR with chest compressions is made on the basis of the use of dispatcher protocols and also the high value placed on time to starting CPR.

Chest compression-only versus conventional CPR

It is acknowledged that bystander CPR is a key element in the chain of survival after cardiac arrest. A large systematic review from 79 studies involving 142,740 patients confirmed that bystander CPR improves survival from 3.9 per cent to 16.1 per cent. Although compression-only led to worse neurological outcome several studies of *Survival with favourable neurological outcome at 12 months, 30 days and discharge from hospital* have all provided very low quality evidence around the difference between compression-only and conventional CPR.

One observational study of fair quality suggests that for all cardiac arrests in infants and children, standard CPR significantly improves survival before hospital arrival. Compression-only CPR leads to a trend to improved survival one month after hospital discharge and leads to a significantly improved neurological status one month after hospital discharge.

Chest compressions should be given to anyone in cardiac arrest. Another main recommendation is that first aid providers should provide rescue breaths especially in infants and children unless they are unable or unwilling to do this.

CPR before the use of the AED

Several studies of *Survival with favourable neurological outcome at one year and hospital discharge* have shown no benefit from a short period of CPR prior to defibrillation. The studies have identified low quality evidence but suggest that there is no benefit to a period of CPR of 90 to 180 seconds before defibrillation when compared with immediate defibrillation with CPR being performed while the AED equipment is made ready and attached to the person.

Hand position during compression
There are no studies reporting the critical outcomes of favourable neurological outcomes, survival or return of spontaneous circulation. For the important outcome of physiological endpoints three very low quality studies are identified. One crossover study of prolonged resuscitation in non-traumatic cardiac arrest in adults and one in children's cardiac arrest observed that some quality criteria of the compressions are improved when they are performed in the lower third of the sternum compared with the centre of the chest. A third crossover study observed no difference between both positions. Hence there is no change proposed to the current recommendation that chest compressions are performed on the centre of the chest, i.e. the lower part of the breastbone.

Chest compression rate
There are several observational studies representing large numbers of casualties, but all were downgraded because of risk of bias and the results were very mixed. There is therefore no new evidence that would change the current guidelines on compression rate of 100 to 120 per minute.

Chest compression depth
One observational study suggests that a compression depth of more than 6cm in an adult is associated with an increased rate of injury when compared with compression depth of 5cm to 6cm. This study included 170 of 353 patients and injuries were reported in 63 per cent with compression depth of more than 6cm and 31 per cent with a compression depth of less than 6cm. Further injuries were reported in 28 per cent, 27 per cent and 49 per cent with compression depths of less than 5cm, 5cm to 6cm and more than 6cm. The recommendation is therefore that chest compressions must be done to a depth of approximately 5cm and a compression depth of more than 6cm should be avoided.

Chest wall recoil
Three observational studies reported a reduced coronary artery pressure with incomplete chest recoil. Two of these studies were on animals and the third on anaesthetised children not in cardiac arrest. One study analysed the effect of leaning by applying force on the chest corresponding to ten per cent and 20 per cent of body weight. This resulted in a proportional reduction in coronary perfusion pressure. In swine models leaning on the chest reduced the coronary perfusion pressure in a dose dependent manner.

The recommendation is that first aid providers should avoid leaning on the chest between chest compressions to allow full chest wall recoil.

Compression and ventilation ratio
There is no new evidence that would lead to a change in the 30:2 ratio.

Minimizing pauses in chest compressions
Some CPR guidelines indicate that the duration of pauses for ventilation should not exceed five seconds. However, forceful inflations to comply with this carry a risk of gastric insufflations and may not be possible for mouth-to-mouth ventilation. Evidence is low quality and not consistent but three observational studies including 3,327 patients showed a better outcome with shorter pre-shock and post-shock pauses. The ILCOR suggestion is therefore that interruption of chest compressions for delivery of two breaths should be less than ten seconds and that total pre-shock and post-shock pauses should be as short as possible.

Harm from CPR delivered to a person who is not in cardiac arrest
Many first aid providers are concerned that the delivery of chest compressions to a person not in cardiac arrest could lead to serious complications and are therefore reluctant to initiate CPR. There are four observational studies involving 762 patients who were not in cardiac arrest. Three of the studies reviewed the medical records and one included telephone follow-up. Data of 345 patients found an incidence of bone fracture of 1.7 per cent, pain in the area of chest compression of 8.7 per cent and no visceral injury. The fourth study relied on the fire department observations at scene and there were no injuries reported in 417 patients. It can therefore be concluded that there is a higher value on the survival benefit of CPR initiated by laypersons for people in cardiac arrest against the low risk of injury to those not in cardiac arrest.

Early defibrillation

The concept of early defibrillation is well established in improving outcome from cardiac arrest and there is no new evidence that goes against this principle.

The ILCOR review dealt with the use of public access systems and identified 15 relevant studies (one randomized controlled trial and 14 observational studies) spanning the years 2002 to 2013. For the critical outcome of survival to one year with favourable neurological outcome, one observational trial involving 1,394 patients showed improved outcomes with public access defibrillation. For the critical outcome of survival to 30 days with favourable neurological outcome, three observational studies involving 4,581 patients showed improved survival. Other studies had the same outcome so despite low quality evidence the conclusion is that public access defibrillation systems should be implemented whenever possible for people with out-of-hospital cardiac arrest.

This document recognizes that throughout the Red Cross Red Crescent National Societies public access systems may not be possible or may be at different stages of development but the principle of early defibrillation remains as a goal for anyone in cardiac arrest.

Resuscitation in children

Asphyxial cardiac arrest is more common in children and there is no new evidence to indicate that there should be a change to the current protocol of initial breaths before chest compressions. One observational study of fair quality suggests that for all cardiac arrests in infants and children, standard CPR significantly improves survival before hospital arrival. While there is only one study based on pathophysiology of cardiac arrest in children and infant, it is advised that first aid providers should provide rescue breaths and chest compressions for both infants and children. If first aid providers cannot provide breaths they should at least perform chest compressions. The question of compression depth was addressed for which there was only low quality evidence. Hence, it is recommended that for infants that the first aid providers should press the chest by at least one-third of the depth of the chest or approximately 4cm. For children, the first aid providers should press the chest by at least one-third of its depth or approximately 5cm.

While VF is less common among children, as many as one quarter of paediatric out-of-hospital arrests are from VF with a similar number from in-hospital cardiac arrests. Importantly, up to 14 per cent of case of VF in children will occur in those less than one year of age. Importantly, survival and survival with good neurological outcome are significantly better when VF is the presenting rhythm compared to asystole. While there do exist specific paediatric AED adapters, there have also been several studies which have demonstrated that even adult AED can correctly identify VF and ventricular tachycardia in infants and children. The optimal energy dose for defibrillation in infants and children, both from an efficacy and safety standpoint is not known. The long-standing recommendation is to defibrillate at two to four joules per kilogram is based on one retrospective study of 27 children. The limited available data suggests that high-energy doses can be effective used in infants and children. Given the dismal outcomes of untreated (or delayed treatment) of VF, shocking with high-energy doses is acceptable. Biphasic energy likely results in less myocardial injury, based on very limited data and no data in infants.

Guidelines

- All dispatchers must be trained to recognize cardiac arrest over the phone. (**)
- All dispatchers should consider a person described as being unconscious with abnormal or no breathing to be in cardiac arrest during a calling. (**)
- All dispatchers must provide CPR instructions to callers who report a person in suspected cardiac arrest. (**)
- In situations when a first aid provider is performing CPR and following telephone instructions from a dispatcher when treating an adult, compression-only CPR should be used. In children and infants it should be full CPR. (**)
- First aid providers who are unwilling or unable to deliver conventional CPR, when treating an adult in cardiac arrest should use compression-only CPR. (**)
- For formally trained first aid providers (and healthcare professionals) treating an adult, compressions with breaths should be provided. (**)
- CPR for adults should be started with chest compressions as soon as possible. (**)
- Chest compressions should be performed on the centre of the chest, i.e. the lower part of the breastbone. (**)
- Compression rate should be 100 to 120 per minute. (**)
- For an adult, chest compression depth should be approximately 5cm but not more than 6cm. (**)
- First aid providers should **NOT** lean on the chest between compressions so that the chest is allowed to recoil fully. (**)
- Interruption of chest compressions to give breaths should be less than ten seconds and pre- and post-shock pauses should be as short as possible. (**)
- For a person in cardiac arrest an AED should be used and as early as possible. (**)
- The first aid provider should always ask if an AED is available. (**)
- When an AED is available the first aid provider must always do CPR while waiting for the AED to be available and made ready for use. (**)
- A standard AED should be used for adults and children aged eight years and over. (**)
- For infants and children up to eight years of age, a paediatric AED must be used. If not available, a standard AED should be used with paediatric pads. If that is not available, a standard AED should be used. (**)

- For infants, children and casualties of drowning the preferred method of CPR is compressions with breaths. (**)
- For infants and children in cardiac arrest being treated by unwilling untrained or people unable to do conventional CPR, compression-only CPR should be used. (**)
- First aid providers may use a compression-ventilation ratio of 30:2 in cardiac arrest for adults and for children and infants with one provider. (*)
- First aid providers may use a compression-ventilation ratio of 15:2 in cardiac arrest for children and infants with two providers. (*)
- For infants and children the anterior-posterior placement of AED pad may be preferred. (*)
- For infants, children and in drowning cases breaths should be given before compressions. (**) Either two or five breaths may be given. (*)

Implementation considerations

The implementation of the guidelines on resuscitation and use of the AED depends on local regulation including National Society influence on regulation, liability protection, capacity of the National Society and level of education and competency of first aid providers in the national context.

Regarding CPR context, the following definitions are used in these guidelines:
- An adult is a person who is older than the age at which puberty occurs.
- A child is defined as being over one year of age up to puberty.
- An infant is defined as being less than one year of age.

Please note that for the use of an AED, a child is defined as being seven years of age and younger.

Assessment of the casualty
1. Make sure that everyone involved in the incident is safe; and
2. Check for a response by gently shaking the shoulders and speaking loudly and clearly to ask a question such as: Are you alright? If the casualty is a child tap the shoulder. If the casualty is an infant tap the sole of the foot.

If the casualty responds:
1. Leave the casualty in the position found provided there is no further danger;
2. Try to determine the problem;
3. Call for emergency help if needed; and
4. Reassess the vital signs regularly until help arrives or the casualty recovers.

If the casualty does not respond:
1. Check breathing;
2. Shout for help if you are alone;
3. If necessary, turn the casualty onto the back and open the airway;
4. Place one hand on the forehead and gently tilt the head back. As you do this, the mouth will fall open;
5. Place the other hand on the point of the casualty's chin and lift the chin;
6. Keeping the airway open, look, listen and feel for normal breathing for no more than ten seconds;
7. Look for chest and/or abdominal movement;
8. Listen for breath sounds;
9. Feel for air on your cheek; and
10. For professional rescuers a simultaneous pulse check can be done.

Note: In the first few minutes after cardiac arrest a person may be barely breathing or taking infrequent noisy gasps. This is agonal breathing and is not to be confused with normal breathing. If there is any doubt about whether or not breathing is normal assume it is not. Similarly for professional rescuers if uncertain as to the presence of a pulse assume it is not present.

If the casualty is breathing normally:

1. But unresponsive and has an open airway and is breathing spontaneously, and you suspect that the he or she might have a spinal injury, it is preferable to not move the person;
2. Send or go for help; call EMS; and
3. Reassess the vital signs regularly until help arrives or the casualty recovers.

If the casualty is not breathing normally:

1. As soon as possible ask a helper to call the EMS and bring an AED if available. If you are alone make the call yourself;
2. Begin chest compressions without delay (except in children, infants and cases of drowning; begin with two to five breaths); and
3. Use an AED as soon as possible when it is available.

Performing chest compressions:

1. Kneel by the casualty at chest level;
2. Place the heel of one hand on the middle of the chest. This will be the lower part of the breastbone;
3. Place the heel of the other hand on top of the first hand. Make sure no pressure is applied on the ribs, the abdomen or the lower tip of the breastbone;
4. Lean over the casualty and with straight arms press down vertically on the chest. Push hard to depress the chest by approximately 5cm;
5. Release the pressure without taking the hands off the chest. Allow the chest to come back up fully (recoil) before doing the next compression; and
6. Compress the chest at a rate of between 100 to 120 compressions per minute. The time taken for compression and release should be the same.

Note: For children and infants the technique is similar except that in children only one hand is used to perform chest compressions and in infants two fingers with either encircling thumbs (best technique but only validated for two persons) or two fingers in centre of chest. The depth of compression is one-third of the depth of the chest for both children and infants.

Combining chest compressions with rescue breaths

For first aid providers the method of choice for CPR is a combination of chest compressions and rescue breaths at a ratio of 30 compressions to two breaths.

1. After 30 compressions open the airway using head tilt and chin lift;
2. Pinch the soft part of the casualty's nose (most easily by using the hand from the forehead);
3. Allow the mouth to open while maintaining chin lift;
4. Take a breath and place your lips around the casualty's mouth making sure you have a good seal;
5. Blow into the casualty's mouth and watch the chest rise;
6. If the chest does not rise you may need to adjust the head position;
7. Maintaining head tilt and chin lift take your mouth away from the casualty's mouth and watch the chest fall. If the chest rises and falls that is an effective rescue breath;
8. Each breath should take one second;
9. Give a second breath;

10. Do not attempt more than two breaths each time before returning to chest compressions;
11. Without delay return to do 30 chest compressions;
12. Continue the cycle of 30 chest compressions followed by two breaths until either EMS help arrives or the casualty shows signs of recovering such as coughing, opening the eyes, speaking or moving purposefully and starts to breathe normally; and
13. If more than one first aid provider is present they should change over every one to two minutes in order to prevent fatigue. Ensure that chest compressions are not interrupted during the changeover. For infants and children when two providers are present a ratio of 15:2 may be used.

CPR when an AED is available
1. Make the AED ready as soon as possible;
2. If more than one first aid provider is present carry on with CPR until the AED is ready. The electrodes are applied to the casualty's chest and the AED is ready to analyse the heart rhythm;
3. Place the electrodes as indicated. It does not matter if the electrodes are reversed. If this happens do not remove them as this wastes time and the electrodes may not stick to the chest properly when reattached;
4. Make sure nobody touches the casualty while the AED is analysing;
5. If a shock is indicated ensure that nobody touches the casualty;
6. Push the button to give a shock (If the AED is fully automated it will give the shock automatically);
7. Continue to follow the voice or visual prompts as directed by the machine;
8. If no shock is indicated immediately resume CPR;
9. Follow the voice or visual prompts as directed by the machine; and
10. Continue CPR until emergency help arrives or the person shows signs of recovery such as speaking, coughing, moving purposefully or opening the eyes and starts to breathe normally.

Note: If there is no AED available CPR should be continued until emergency help arrives and takes over or the casualty shows signs of recovery such as coughing, speaking, moving purposefully, opening the eyes and starting to breathe normally.

AED use for children and infants
The protocols are the same as above but for children up to seven years a paediatric AED should be used. If not available, a standard AED should be used with paediatric pads. If neither of these is available a standard AED with adult pads can be used.

Chest compression-only CPR
1. If the first aid provider is unwilling or unable to give rescue breaths give chest compressions only;
2. These should be continuous at a rate of between 100 to 120 compressions per minute; and
3. Continue compressions until emergency help arrives or the casualty shows signs of recovery.

Dispatcher management of cardiac arrest
The emergency medical dispatcher provides a critical role in the early management of cardiac arrest through the prompt recognition of cardiac arrest, provision of telephone CPR instructions and dispatch of the emergency medical services with an AED.

It is important that the dispatcher recognizes cardiac arrest as soon as possible.

1. The use of scripted protocols is helpful in stating that a casualty who is unconscious and not breathing normally must be considered to be in cardiac arrest;
2. Additional education around the recognition of agonal breathing can improve recognition;
3. Dispatchers should provide CPR instructions for an adult in cardiac arrest; and
4. Dispatchers should provide instructions for both rescue breaths and compressions if the casualty is a child or infant.

CPR for children, infants and in cases of drowning

In these groups cardiac arrest is much more likely to be asphyxial so it is advisable to give two to five initial breaths before starting chest compressions.

1. Take a normal breath, make a seal around the person's mouth and blow steadily until the chest rises;
2. Maintaining head tilt and chin lift take your mouth away and allow the chest to fall;
3. This is an effective rescue breath and should take one second;
4. Start chest compressions and continue at a ratio of 30 compressions to two rescue breaths;
5. If alone and no method to simultaneously contact EMS (such as cell phone) do CPR for one minute before calling for emergency help;
6. Continue until emergency help arrives or the casualty shows signs of recovery; and
7. When two first aid providers are present a ratio of 15:2 may be used. Change every one to two minutes in order to prevent fatigue. Ensure that chest compressions are not interrupted during the changeover.

Note: If the rescuer is unwilling or unable to give rescue breaths chest compression-only CPR should be done. Also while cardiac causes are less likely, if in an infant or child a sudden arrest is witnessed, this is most likely cardiac and should be treated like an adult cardiac arrest.

Withholding of resuscitation in cases of traumatic pre-hospital cardiopulmonary arrest

Introduction

Injury is a leading cause of death across the world and pre-hospital traumatic cardiac arrest confers a very poor prognosis. In order to preserve dignity, conserve human and financial resources as well as minimize risks to healthcare workers the performance of resuscitation should be weighed against the risks and costs of resuscitation attempts.

It is possible to identify those in whom there is no realistic chance of survival and when resuscitation attempts would be futile and distressing for relatives, friends and healthcare personnel and when time and resources would be wasted undertaking such attempts. This is a new topic and guidelines are based on the evidence review conducted in 2015.

Summary of scientific foundation

Much of the data about predictors of survival is acquired from research in emergency in-hospital thoracotomy. Several studies have shown a less than one per cent survival rate in people with severe trauma and of those who survive almost half have resulting neurological deficit. Stratton et al. looked at 497 cases of penetrating trauma of whom four survived (0.8 per cent) including one in a neurologically devastated state. Shimazu et al. studied 267 cases of blunt and penetrating trauma of whom seven survived in the long-term with only four returning to their pre-injury level of neurological function.

References

Guidelines

- Resuscitation efforts may be withheld in casualties with injuries incompatible with life such as decapitation or hemicorporectomy. (*)
- Resuscitation efforts may be withheld in casualties with injuries incompatible with life with evidence of significant time lapse since cardiac arrest including dependent hypostasis (blood pooling in congested blood vessels in the dependent part of the body) rigor mortis and decomposition. (*)
- Resuscitation efforts may be withheld in cases of incineration when full thickness burns are associated with charring over more than 95 per cent of the body surface. (*)
- These guidelines do **NOT** address children, people with complicating factors such as hypothermia and for those whom a medical cause is the likely reason of the cardiac arrest. (Good Practice Point)
- Specific guidelines may be in place in different countries such as living wills, advanced directives and other specific directions around resuscitation attempts and each individual National Society has a responsibility to be familiar with own national protocols. (Good Practice Point)

Implementation considerations

The decision to withhold resuscitation in the out-of-hospital environment is a difficult one, but there are a number of situations where it is highly unlikely that a person will survive. There is sufficient evidence to indicate what these conditions are and to recommend the withholding of resuscitation. In all other cases of cardiac arrest resuscitation attempts must be started.

Methods of providing ventilation

Introduction

While providing ventilation has been minimized in certain resuscitation procedures such as compression-only CPR, it remains an important skill and part of the sequence of care for professional and lay providers who are resuscitating infants, children and certain adult casualties. Guidelines on this topic remain unchanged from the ones issued in 2011.

Summary of scientific foundation

This topic was reviewed as part of the 2011 IFRC Guidelines and by the American Red Cross Scientific Advisory Council.

The first study of the mouth-to-mask method found that the technique allowed effective ventilation to be delivered to nine adult postoperative patients. The operators could easily maintain acceptable blood levels of oxygen and carbon dioxide in the patients without experiencing fatigue, shortness of breath or dizziness. The authors suggested that the technique had several advantages and could be useful in emergency situations.

A review of the available literature comparing mouth-to-mask and BVM ventilation reveals that there are many unanswered questions regarding these potentially lifesaving techniques. For example, the actual risk of infection while using either of these methods is unknown. More research is needed, but still, some conclusions can be drawn.

The mouth-to-mask method may be effective at delivering adequate tidal volumes, although with higher peak airway pressures and increased risk of excessive ventilation and gastric insufflation than two-rescuer BVM use. This technique can also be more tiring for the first aid provider to perform.

Mouth-to-mask ventilation may be easier to learn and perform than the one-rescuer BVM technique. When a single first aid provider is required to perform both ventilation and compressions during one-rescuer CPR, the mouth-to-mask technique is simpler and faster, and results in shorter interruptions of chest compressions.

Most brands of resuscitation masks are available in one standard adult size. This size is particularly ineffective when used on infants. BVM devices are available in adult and paediatric versions, with a complete range of mask sizes.

One-rescuer BVM ventilation is a complex skill that is harder to learn and perform. In order to use this technique, the first aid provider first has to select the appropriate-sized mask and bag. Using one hand, the first aid provider needs to open the person's airway and form an adequate seal between the mask and face. Then, using the other hand, the first aid provider has to deliver the necessary tidal volume by squeezing the bag with one hand, while observing the casualty for visible chest rise. Many first aid providers have difficulty performing this skill, especially on adults. Mask design and variations in technique influence the results.

The two-rescuer method of BVM ventilation may facilitate making an adequate seal and delivering the necessary tidal volume, with less peak airway pressure and lower risk of excessive ventilation and gastric insufflation than the mouth-to-mask technique. It also allows higher concentrations of supplemental oxygen and facilitates transportation of the casualty. It may be an easier skill to learn and perform than the one-rescuer technique.

The first study of the mouth-to-mask method (Elam et al. in 1954) found that the technique allowed effective ventilation to be delivered to nine adult postoperative patients. In 1974, Safar evaluated the modified Laerdal Pocket Mask ™. While limited in size and scope, the study did show that it was possible to use the new device to deliver supplemental oxygen during ventilation of an adult. Harrison et al. (1982) conducted a direct comparison of mouth-to-mask and BVM ventilation using an adult-sized manikin connected to a spirometer. With the mouth-to-mask method, subjects delivered ventilations with tidal volumes exceeding 1,000ml. With the one-rescuer BVM technique, the tidal volumes were between 495ml and 509ml. In a similar study in 1983, Elling and Politis used an adult-sized recording manikin to test the ability of emergency medical technicians to use the two methods. The results showed that all of the subjects were able to deliver a tidal volume of greater than 800ml when using the mouth-to-mask technique. More than 50 per cent of the subjects failed to achieve this tidal volume when using their choice of BVM. Hess and Baran (1985) conducted another adult-sized manikin study of mouth-to-mask and one-rescuer BVM that not only compared the two methods, but also examined the two-rescuer BVM technique as well. The subjects were students in a respiratory therapy programme and therapists in practice. The study showed that two-rescuer BVM and mouth-to-mask ventilation delivered comparable ventilatory volumes, although less than in previous studies. One-rescuer BVM averaged about half the volume of the other techniques. Interestingly, subject's level of experience made no significant difference in their ability to deliver adequate ventilations. Lawerence and Sivaneswaran (1985) studied a range of healthcare personnel to measure their ability to ventilate adult-sized manikins with both the mouth-to-mask and one-rescuer BVM techniques. Before conducting skill testing, they surveyed the subjects and found significant reluctance to use mouth-to-mouth ventilation, which varied depending on the circumstances. When given the option of performing mouth-to-mask ventilation using a resuscitation mask with a bacterial filter, 100 per cent of the subjects indicated willingness to use that method. The researchers found that, as in previous studies, mouth-to-mask ventilation produced adequate tidal volumes. Using the one-rescuer BVM technique, only a single subject was able to deliver the target volume of 800ml. The results of this study prompted the institution to discontinue use of the BVM in patients until an advanced airway was placed.

Johannigman et al. (1991) conducted a study using an adult-sized manikin with adjustable lung compliance. Peak airway pressure, tidal volume, and gastric insufflation volume were all recorded. Paramedics ventilated the manikin using the mouth-to-mouth, mouth-to-mask, and one-rescuer BVM techniques. With normal compliance, the subjects were able to ventilate successfully with all the methods. Some gastric insufflation occurred with both mouth-to-mouth and mouth-to-mask ventilation, but not with the BVM. As compliance was decreased, tidal volumes fell and gastric insufflation increased for all methods. Mouth-to-mouth ventilations consistently produced the highest peak airway pressures, tidal volumes and gastric insufflation, and BVM the lowest. Ultimately, when compliance was at its lowest level, first aid providers were unable to deliver adequate tidal volumes with the BVM. Terndrup and Warner (1992) compared mouth-to-mouth, mouth-to-mask, and one-rescuer BVM ventilation, using both adult and paediatric sizes of BVM, when performed by basic emergency medical technicians on infant-sized manikins. They found that each method produced adequate ventilation. However, both adult and paediatric BVMs were associated with excessive peak airway pressure. Another adult-sized manikin study was conducted by Thomas et al. (1992) to compare three methods of BVM ventilation. First aid providers alternated between the standard one-rescuer technique, where the bag is squeezed with one hand, and an open palm variation where the bag was compressed between their hand and thigh or torso. The open palm method produced increased tidal volumes, which were significantly larger for first aid providers with small hands. The two-rescuer BVM technique, with one first aid provider opening the airway and sealing the mask with both hands, and the second first aid provider squeezing the bag with two hands, was then performed. The two-rescuer technique produced much greater tidal volumes, in some cases twice as high, as either one-rescuer technique.

Hackman et al. (1995) compared one and two-rescuer techniques of BVM ventilation on adult-sized manikins during CPR administered by fire fighter first responders. They found that when two first aid providers operated the BVM and a third performed chest compression, ventilation was consistently of higher quality. They also observed that the overall CPR effort appeared to be superior. The first aid providers maintained better hand position, and delivered compressions of greater depth. These results suggest that the technique they termed three-rescuer CPR may be more efficient and should be considered when sufficient personnel are available. In 2005, Davidovic et al. conducted a study that compared one- and two-rescuer BVM ventilation on infant-sized and child-sized manikins. The subjects came from a variety of healthcare fields. Overall, the two-rescuer technique resulted in higher airway pressures and larger tidal volumes than the one-rescuer method. This study supported previous findings and provided data specific to the paediatric population.

References

Guidelines

- A single first aid provider performing ventilations should use the mouth-to-mask technique rather than the BVM technique. (**)
- Multiple first aid providers with at least two available for providing ventilation should use the two-person BVM technique if properly trained and experienced in this method. (**)

Implementation considerations

National Societies need to determine, based on the first aid providers they train, whether to address only barrier devices or to also include BVM usage. In addition, certain National Societies may choose to allow in their materials the provision of ventilation without a barrier device based on local beliefs and practices, but this would not be consistent with current infection control practices.

14. Psychological first aid

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Introduction

Psychosocial support, as defined by the IFRC Reference Centre for Psychosocial Support, refers to the actions that address both the psychological and social needs of individuals, families and communities after critical events and aim at enhancing the resilience of the affected individuals, group and community. This definition corresponds with the Interagency Standing Committee (IASC) Guidelines on Mental Health and Psychosocial Support in Emergency Settings and is widely accepted. The IASC guidelines state that in emergencies, people are affected in different ways and require different kinds of support. A key to organizing mental health and psychosocial support is to develop a layered system of complementary supports that meets the needs of different groups; these layers include basic services and security, community and family support, focused non-specialized support and specialized services.

The most basic aspects of psychosocial interventions of this multi-layered approach are integrated into the provision of basic services and security. A psychosocial approach ensures that these services are provided in a respectful and socially appropriate way. These interventions may include advocating that the basic services are put in place by responsible actors, documenting their impact on mental health and psychosocial well-being and influencing humanitarian actors to deliver them in a way that promotes mental health and psychosocial well-being. At a community or family level psychosocial interventions aim to promote social support by re-establishing family links and social support networks. Trained volunteers may also provide psychological first aid and implement activities that support the inherent resilience of the affected groups. Psychological first aid as described in *The Psychological First Aid Field Operations Guide* (2006) is one example of this very basic aspect of psychosocial support. A smaller number of people may require support focused on specific problems or issues. The World Health Organization has published the most recent psychological first aid approach in 2011.[9]

Psychosocial interventions may take the form of individual, family or group interventions and should be carried out by trained and supervised personnel. In cases when the more focused interventions are insufficient or severe mental health disorders are suspected it is important to arrange for referral to mental health professionals. Evidence has been reviewed in 2015 and guidelines have been updated for this topic.

9 *World Health Organization, War Trauma Foundation and World Vision International, and Psychological first aid: Guide for field workers, WHO.*

Summary of scientific foundation

Five existing practice guidelines and three systematic reviews were identified; all published between 2007 and 2015, specifically focused on the intervention of providing psychological first aid the first few hours or days following a disaster. However, no controlled studies were found on this topic.

In the absence of evidence, there is however strong definition of psychosocial support and its underlying goals. The primary goal is the enhancement of resilience and psychosocial well-being through providing structured psychosocial support that may mitigate against the development of adverse psychological reactions. Psychosocial support interventions in emergency response situations that provide informational, practical and emotional support, such as psychological first aid, are highly recommended by various experts and guidelines (*see* NICE guidelines 2005, IASC guidelines 2009 and TENTS guidelines 2009). Given the limited evidence base, it was decided to develop guidelines through achieving a consensus of expert opinion. The recommendations propose that every area has a multi-agency psychosocial care planning group and that responses provide general support, access to social, physical and psychological support and that specific mental health interventions are provided only if indicated by a comprehensive assessment.

The Psychological First Aid Field Operations Guide (2006) issued by the National Child Traumatic Stress Network and National Center for Post-Traumatic Stress states that psychological first aid is an acceptable intervention that can be provided by trained volunteers without professional mental health training for people who have experienced a traumatic event. The *Psychological First Aid: Field Operations Guide (2006)* and the Disaster Services of the American Red Cross course entitled Psychological First Aid (DSCLS206A), intended for volunteers responding to disasters offer strong support for the credibility of this intervention. Many international and national expert groups, including IASC and the Sphere Project, have recommended psychological first aid. Psychological first aid is an alternative to psychological debriefing. In 2009, the World Health Organization's GAP Guidelines Development Group evaluated the evidence for psychological first aid and psychological debriefing. They concluded that psychological first aid, rather than psychological debriefing, should be offered to people in severe distress after being recently exposed to a traumatic event.

Guideline

- The core principles of psychosocial support should be included in all first aid training. (Good Practice Point)

Implementation considerations

Psychosocial support as well as psychological first aid must be conducted in collaboration with emergency services and the provision of first aid expertise. Support or supervision can be overseen by mental health practitioners and experts in psychosocial support. It is also important to determine the type of intervention as appropriate and necessary and to identify which psychosocial support provider is best suited for the task according to resources available. Lastly, it is important to include information for both casualties and first aid providers.

Psychological first aid principles

Measures to enhance resilience and psychosocial well-being after a traumatic event have been explored by different healthcare professionals. First aid providers should use the following intervention strategies for a person who has experienced a traumatic event. Training in psychological first aid or other similar psychosocial support interventions will provide the platform for their application.

- **Safety and security:** Ensure security and enhance immediate and ongoing safety and provide physical and emotional comfort. Allow the person a period of rest and provide an opportunity to discuss feelings and experiences if he or she wants to. If the person talks about thoughts, feelings or emotions in relation to the event voluntarily, listen in a calm, non-judgmental way.
- **Assessment of needs:** Provide practical and emotional support to the affected person according to needs (e.g. shelter, financial assistance, social network, medical and legal assistance).
- **Stabilization:** In some cases, the person may have an initial state of daze, in which his or her field of consciousness is constricted and attention narrowed, with a loss of the ability to comprehend stimuli (symptoms of acute stress reaction, i.e. the immediate and brief responses to a sudden intense stressor). Calm and orient emotionally overwhelmed persons. Give the affected person opportunities to distance him or her from the traumatic event. Give children opportunities to play.
- **Information:** Provide useful information related to the event including the state and place of missing persons, the resources in the community, and where the person can seek help in case emotional or mood problems develop in the future, as appropriate. Providing psycho-educational supports the healing process: Explain normal reactions to abnormal situations, to help prepare the person for reactions that may come in the following days and weeks and how to best cope in a healthy manner.
- **Connect to social support and collaborating services:** Social and peer support has been found to be useful and should be facilitated as should help-seeking behaviour. Help establish contact with primary social support persons or other sources of support such as family members or friends. Link with available services at the time or in the future.
- **Empowerment and hope:** Help the person to be active and take their own decisions wherever possible. Support in planning small steps into the near future.
- **Facilitate culturally appropriate rituals:** Rituals of mourning and farewell have an important function in promoting resilience at an individual as well as cultural and social level.

Basics of interviewing
- Attitude: active listening
- Questioning techniques: repeat, ask questions, etc.

The red thread for the first aid intervention:
The BASIS-model can be used to maintain a better overview of the course of the conversation:

- **B:** beginning, introduce yourself and your tasks, clarify timeframe and secrecy.
- **A:** acknowledge: recognize the event and the ensuring feelings.
- **S:** structure: provide security and structure during the conversation also regarding feelings.
- **I:** information: offer information about the next hours and days and about common reactions to extreme stress which may include anxiety, fear, intrusive imagery, sleep disturbances, etc. It is very important to convey that these reactions may occur but that not everybody gets them.
- **S:** social networks: make sure of safety nets (family members, friends, etc.), think of the referral to psychosocial specialists.

It is important to remember that mental health of the first aid providers is equally important as offering psychosocial first aid and they can be supervised and accompanied if needed.

De-escalating techniques for violent behaviour

Introduction

First aid providers may occasionally encounter a person at risk of violent behaviour.

Summary of scientific foundation

There are no data from randomized controlled trials evaluating the effects and usefulness of de-escalating techniques as short-term measures in preventing a violent behaviour. Evidence for the effectiveness of de-escalating techniques in regard to violent behaviour stems from case reports, case series, cohorts and expert opinions and consensus.

However, no evidence has yet been found against the usefulness of de-escalating techniques in preventing violence or that these techniques would cause any harm to a person at risk of violent behaviour.

References

Guidelines

- First aid providers should have basic skills in handling a person at risk of violent behaviour until help from a healthcare professional is available. (Good Practice Point)
- Thorough and comprehensive assessment for violent risk and for the possibility of an underlying mental illness for violent risk should be conducted by a trained healthcare professional. (Good Practice Point)
- If a person is considered to be at risk of engaging in violence, trained first aid providers can adopt de-escalating techniques as a short-term measure in preventing a violent behaviour. (Good Practice Point)

Implementation considerations

Violent risk is assessed based on the risk factors for violence and on the nature of the violent act if the assessment is conducted after the act. Risk factors for violence include the following:

- age (higher risk if less than 30 years old)
- sex (higher risk if male)
- unstable relationship
- unstable employment
- history of repeated impulsive behaviours and problems with authority
- previous history of violence
- presence of personality disorders (e.g. antisocial type, impulsive type)
- presence of other mental disorders (e.g. schizophrenia with psychotic symptoms related to violence, morbid jealousy)
- history of childhood problems (e.g. behavioural and conduct problems)
- presence of alcohol and substance abuse
- presence of brain injury
- presence of pain
- lack of social support

The nature of and circumstances after a violent act that suggest a higher risk include:

- lack of provocation for the violent act
- bizarre violent act
- lack of remorse and regret
- continuing major denial
- threats to repeat violence
- negative attitudes towards treatment if physical or mental illnesses are identified
- provocation or precipitant likely to recur (if provocation for or precipitant of the violent act is identified)
- the presence of alcohol or substance abuse
- social difficulties and lack of social support

If a person is considered to be at risk of engaging in violent behaviour, preventing it is a major concern.

De-escalation is defined as a gradual resolution of a potentially violent and or aggressive situation through the use of verbal and physical expressions of empathy, alliance and non-confrontational limit setting based on respect. It involves defusing, negotiation and conflict resolution with the eventual aim of recognizing signs of impending violence so as to prevent it before it happens. First aid providers can use the following de-escalating techniques in approaching a person at risk of engaging in violent behaviour:

- Adopt a calm and sincere attitude; show genuine concern.
- Beware of your own safety and the safety of other people at the scene. Be alert to the possibility that the person may have a weapon; if needed, evacuate other people to a safe place.
- Keep at a safe distance from the person at risk of violence.
- Stand at a friendly angle to the person (e.g. 45°).
- Keep an open posture (e.g. hands by side and palms turned outwards).
- Avoid touching the person at risk of violence.
- Monitor for signs of violence (e.g. observe for facial expression and posture).
- Speak to the person at risk of violence using a calm and soothing tone and in a non-provocative, non-confrontational way (e.g. nod your head to show that you are listening, use open-ended sentences).

- Adopt empathetic statements such as, "I understand that you are having a hard time and would like to understand what makes you so angry", but try to keep a factual stance and do not get too emotional or talk too much about emotions.
- Encourage the person to talk about his or her reasons for being angry or agitated (focus on the situation and his or her problem, not on his or her intent to take action).
- Maintain contact with the person and keep him or her talking until he or she has time to calm down.
- Listen to the person in a non-judgmental way.
- Be assertive and tell the person decisively and empathically that he or she will not be allowed to harm himself or herself or others. If appropriate, provide positive reinforcements and suggest ways other than violent behaviours to solve the difficulties or problems.
- Ask about the person's social support and resources.
- Call for help early, especially if the person appears emotional and cannot be calmed down (e.g. call the crisis team, ambulance or police).
- Send the person to the hospital for further assessment and management if required.

Panic attack

Introduction

A panic attack is a distinct episode of anxiety during which a person develops fear and apprehension and the anxiety reaches its peak within ten to 15 minutes. During the panic attack, the person can have multiple somatic symptoms such as palpitation, shortness of breath with hyperventilation, chest discomfort, profuse sweating, dizziness and light-headedness and nausea, with fear of dying, fear of losing control and fear of fainting. An accident or a traumatic event can precipitate a panic attack. It is important for first aid providers to know how to handle a person with a panic attack.

Summary of scientific foundation

A formal scientific evidence review was not conducted on this subject, but it is important in first aid education, and the following guidelines are based on expert opinion.

Guideline

- A person experiencing a panic attack should be assessed and treated by a mental healthcare provider. (Good Practice Point)

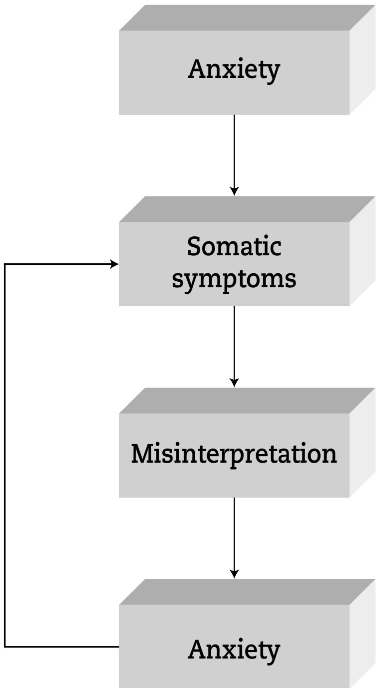
Implementation considerations

For a first aid provider it may be difficult to recognize or distinguish between common symptoms of heightened anxiety and that of panic disorder in emergency situations. However, trained first aid providers can use the following approaches to assist a person suspected of having a panic attack:

- Be aware that the presentation of chest discomfort and shortness of breath can be caused by physical problems such as a heart attack or asthma; if in doubt, send the person to a hospital for management.
- Speak to the person in a calm and unhurried manner. Speak slowly with clear, short sentences.

- Ask the person if he or she knows whether their symptoms are being caused by a panic attack.
- Encourage the person to breathe in through the nose and out through the mouth slowly.
- Reassure the person that his or her anxiety and somatic discomfort will decrease gradually and that the condition is not life-threatening.
- Explain to the person that the somatic symptoms are caused by anxiety and that they will disappear after he or she calms down. However, if he or she misinterprets that the somatic symptoms are originating from severe physical problems, his or her anxiety will increase, which will further increase the intensity of the somatic symptoms resulting in a vicious cycle (*see* Figure 5 below).

Figure 5: The vicious cycle in panic attack[10]



Extreme stress and post-traumatic stress disorder

Introduction

Major events outside the range of everyday experience involving the experience of serious threat, real or imagined, accompanied by feelings of powerlessness, horror or terror may result in extreme or traumatic stress.

Common reactions to extreme stress can include anxiety and fear; constant vigilance and accompanying startled responses; poor concentration and memory; intrusive imagery and sensory intrusions; sleep disturbances including nightmares; feelings of guilt, sadness and anger; emotional numbness and

10 *IFRC. International first aid and ressuscitation guidelines, 2011.*

diminished interest as well as both mental and behavioural avoidance. These reactions may be accompanied by physical symptoms such as muscular tensions and trembling or shaking; aches and pains; nausea, vomiting or diarrhoea, disturbance of the menstrual cycle or loss of interest in sex.

It is important to be aware that these reactions and symptoms are a normal response to an abnormal event. This message should be conveyed to affected people as the reactions may be interpreted as signs of ill health or mental disturbance. Usually people are resilient and these reactions fade gradually and eventually disappear. Resilience can be promoted by providing different forms of psychosocial support, including psychological first aid. However, for some people these reactions may be particularly powerful or persist over a longer period of time or worsen. In these cases it is important to intervene as this may lead to serious mental health problems that require professional help.

Post-traumatic stress disorder is a protracted pathological response to a traumatic event, in some cases this may be delayed. In general, post-traumatic stress disorder is not a very common disorder (prevalence rates are rather low). Today, the focus of psycho-traumatology is more on resilience and less on disorders.

The core symptoms of post-traumatic stress disorder are similar to the acute reactions to extreme stress but are protracted, they include the followings:
- hyperarousal (e.g. persistent anxiety, irritability, insomnia, poor concentration)
- intrusions (e.g. intense intrusive imagery, smells or sounds (sensory intrusions), recurring distressing dreams)
- avoidance (e.g. difficulty in recalling stressful events at will, avoidance of reminders of the events, detachment, inability to feel emotion (numbness), diminished interest in activities)

By witnessing traumatic events, first aid providers are also at risk of developing stress reactions and post-traumatic stress disorder. It is important for first aid providers to know about this and seek help if needed.

References

Guideline

- First aid providers are **NOT** expected to make a diagnosis of post-traumatic stress disorder. However, in case of particularly powerful or persistent stress reactions or symptoms, first aid providers should seek help from healthcare professionals, including a clinical psychologist or psychiatrist. (Good Practice Point)

Implementation considerations

Although post-traumatic stress disorder is not very common, some people may have a higher risk of developing it after a traumatic event. Risk factors for post-traumatic stress disorder include the following:
- history of exposure to previous trauma(s)
- subjective life threat (the person believes they were going to die)
- lack of positive social support
- history of psychiatric disorder
- a strong sense of a loss of control
- proximity to the event
- high degree of dissociation during trauma

- high degree of psychophysiological arousal immediately after the trauma
- loss of resources

Suicidal ideation

Introduction

It is not uncommon for first aid providers to encounter a person who expresses suicidal ideation. Certainly, a trained healthcare professional should conduct a thorough and comprehensive suicide risk assessment. Regardless, it is important for first aid providers to have basic skills in handling a person with suicide risk until help from a healthcare professional is available.

Summary of scientific foundation

The belief that asking about suicidal thoughts directly can induce a suicide attempt has been described as a myth by commentators. There are no studies supporting that asking about suicide thought or inclination will increase the suicide risk. On the contrary, a randomized controlled trial showed that asking about suicidal ideation does not increase the risk of suicide. Expert opinions support the belief that asking about suicidal thoughts generally will neither increase the person's distress, nor precipitate a suicide attempt. When asked appropriately, the person feels more understood and cared for.

References

Guidelines

- If a person is considered to have suicidal ideation, trained first aid providers should directly ask him or her about the suicidal thoughts. Inquiry about suicidal thoughts will **NOT** precipitate a suicide attempt. Instead, the person will feel being cared for if the inquiry is performed appropriately. (Good Practice Point)
- If a person is considered to have suicidal ideation, a trained mental health provider should evaluate him or her immediately or EMS should be activated. (Good Practice Point)

Implementation considerations

The depth and level of assessment and intervention need to be based on the level of training and support of the first aid provider. This will vary among different countries and first aid educational programmes.

Suicide risk is assessed based on the risk factors and circumstances of the suicide attempt if the person survives after such an attempt. Risk factors for suicide include the following:
- presence of depression
- presence of psychosis
- sex (the risk ratio of male: female is 2:1)
- age (the older the age, the higher the risk)
- single/separated/divorced/widowed
- presence of alcohol or substance abuse
- previous history of suicide attempts

- presence of a suicide plan
- lack of social support
- presence of chronic illness (e.g. chronic pain)

Circumstances of an unsuccessful suicide attempt that indicate a higher risk:
- planning in advance
- precautions to avoid discovery
- no attempts to obtain help afterwards
- final acts (e.g. writing a suicide note or making a will, transferring savings to a close relative's account, asking someone to help to take care of small children)
- dangerous method (e.g. a lethal dosage of drugs was used; the use of a violent method).

The person's own perception of the lethality of the method used should also be considered.

See Poisoning

First aid providers can use the following approaches for a person with suicidal ideation:
- Talk in a calm and unhurried way.
- Express empathy.
- Be aware of your own safety and the safety of other people in the area (a person with suicidal ideation may have items such as sharp objects intended to harm himself or herself).
- Encourage the person to talk about his or her suicide thoughts and plans, and the problems that lead to suicide as a way of coping, including ambivalence between the will to live and the will to die, if still present.
- Listen in a non-judgmental way.
- Ask about the person's social support and resources.
- Encourage the person to seek professional help.
- Ensure that the suicidal person is not left alone; ask the person's relatives or friends to accompany him or her to the hospital, other medical facility or notify EMS.
- If the person appears emotional and cannot be calmed down, summon for help (e.g., call the crisis team, ambulance, or police).

A trained healthcare professional should conduct a thorough and comprehensive assessment for suicide risk and for the possibility of an underlying mental illness that can lead to the same.

15. References

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Since the references for this document are in hundreds, they have been grouped within relevant sections. The reference citations have been numbered in these groups and are listed below under headings that correspond to the relevant chapters or sections of the main text.

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Cervical spinal motion restriction

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16. Appendix

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Global survey data on first aid

In 2015, the IFRC Global First Aid Reference Centre decided to update the data on first aid using an online questionnaire.

The key findings of this survey are as follows:

- Hundred and sixteen National Societies responded to the questionnaire.
- In 2014, the Red Cross Red Crescent National Societies trained **13,429,399** people in first aid worldwide.
- There are approximately **180,000 active first aid trainers** among all National Societies.
- In 50 per cent and 37 per cent of the countries that provided an answer to the survey there is a law that makes first aid training compulsory for workers and professional drivers respectively. These are among the categories of people for whom the greatest number of countries have enacted a law making first aid training compulsory. On the contrary, only 16 per cent and 20 per cent of the countries have enacted a law that makes first aid training compulsory at school or for retirement home's personnel.
- In 33 per cent of the countries there is a law that requires a citizen to act in case of an emergency. However there is a great disparity between all the IFRC regions: whereas this is a requirement in **66 per cent of the countries** in Europe, only **four per cent of the countries** in Asia and the Pacific have the same requirement.
- In **72 per cent of the countries** there is no special protection against lawsuits or criminal prosecutions for persons voluntarily providing first aid.
- In only 38 per cent of the countries there is a law that makes keeping a first aid kit in private vehicles compulsory. However this is not compulsory in **93 per cent of the countries** in Asia and the Pacific region.
- Eighty-five per cent of the National Societies have opted for a length of validity for their first aid certificates. In 19 per cent of the countries globally, the length of validity is imposed by the state.

Africa

- Only **14** National Societies in the Africa region responded to the questionnaire.
  - **In Africa, 667** active first aid trainers trained **62,623** people in 2014.
  - In 2014, Red Cross Red Crescent National Societies trained only **0.01 per cent** of the African population in first aid.
- In 14 per cent of the countries law makes it compulsory for laypeople to act in case of emergency.
- In 36 per cent of the countries, law makes it compulsory to keep a first aid kit in private vehicles.

- In seven per cent of the countries, there is a state law that regulates the use of AED.
- None of the countries have a state law that regulates the access to public defibrillation.
- In 21 per cent of the countries, the general public can access AED.
- Twenty-nine per cent of the National Societies train the general public to use AED.

Americas

- **Twenty-six** National Societies in the Americas region responded to the questionnaire.
  - In Americas, **3,409,693** people were trained; **96,672** active first aid trainers; **0.83** per cent of the population trained in first aid, in 2014.
- In 23 per cent of the countries, law makes it compulsory for laypeople to act in case of emergency.
- In 70 per cent of the countries, in the event that a person performs first aid voluntarily and something goes wrong, the first aid provider is not protected against a potential lawsuit or criminal prosecution.
- In 39 per cent of the countries, law makes it compulsory to keep a first aid kit in private vehicles.
- Eighty-five per cent of the National Societies issue first aid certificates with a fixed duration of validity ranging from one to three years. In 15 per cent of the countries, the length of validity is decided by the state.
- Sixty-nine per cent of the National Societies propose refreshing courses: 73 per cent organize face-to-face sessions, four per cent propose online sessions and eight per cent offer blended learning courses.
- In 92 per cent of the countries, the use of AED by Red Cross volunteers is authorized.
- In 46 per cent of the countries, the general public can have access to AED.
- Eighty-one per cent of the National Societies train the general public to use AED.

Asia and the Pacific

- Twenty-nine National Societies (out of 35) in Asia and the Pacific region responded to the questionnaire.
  - Red Cross Red Crescent National Societies trained **5,727,429** people in first aid.
  - **There are 50,322** first aid active trainers in the region.
- In four per cent of the countries, it is mandatory, by law, for a citizen to act in case of emergency.
- In 50 per cent of the countries, in the event that a person performs first aid voluntarily and something goes wrong, the first aid provider is not protected against a potential lawsuit or criminal prosecution.
- It is not compulsory, by law, to keep a first aid kit in private vehicles in any of the countries that responded to the questionnaire.
- Ninety-three per cent of the National Societies issue first aid certificates with a fixed duration of validity that ranges from one to five years. In 22 per cent of the countries, the length of validity is decided by the state.
- Eighty-nine per cent of the countries organize refresher courses: face-to-face (85 per cent) or blended learning (11 per cent).
- In 61 per cent of the countries, the use of AED by Red Cross Red Crescent volunteers is authorized.
- In 18 per cent of the countries, there is a state law that regulates AED.

- In 11 per cent of the countries, there is a state law that regulates public access to a defibrillator.
- In 36 per cent of the countries, the general public can have access to AED.
- Fifty-two per cent of the National Societies train the general public in how to use AED.

Europe

- **Forty-one** European National Societies responded to the questionnaire.
  - In Europe, Red Cross Red Crescent National Societies trained **4,161,366** people in first aid.
  - There are **31,118** active first aid trainers in Europe.
- In 66 per cent of the countries, law makes it compulsory for laypeople to act in case of emergency.
- In 58 per cent of the countries, in the event that a person performs first aid voluntarily and something goes wrong, the first aid provider is not protected against a potential lawsuit or criminal prosecution.
- In 61 per cent of the countries, law makes it compulsory to keep a first aid kit in private vehicles.
- Eighty-one per cent of the National Societies issue first aid certificates with a fixed duration of validity that ranges from one to six years). In 29 per cent of the countries, the length of validity has been decided by the state.
- Regarding refresher courses, 81 per cent of National Societies offer these. Seventy-three per cent organize face-to-face sessions; eight per cent offer blended learning courses.
- In 71 per cent of the countries, the use of AED by non-medical staff is authorized.
- In 68 per cent of the countries, the use of AED by Red Cross Red Crescent volunteers is authorized.
- In 34 per cent of the countries, there is a state law that regulates AED.
- In 29 per cent of the countries, there is a state law that regulates the access to public defibrillator.
- In 44 per cent of the countries, the general public can have access to AED.
- Fifty-nine per cent of the National Societies train the general public in how to use AED.

Middle East and North Africa

- Only **six** National Societies from the Middle East and North Africa region responded to the questionnaire.
  - In 2014, **68,288** people were trained by **1,180** active first aid trainers; **0.37 per cent** of the population trained in first aid.
- In 33 per cent of the countries, there is a law that makes it mandatory for a citizen to act in case of emergency.
- In 50 per cent of the countries, in the event that a person performs first aid voluntarily and something goes wrong, the first aid provider is not protected against a potential lawsuit or criminal prosecution.
- In 67 per cent of the countries, the law makes it compulsory to keep a first aid kit in private vehicles.
- All National Societies organize face-to-face refresher courses.
- In 50 per cent of the countries, the use of AED by Red Cross Red Crescent volunteers is authorized.
- In 33 per cent of the countries, the general public can have access to AED.
- Eighty-three per cent of the National Societies train the general public in how to use AED.

Summary table of topics revision

Summary table of topics revision	New topic	Update of 2011 (reviewed)	Update of 2011 (not reviewed)	International Liaison Committee on Resuscitation 2015	Scientific Advisory Council of the American Red Cross	European Resuscitation Council	Belgian Red Cross Centre for Evidence-Based Practice	Evidence-Based Network	Other
General principles		X							
Self-protection by citizens in daily emergencies and disasters		X							
Prevention		X							
Personal safety		X							
Linkages to other healthcare		X							
Update and retraining		X							
Target populations and their supporters		X							
Ethics		X							
Education									
What is effective first aid education?	X								
Foundation for first aid education	X								
The effectiveness of first aid education on casualty outcomes	X			X				X	
Motivation of the learner	X			X				X	
The effectiveness of using different learning modalities	X							X	

Summary table of topics revision	New topic	Update of 2011 (reviewed)	Update of 2011 (not reviewed)	International Liaison Committee on Resuscitation 2015	Scientific Advisory Council of the American Red Cross	European Resuscitation Council	Belgian Red Cross Centre for Evidence-Based Practice	Evidence-Based Network	Other
Scenario-based and simulation learning	X							X	
First aid education for children	X						X	X	
Measuring outcomes	X								
General approach									
Assessment		X							
Casualty positioning		X		X				X	
Call for help, EMS and further help		X							
Medication administration		X							
First aid for medical conditions									
Allergic reaction and second dose of epinephrine for anaphylaxis		X		X					
Poisoning		X					X		X
Breathing difficulties		X		X			X		
Chest pain		X		X					
Stroke		X		X			X		
Dehydration and gastrointestinal distress		X		X			X		
Seizures		X					X		

Summary table of topics revision	New topic	Update of 2011 (reviewed)	Update of 2011 (not reviewed)	International Liaison Committee on Resuscitation 2015	Scientific Advisory Council of the American Red Cross	European Resuscitation Council	Belgian Red Cross Centre for Evidence-Based Practice	Evidence-Based Network	Other
Fever	X						X		
Diabetes and hypoglycaemia treatment		X		X	X				
Use of oxygen		X		X					
Shock and optimal position for shock		X		X					
Unresponsive and altered mental status		X		X					
Fainting	X						X		
Croup	X						X		
First aid for injuries									
Foreign body airway obstruction		X		X	X				
Burns		X		X			X		
Bleeding		X		X			X		
Amputation	X						X		
Concussion		X		X	X				
Cervical spinal motion restriction		X		X					
Chest and abdomen injuries		X		X			X		
Injured extremity		X		X			X		
Wounds and abrasions		X					X		

Summary table of topics revision	New topic	Update of 2011 (reviewed)	Update of 2011 (not reviewed)	International Liaison Committee on Resuscitation 2015	Scientific Advisory Council of the American Red Cross	European Resuscitation Council	Belgian Red Cross Centre for Evidence-Based Practice	Evidence-Based Network	Other
Dental avulsion		X		X					
Injuries due to chemical exposure		X		X			X		
Environmental health problems									
Health problems caused by cold									
Frostbite		X					X	X	
Hypothermia		X					X	X	
Health problems caused by high altitude		X					X	X	
Radiation emergencies	X							X	
First aid for animal related-impairments									
Animal bites		X					X		
Snakebites		X					X		
Jellyfish stings		X					X		
Insect bites and stings		X					X		
Drowning and scuba decompression illness									
Drowning process		X							
Cervical spine injury among drowning casualties		X							
Scuba diving		X							

Summary table of topics revision	New topic	Update of 2011 (reviewed)	Update of 2011 (not reviewed)	International Liaison Committee on Resuscitation 2015	Scientific Advisory Council of the American Red Cross	European Resuscitation Council	Belgian Red Cross Centre for Evidence-Based Practice	Evidence-Based Network	Other
Resuscitation									
Cardiac arrest									
Early defibrillation									
Resuscitation in children									
Withholding of resuscitation in cases of traumatic pre-hospital cardiopulmonary arrest	X								
Methods of providing ventilation		X			X				
Psychological first aid									
Psychological first aid principles							X		
De-escalating techniques for violent behaviour			X						
Panic attack									
Extreme stress and post-traumatic stress disorder									
Suicidal ideation									

The Fundamental Principles of the International Red Cross and Red Crescent Movement

Humanity The International Red Cross and Red Crescent Movement, born of a desire to bring assistance without discrimination to the wounded on the battlefield, endeavours, in its international and national capacity, to prevent and alleviate human suffering wherever it may be found. Its purpose is to protect life and health and to ensure respect for the human being. It promotes mutual understanding, friendship, cooperation and lasting peace amongst all peoples.

Impartiality It makes no discrimination as to nationality, race, religious beliefs, class or political opinions. It endeavours to relieve the suffering of individuals, being guided solely by their needs, and to give priority to the most urgent cases of distress.

Neutrality In order to enjoy the confidence of all, the Movement may not take sides in hostilities or engage at any time in controversies of a political, racial, religious or ideological nature.

Independence The Movement is independent. The National Societies, while auxiliaries in the humanitarian services of their governments and subject to the laws of their respective countries, must always maintain their autonomy so that they may be able at all times to act in accordance with the principles of the Movement.

Voluntary service It is a voluntary relief movement not prompted in any manner by desire for gain.

Unity There can be only one Red Cross or Red Crescent Society in any one country. It must be open to all. It must carry on its humanitarian work throughout its territory.

Universality The International Red Cross and Red Crescent Movement, in which all societies have equal status and share equal responsibilities and duties in helping each other, is worldwide.

For more information on this IFRC publication, please contact:

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