EUROPEAN RESUSCITATION COUNCIL

European Resuscitation Council Guidelines 2021: First aid

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Abstract

The European Resuscitation Council has produced these first aid guidelines, which are based on the 2020 International Consensus on Cardiopulmonary Resuscitation Science with Treatment Recommendations. The topics include the first aid management of emergency medicine and trauma. For medical emergencies the following content is covered: recovery position, optimal positioning for shock, bronchodilator administration for asthma, recognition of stroke, early aspirin for chest pain, second dose of adrenaline for anaphylaxis, management of hypoglycaemia, oral rehydration solutions for treating exertion-related dehydration, management of heat stroke by cooling, supplemental oxygen in acute stroke, and presyncope. For trauma related emergencies the following topics are covered: control of life-threatening bleeding, management of open chest wounds, cervical spine motion restriction and stabilisation, recognition of concussion, cooling of thermal burns, dental avulsion, compression wrap for closed extremity joint injuries, straightening an angulated fracture, and eye injury from chemical exposure.

Introduction and scope

In 2015 the European Resuscitation Council published its initial First Aid guidelines[1] based on the International Liaison Committee on Resuscitation (ILCOR) Consensus on First Aid Science with Treatment Recommendations published in the same year.[2,3] In 2015 ILCOR modified its consensus on science review process from a five-year cycle to a continuous evidence evaluation process. This is reflected in the 2020 ILCOR Consensus on Science with Treatment Recommendations (CoSTRs).[4,5]

In 2016 the ILCOR First Aid Task Force assessed all the topics reviewed by the American Heart Association and American Red Cross in the 2010 evidence review[6] and the 13 medical Population, Intervention, Comparison, Outcome (PICO) questions, ten trauma PICO questions and one education PICO examined in the ILCOR 2015 CoSTR review.[2,3] Thirty-eight PICO topics were selected for scoring and ranking by the task force members. Scoring was

orientated as to whether there was any published new evidence that would modify the 2015 CoSTRs. The top twenty ranked topics were selected and submitted by the ILCOR Continuous Evidence Evaluation (CEE) group, the constituent ILCOR councils for ratification and then opened for public comment. The First Aid task force then evaluated each selected topic. The task force selected topics where they believed there was new published evidence (since 2015) and submitted these for systematic review. For some topics the PICO question was changed to address gaps identified by previous reviews and these were also submitted for systematic review. The control of life-threatening bleeding topics were combined into a mega-PICO for an integrated systematic review. Where the task force was uncertain that there was sufficient new published evidence to support a systematic review, the PICO was submitted to a scoping review process. Scoping reviews are based on a broader search strategy, including grey literature, and provide a narrative report of their findings rather than the critical appraisal of a systematic review. The resulting manuscripts for both the systematic reviews and scoping reviews were subject to public comment and published on the ILCOR CoSTR website and in the 2020 CoSTR summary.[4,5] A number of the systematic reviews have been directly published including 'Immediate interventions for presyncope',[7] 'Management of hypoglycaemia',[8] 'Early versus late administration of aspirin for non-traumatic chest pain',[9] 'Cooling techniques for heat stroke and exertional hyperthermia',[10] 'Compression Wrapping for Acute Closed Extremity Joint Injuries',[11] 'Dental avulsion'[12] and 'Stroke Recognition for First Aid Providers'.[13]

The European Resuscitation Council First Aid writing group has used the published systematic reviews and scoping reviews together with the ILCOR First Aid task force consensus on science and treatment recommendations (ILCOR/CoSTR) as evidence for these first aid guidelines. The writing group also carefully considered the evidence to decision tables, narrative reviews and task force discussions when writing these guidelines. In addition, the Writing Group considered five additional topics, not included in the 2020 ILCOR process, that had been previously included in the 2015 ILCOR process, for short evidence reviews. The Writing Group has added these additional clinical recommendations as expert consensual opinion and labelled them as Good Practice Points to differentiate them from guidelines derived directly from scientific review.

In total these guidelines include 20 PICO topics, subdivided into eleven medical and nine trauma emergencies.

Medical emergencies

Recovery position
Optimal positioning for shock victims
Bronchodilator administration for asthma
Recognition of stroke
Early aspirin for chest pain
Anaphylaxis:
 Second dose of adrenaline (epinephrine) in anaphylaxis
 Recognition of anaphylaxis by first aid providers
Management of hypoglycaemia
Oral rehydration solutions for treating exertion-related dehydration
Management of heat stroke by cooling
Supplemental oxygen in acute stroke
Management of presyncope

Trauma emergencies

Control of life-threatening bleeding
Management of open chest wounds
Cervical spine motion restriction and stabilisation
Recognition of concussion
Thermal burns:
 Cooling of thermal burns
 Thermal burn dressings
Dental avulsion
Compression wrap for closed extremity joint injuries
Straightening an angulated fracture
Eye injury from chemical exposure

Definition of first aid

First aid is the initial care provided for an acute illness or injury. The goals of first aid include preserving life, alleviating suffering, preventing further illness or injury and promoting recovery. First aid can be initiated by anyone in any situation, including self-care. General characteristics of the provision of first aid, at any level of training include:

- Recognising, assessing and prioritising the need for first aid
- Providing care using appropriate competencies and recognising limitations
- Seeking additional care when needed, such as activating the emergency medical services (EMS) system or other medical assistance.

Key principles include:

- First aid should be medically sound and based on the best available scientific evidence
- First aid education should be universal: everyone should learn first aid
- Helping behaviours should be promoted: everyone should act
- The scope of first aid and helping behaviours varies and may be influenced by environmental, resource, training and regulatory factors.

These guidelines were drafted and agreed by the First Aid Writing Group members. The methodology used for guideline development is presented in the Executive summary.[13a] The guidelines were posted for public comment in October 2020. The feedback was reviewed by the writing group and the guidelines were updated where relevant. The Guideline was presented to and approved by the ERC General Assembly on 10th December 2020.

Key messages from the guidelines are presented in Fig. 1.

Concise guideline for clinical practice

Recovery position

For adults and children with a decreased level of responsiveness due to medical illness or non-physical trauma, who do NOT meet the criteria for the initiation of rescue breathing or chest compressions (CPR), the ERC recommends they be placed into a lateral, side-lying, recovery position (see Fig. 2). Overall, there is little evidence to suggest an optimal recovery position, but the ERC recommends the following sequence of actions:

FIRST AID 2021

5 TOP MESSAGES

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1. Only use the recovery position for casualties who do NOT meet the criteria for the initiation of rescue breathing or chest compressions (CPR)

2. Use stroke scale assessment protocols for the early recognition of stroke

3. When exertional or non-exertional heatstroke is suspected, immediately remove the casualty from the heat source, commence passive cooling and use additional, available cooling techniques

4. To control severe-life threatening bleeding, apply direct pressure and consider the use of a haemostatic dressing or the application of a tourniquet

5. For thermal burns, remove the casualty from the heat source and commence immediate cooling of the burn with cold or cool water for 20 minutes. Loosely cover the burn with a dry, sterile dressing or cling wrap
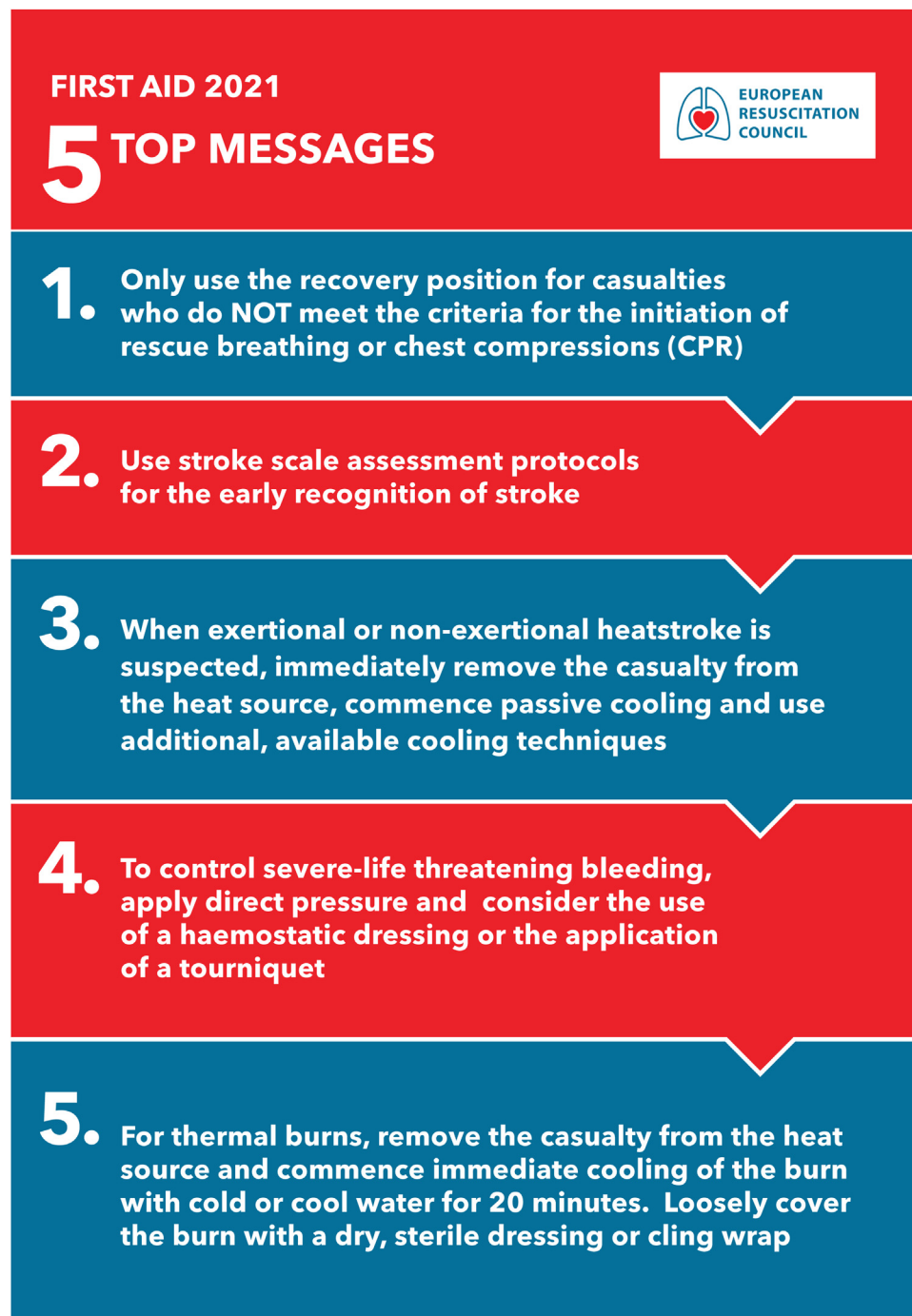
Fig. 1 – Infographic summary of key messages relating to first aid.

- Kneel beside the victim and make sure that both legs are straight
- Place the arm nearest to you out at right angles to the body with the hand palm uppermost
- Bring the far arm across the chest, and hold the back of the hand against the victim's cheek nearest to you
- With your other hand, grasp the far leg just above the knee and pull it up, keeping the foot on the ground
- Keeping the hand pressed against the cheek, pull on the far leg to roll the victim towards you onto their side

- Adjust the upper leg so that both hip and knee are bent at right angles
- Tilt the head back to make sure the airway remains open
- Adjust the hand under the cheek if necessary, to keep the head tilted and facing downwards to allow liquid material to drain from the mouth
- Check regularly for normal breathing
- Only leave the victim unattended if absolutely necessary, for example to attend to other victims.

Fig. 2 – The recovery position.

It is important to stress the importance of maintaining a close check on all unresponsive individuals until the EMS arrives to ensure that their breathing remains normal. In certain situations, such as resuscitation-related agonal respirations or trauma, it may not be appropriate to move the individual into a recovery position.

Optimal position for shock victim

- Place individuals with shock into the supine (lying-on-back) position.
- Where there is no evidence of trauma first aid, providers might consider the use of passive leg raising as a temporising measure while awaiting more advanced emergency medical care.

Bronchodilator administration for asthma

- Assist individuals with asthma who are experiencing difficulty in breathing with their bronchodilator administration.
- First aid providers must be trained in the various methods of administering a bronchodilator.

Recognition of stroke

- Use a stroke assessment scale to decrease the time to recognition and definitive treatment for an individual suspected of acute stroke.
- The following stroke assessment scales are available:
  ○ Face Arm Speech Time to call (FAST)
  ○ Melbourne Ambulance Stroke Scale (MASS)
  ○ Cincinnati Prehospital Stroke Scale (CPSS)
  ○ Los Angeles Prehospital Stroke Scale (LAPSS) are the most common.
- The MASS and LAPSS scales can be augmented by blood glucose measurement.

Early aspirin for chest pain

For conscious adults with non-traumatic chest pain due to suspected myocardial infarction:
- Reassure the casualty
- Sit or lie the casualty in a comfortable position
- Call for help
- First aid providers should encourage and assist the casualty in the self-administration of 150−300 mg chewable aspirin as soon as possible after the onset of chest pain
- Do not administer aspirin to adults with chest pain of unclear or traumatic aetiology

- There is a relatively low risk of complications, particularly anaphylaxis and serious bleeding. Do not administer aspirin to adults with a known allergy to aspirin or contraindications such as severe asthma or known gastrointestinal bleeding.

Anaphylaxis

The management of anaphylaxis has been described in the ERC Special Circumstances Guidelines.
- If the symptoms of anaphylaxis do not resolve after 5 min of the first injection of adrenaline or, if the symptoms begin to return after the first dose, administer a second dose by intramuscular injection using an autoinjector.
- Call for help.
- Train first aid providers regularly in the recognition and first aid management of anaphylaxis.

Management of hypoglycaemia

- The signs of hypoglycaemia are sudden impaired consciousness: ranging from dizziness, fainting, sometimes nervousness and deviant behaviour (mood swings, aggression, confusion, loss of concentration, signs that look like drunkenness) to loss of consciousness.
- A person with mild hypoglycaemia typically has less severe signs or symptoms and has the preserved ability to swallow and follow commands.
- If hypoglycaemia is suspected in someone who has signs or symptoms of mild hypoglycaemia and is conscious and able to swallow:
  ○ Give glucose or dextrose tablets (15−20 g), by mouth
  ○ If glucose or dextrose tablets are not available give other dietary sugars in an equivalent amount to glucose, such as Skittles, Mentos, sugar cubes, jellybeans, or half a can of orange juice
  ○ Repeat the administration of sugar if the symptoms are still present and not improving after 15 min
  ○ If oral glucose is not available a glucose gel (partially held in the cheek, and partially swallowed) can be given
  ○ Call the emergency services if:
    ▪ the casualty is/or becomes unconscious
    ▪ the casualty's condition does not improve

  ○ Following recovery from the symptoms after taking the sugar, encourage taking a light snack such as a sandwich or a waffle
- For children who may be uncooperative with swallowing oral glucose:
  ○ Consider administering half a teaspoon of table sugar (2.5 g) under the child's tongue.
- If possible, measure and record the blood sugar levels before and after treatment.

Oral rehydration solutions for treating exertion-related dehydration

- If a person has been sweating excessively during a sports performance and exhibits signs of dehydration such as feeling thirsty, dizzy or light-headed and/or having a dry mouth or dark yellow and strong-smelling urine, give him/her 3−8% carbohydrate-electrolyte (CE) drinks (typical 'sports' rehydration drinks) or skimmed milk.

- If 3−8% CE drinks or milk are not available or not well tolerated, alternative beverages for rehydration include 0−3% CE drinks, 8−12% CE drinks or water.
- Clean water, in regulated quantities, is an acceptable alternative, although it may require a longer time to rehydrate.
- Avoid the use of alcoholic beverages.
- Call the emergency services if:
  ○ The person is or becomes unconscious
  ○ The person shows signs of a heat stroke.

Management of heat stroke by cooling

Recognise the symptoms and signs of heat stroke (in the presence of a high ambient temperature):
- Elevated temperature
- Confusion
- Agitation
- Disorientation
- Seizures
- Coma.

When exertional or non-exertional heat stroke is suspected:
- Immediately remove the casualty from the heat source and commence passive cooling
- Commence additional cooling using any technique immediately available
  ○ If the core temperature is above 40 °C commence whole body (neck down) cold water (1−26 °C) immersion until the core temperature falls below 39 °C
  ○ If water immersion is not possible use alternative methods of cooling e.g. ice sheets, commercial ice packs, fan alone, cold shower, hand cooling devices, cooling vests and jackets or evaporative cooling (mist and fan)
- Where possible measure the casualty's core temperature (rectal temperature measurement) which may require special training
- Casualties with exertional hyperthermia or non-exertional heat-stroke will require advanced medical care and advance assistance should be sought.

The recognition and management of heat stroke requires special training (rectal temperature measurement, cold water immersion techniques). However, the recognition of the signs and symptoms of a raised core temperature and the use of active cooling techniques is critical in avoiding morbidity and mortality.

Use of supplemental oxygen in acute stroke

- Do not routinely administer supplemental oxygen in suspected acute stroke in the prehospital first aid setting.
- Oxygen should be administered if the individual is showing signs of hypoxia.
- Training is required for first aid providers in the provision of supplementary oxygen.

Management of presyncope

- Presyncope is characterised by light-headedness, nausea, sweating, black spots in front of the eyes and an impending sense of loss of consciousness.

- Ensure the casualty is safe and will not fall or injure themselves if they lose consciousness.
- Use simple physical counterpressure manoeuvres to abort presyncope of vasovagal or orthostatic origin.
- Lower body physical counterpressure manoeuvres are more effective than upper body manoeuvres.
  ○ Lower body − Squatting with or without leg crossing
  ○ Upper body − Hand clenching, neck flexion
- First aid providers will need to be trained in coaching casualties in how to perform physical counterpressure manoeuvres.

Control of life-threatening bleeding

Direct pressure, haemostatic dressings, pressure points and cryotherapy for life-threatening bleeding
- Apply direct manual pressure for the initial control of severe, life-threatening external bleeding.
- Consider the use of a haemostatic dressing when applying direct manual pressure for severe, life-threatening bleeding. Apply the haemostatic dressing directly to the bleeding injury and then apply direct manual pressure to the dressing.
- A pressure dressing may be useful once bleeding is controlled to maintain haemostasis but should not be used in lieu of direct manual pressure for uncontrolled bleeding.
- Use of pressure points or cold therapy is not recommended for the control of life-threatening bleeding.

Tourniquets for life-threatening bleeding
- For life-threatening bleeding from wounds on limbs in a location amenable to the use of a tourniquet (i.e. arm or leg wounds, traumatic amputations):
  ○ Consider the application of a manufactured tourniquet as soon as possible:
    ■ Place the tourniquet around the traumatised limb 5−7 cm above the wound but not over a joint
    ■ Tighten the tourniquet until the bleeding slows and stops. This may be extremely painful for the casualty
    ■ Maintain the tourniquet pressure
    ■ Note the time the tourniquet was applied
    ■ Do not release the tourniquet − the tourniquet must only be released by a healthcare professional
    ■ Take the casualty to hospital immediately for further medical care
    ■ In some cases, it may require the application of two tourniquets in parallel to slow or stop the bleeding.
- If a manufactured tourniquet is not immediately available, or if bleeding is uncontrolled with the use of a manufactured tourniquet, apply direct manual pressure, with a gloved hand, a gauze dressing, or if available, a haemostatic dressing.
- Consider the use of an improvised tourniquet only if a manufactured tourniquet is not available, direct manual pressure (gloved hand, gauze dressing or haemostatic dressing) fails to control life-threatening bleeding, and the first aid provider is trained in the use of improvised tourniquets.

Management of open chest wounds

- Leave an open chest wound exposed to freely communicate with the external environment.

- Do not apply a dressing or cover the wound.
- If necessary:
  ○ Control localised bleeding with direct pressure
  ○ Apply a specialised non-occlusive or vented dressing ensuring a free outflow of gas during expiration (training required).

Cervical spine motion restriction and stabilisation

- The routine application of a cervical collar by a first aid provider is not recommended.
- In a suspected cervical spine injury:
  ○ If the casualty is awake and alert, encourage them to self-maintain their neck in a stable position.
  ○ If the casualty is unconscious or uncooperative consider immobilising the neck using manual stabilisation techniques.
    ■ Head squeeze:
      • With the casualty lying supine hold the casualty's head between your hands.
      • Position your hands so that the thumbs are above the casualty's ears and the other fingers are below the ear
      • Do not cover the ears so that the casualty can hear.
    ■ Trapezium squeeze:
      • With the casualty lying supine hold the casualty's trapezius muscles on either side of the head with your hands (thumbs anterior to the trapezius muscle). In simple terms − hold the casualty's shoulders with the hands thumbs up
      • Firmly squeeze the head between the forearms with the forearms placed approximately at the level of the ears.

Recognition of concussion

- Although a simple single-stage concussion scoring system would greatly assist first aid providers' recognition and referral of victims of suspected head injury there is currently no such validated system in current practice.
- An individual with a suspected concussion must be evaluated by a healthcare professional.

Thermal burns

Following a thermal burn injury:
- Immediately commence cooling the burn in cool or cold (not freezing) water
- Continue cooling the burn for at least 20 min
- Loosley cover the burn with a dry sterile dressing or use cling wrap.
- Seek immediate medical care.

Care must be taken when cooling large thermal burns or burns in infants and small children so as not to induce hypothermia.

Dental avulsion

- If the casualty is bleeding from the avulsed tooth socket:
  ○ Put on disposable gloves prior to assisting the victim
  ○ Rinse out the casualty's mouth with cold, clean water
  ○ Control bleeding by:
    ■ Pressing a damp compress against the open tooth socket
    ■ Tell the casualty to bite on the damp compress

■ Do not do this if there is a high chance that the injured person will swallow the compress (for example, a small child, an agitated person or a person with impaired consciousness).

- If it is not possible to immediately replant the avulsed tooth at the place of accident:
  ○ Seek help from a specialist
    ■ Take the casualty and the avulsed tooth to seek expert help from a specialist.
- Only touch an avulsed tooth at the crown. Do not touch the root
- Rinse a visibly contaminated avulsed tooth for a maximum of 10 seconds with saline solution or under running tap water prior to transportation.
- To transport the tooth:
  ■ Wrap the tooth in cling film or store the tooth temporarily in a small container with Hank's Balanced Salt solution (HBSS), propolis or Oral Rehydration Salt (ORS) solution
  ■ If none of the above are available, store the tooth in cow's milk (any form or fat percentage)
  ■ Avoid the use of tap water, buttermilk or saline (sodium chloride).

Compression wrap for closed extremity joint injuries

- If the casualty is experiencing pain in the joint and finds it difficult to move the affected joint, ask him/her not to move the limb. It is possible there is swelling or bruising on the injured joint.
- There is no evidence to support or not support the application of a compression wrap to any joint injury.
- Training will be required to correctly and effectively apply a compression wrap to a joint injury.

Straightening an angulated fracture

- Do not straighten an angulated long bone fracture.
- Protect the injured limb by splinting the fracture.
- Realignment of fractures should only be undertaken by those specifically trained to perform this procedure.

Eye injury from chemical exposure

For an eye injury due to exposure to a chemical substance:
- Immediately irrigate the contaminated eye using continuous, large volumes of clean water or normal saline for 10−20 min.
- Take care not to contaminate the unaffected eye.
- Refer the casualty for emergency health care professional review.
- It is advisable to wear gloves when treating eye injuries with unknown chemical substances and to carefully discard them when treatment has been completed.

Evidence informing the guidelines

Recovery position

The 2015 ILCOR CoSTR suggested that first aid providers position individuals who are unresponsive and breathing normally into a lateral, side-lying recovery (lateral recumbent) position as opposed to leaving them supine (weak recommendation, very-low-quality evidence). There is little evidence to suggest the

optimal recovery position.[2,3] Since this review there have been a series of publications evidencing delays in commencing resuscitation when the casualty is turned into the recovery position.[14−16] In 2019 ILCOR revised its review population to 'Adults and children with decreased level of consciousness, due to medical illness or nonphysical trauma, that do not meet criteria for the initiation of rescue breathing or chest compressions (CPR)' and undertook a scoping review. The result of this scoping review for this modified question was no change from the 2015 treatment recommendation or guideline.

The subsequent 2020 scoping review[4,5] with this modified population identified over 4000 citations from which 34 were selected for review. All studies were considered to be of low or very low certainty of evidence with most being undertaken on conscious healthy volunteers and focussing on comfort and non-occlusion of the dependent arm vascular supply. Several studies did report on patients with a decreased level of consciousness due to medical aetiology or intervention.[17−22] There were reported beneficial outcomes, such as maintenance of a clear airway and in children, decreased hospitalisation rates supporting the lateral recumbent position for medical conditions resulting in a decreased level of consciousness. However, in a single observational study, the semi-recumbent position was favoured over the lateral position in opioid overdose.[23]

The remainder were studies involved healthy volunteers with normal level of consciousness, patients with obstructive sleep apnoea or sleep disordered breathing or cadavers with surgically induced cervical spine injuries.

The First Aid Task Force discussions reflected the lack of direct evidence in favour of any one particular recovery position and recommended that the 2015 treatment recommendation be upheld but modified to:

'For adults and children with decreased level of responsiveness, due to medical illness or non-physical trauma that do not meet criteria for the initiation of rescue breathing or chest compressions (CPR), the ERC recommends positioning the individual into a lateral, side-lying recovery (lateral recumbent) position as opposed to leaving them supine.'

A person placed in the recovery position should be monitored for continued airway patency/breathing and level of responsiveness. If either of these deteriorate, the person should be repositioned in a supine position and, if needed, CPR initiated.

The ILCOR First Aid Task Force recommended undertaking a further systematic review on this topic.

Optimal position for shock victim

Shock is a condition in which there is failure of the peripheral circulation. It may be caused by sudden loss of body fluids (such as in bleeding), serious injury, myocardial infarction (heart attack), pulmonary embolism, and other similar conditions.

This subject was reviewed in the 2015 ILCOR CoSTR[2,3] and in the 2015 ERC guidelines.[1] It was not formally reviewed in 2020 but was subject to an evidence update.[4,5]

While the primary treatment is usually directed at the cause of shock, support of the circulation is important. Although the evidence is of low certainty, 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 transient (<7 min) improvement in heart rate, mean arterial pressure, cardiac index, or stroke volume,[24−26] for those with no evidence of trauma. However, one study, published in 2018, reported adverse effects due to PLR.[27] 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- and 60-degrees elevation. Because improvement with PLR is brief and its clinical significance uncertain, it is not recommended as a routine procedure, although it may be appropriate in some first aid settings.

These recommendations place an increased value on the potential, but uncertain, clinical benefit of improved vital signs and cardiac function, by positioning a victim with shock in the supine position (with or without PLR), over the risk of moving the victim.

Bronchodilator administration for asthma

This CoSTR was not re-examined by ILCOR in 2020. In the 2015 CoSTR it was recommended that when an individual with asthma is experiencing difficulty in breathing, we suggest that trained first aid providers assist the individual with administration of a bronchodilator (weak recommendation, very-low-quality evidence).[2,3] This recommendation was made on the evidence provided by 8 double-blind randomised controlled trials (RCTs),[28−35] 2 observational studies[36,37] and 1 meta-analysis.[38] None of these studies examined the administration of bronchodilators by first aid providers. Two RCTs demonstrated a faster return to baseline levels following the administration of a fast acting beta-2 agonist[28,29] with only three studies reporting complications.[28,30,31] The remaining studies reported an improvement in the specific therapeutic endpoints of Forced Expiratory Volume in 1 second (FEV1)[30−35] and Peak Expiratory Flow Rate (PEFR).[36,37]

The 2015 first aid guideline remains unchanged.

Recognition of stroke

Stroke is one of the leading causes of death and disability worldwide.[39] Over the last 20 years, new treatments such as rapid thrombolytic delivery or endovascular reperfusion techniques for ischaemic stroke and medical or surgical treatment for haemorrhagic stroke have been shown to significantly improve outcomes.[40−42] Earlier detection of stroke in the prehospital setting will reduce time to treatment delays and prenotification of the hospital is key to improve successful treatment.[43−45]

In recent years, stroke recognition campaigns have proposed the training of laypeople, first aid providers and paramedics in the use of stroke scales or scoring systems to facilitate the early recognition of stroke. An ideal stroke assessment system for first aid use must be easily understood, learned and remembered, must have high sensitivity and must take a minimal time to be completed.

The systematic review of the 2015 ILCOR First Aid task Force[2,3] was rerun in late 2019. Four included studies which were published following the 2015 First Aid CoSTR showed that achieving a rapid stroke recognition score during the first aid assessment decreased the key outcome time from onset to treatment.[46−49] Use of the stroke recognition scale in the prehospital setting increased the number of patients with confirmed stroke diagnosis promptly admitted to hospital and the rate of administering urgent treatment.[46,48−51] First aid providers should use stroke scale assessment protocols that provide the highest sensitivity and the lowest number of false negatives.

FAST, CPSS, LAPSS and MASS are commonly used in the prehospital setting (strong recommendation, very-low-quality of evidence).

In many of the prehospital setting studies, the stroke assessments were performed by paramedics or nurses[4,5,51] so this guideline was based on extrapolation of potential benefit when these tools are used by lay people or first aid providers.

The specificity of stroke recognition can be improved by using a stroke assessment tool that includes blood glucose measurement such as the LAPSS[52−56] or MASS.[53,54,57] (weak recommendation, low certainty evidence). However, it is recognised that not all first aid providers have access to or the skills or the authority to use a calibrated glucose measurement device. For first aid providers, assessment with a stroke recognition scale that includes blood glucose measurement will require additional training and the acquisition of measurement devices that can be costly.

Early aspirin for chest pain

The pathogenesis of acute coronary syndromes (ACS) including acute myocardial infarction (AMI) is most frequently a ruptured plaque in a coronary artery. As the plaque contents leak into the artery, platelets clump around them and coronary thrombosis occurs completely or partially occluding the lumen of the artery, leading to myocardial ischaemia and possible infarction. The symptoms of an AMI include chest pain often described as a pressure with/without radiation of pain to the neck, lower jaw, or left arm. However, some people, particularly women, present with less typical symptoms such as dyspnoea, nausea/vomiting, fatigue or palpitations.

The 2015 CoSTR recommended the administration of aspirin to adults with chest pain due to suspected myocardial infarction.[2,3] This recommendation was based on the evidence from four studies.[58−61] A second 2015 CoSTR recommended aspirin administration early (i.e. prehospital or the first few hours after symptom onset) rather than late (at hospital).[2,3]

In 2020 the First Aid Task Force re-evaluated the question of early versus late administration of aspirin for non-traumatic chest pain. Two further observational studies were identified[62,63] comparing the early and late administration of aspirin in the prehospital environment. Both studies reported an improvement in survival at 7 days and at 30 days, although the dose of aspirin did vary between studies. One study reported an improved survival at one year associated with the early administration of aspirin.[62] Both studies did not report any increase in complications from early administration. Interestingly, one study[63] reported a lower incidence in the occurrence of asystole and the need for resuscitation with early administration whereas the second study[62] reported a higher incidence of ventricular fibrillation and ventricular tachycardia associated with early administration but the clinical significance of these events is uncertain.

The use of a single low dose of aspirin as an antithrombotic agent to potentially reduce mortality and morbidity in ACS/AMI is considered beneficial even when compared with the low risk of complications, particularly anaphylaxis and serious bleeding.[60,61,64,65]

Anaphylaxis

In the 2015 ILCOR CoSTR the Task Force suggested that a second dose of epinephrine be administered by autoinjector to individuals with severe anaphylaxis whose symptoms are not relieved by an initial dose (weak recommendation, very-low-quality evidence).[2,3] Nine observational studies provided very-low-quality evidence to support this recommendation.[66−74] This CoSTR was the subject of a scoping review in 2020.[4,5,75] Two studies identified were included; both studies found that for persons requiring treatment with adrenaline for anaphylaxis, two or more doses were required in 8% of 582 patients, and in 28% of 18 patients, respectively.[75] These studies reaffirm the 2015 treatment recommendation for use of a second dose of adrenaline in people with anaphylaxis who fail to improve within 5 −15 min after an initial dose.

A question arose in the knowledge gaps of the 2015 CoSTR as to the ability of first aid providers to be able to recognise the symptoms of anaphylaxis. In 2019 the Task Force undertook a scoping review to examine this question. 1081 records were identified but only two studies were relevant.[76,77] Both studies reported an improvement in the knowledge, recognition and management of anaphylaxis with education and training, but neither were tested in clinical scenarios.

Management of hypoglycaemia

Hypoglycaemia commonly occurs in individuals with diabetes but can also occur in other individuals due to an imbalance in blood sugar regulation. Someone experiencing hypoglycaemia will exhibit sudden impaired consciousness: ranging from dizziness, fainting, sometimes nervousness and deviant behaviour (mood swings, aggression, confusion, loss of concentration, signs that look like drunkenness) to loss of consciousness.[78,79] First aid for this condition consists of providing glucose tablets or other dietary forms of sugar such as juice, candies or dried fruit strips, to quickly increase the blood sugar level. These sugars can be self-administered but are also often provided by family or friends.[78,80] Glucose or sugar can be given orally, followed by swallowing the substance. However, other forms of administration are also possible, where the substance is not swallowed into the gastrointestinal tract, leading to faster absorption than the oral route. These other administration forms include 'buccal administration', placing the glucose inside the cheek against the buccal mucosa or 'sublingual administration', taking it under the tongue. This 2020 guideline is based on two systematic reviews conducted by the ILCOR First Aid Task Force.[8,81]

The first systematic review investigated the effect of oral glucose (i.e. tablets) or other dietary sugars (search date June 2016, updated September 2020). The review and update identified three randomised controlled trials and one observational study comparing dietary sugars, including sucrose, fructose, orange juice, jelly beans, Mentos, corn-starch hydrolysate, Skittles and milk to glucose tablets.[81] It was shown in a meta-analysis that dietary sugars resulted in a lower resolution of symptoms 15 min following treatment than glucose tablets. The evidence has a low to very low certainty and led to a strong recommendation concerning the use of glucose tablets, and a weak recommendation concerning the use of other dietary sugars when glucose tablets are not available.[2,3]

The second systematic review aimed to assess the effects of different enteral routes for glucose administration as first aid treatment for hypoglycaemia (search date January 2018).[8] The review identified two randomised controlled trials, including individuals with hypoglycaemia, and two non-randomised controlled trials, including healthy volunteers. It was shown that sublingual glucose administration, by giving table sugar under the tongue to children with hypoglycaemia and symptoms of concomitant malaria or respiratory tract infection, had better results in terms of glucose concentration after 20 min, than

oral glucose administration. When comparing buccal administration to oral administration, the buccal route was shown to be worse, with a lower plasma glucose concentration after 20 min. When glucose was administered in the form of a dextrose gel (resulting in a combined oral and buccal mucosal route), no benefit could be shown compared to oral glucose administration. The certainty of the evidence is moderate to very low certainty and led to a strong recommendation concerning the use of oral glucose (swallowed) and a weak recommendation in favour of using a combined oral + buccal glucose (e.g. glucose gel) administration if oral glucose (e.g. tablet) is not immediately available, both in case of individuals with suspected hypoglycaemia who are conscious and able to swallow. In addition, a weak recommendation against buccal glucose administration compared with oral glucose administration and a weak recommendation concerning the use of sublingual glucose administration for suspected hypoglycaemia for children who may be uncooperative with the oral (swallowed) glucose administration route was formulated.[4,5]

Oral rehydration solutions for treating exertion-related dehydration

Human body water accounts for 50−70% of the total body mass but, despite this abundance, it is regulated within narrow ranges. During prolonged exercise, sweat losses generally exceed fluid intake and even low levels of dehydration (about 2% of the body mass) impair thermoregulation[82] and cardiovascular strain.[83,84] Progressive fluid loss can lead to impaired physical and cognitive performance,[85,86] syncope due to hypotension and, finally, heat illness that can be fatal.[87,88] In such situations, it is of utmost importance to promote post-exercise drinking to restore fluid balance. For rapid and complete rehydration, the drink volume and composition are key.[89,90] Although the American College of Sports Medicine Guidelines on Nutrition and Athletic Performance recommend drinking 1.25−1.5 L fluid per kg body mass lost,[91] there is no clear endorsement regarding the specific type of rehydrating fluid. The most common forms of carbohydrate in sports drinks are glucose, fructose, sucrose and maltodextrin; the carbohydrate concentration varies between brands of sports drinks, but typically ranges are between 6−8%, compared to 10−12% carbohydrates in sugared soft drinks and fruit juices. Lower carbohydrate concentrations are sometimes promoted as 'lite' or reduced carbohydrate sports drinks. The advantages of these varying concentrations of carbohydrate-electrolyte drinks has been subject of many studies in athletes.

The ideal rehydration solution following exercise-induced dehydration was the topic of an ILCOR review in 2015[2,3] and is now updated by the ILCOR First Aid Task Force.[4,5] An additional 15 studies were identified (search date July, 2019), leading to the inclusion of a total of 23 randomised controlled trials (RCTs) and four non-randomised studies, comparing different concentrations of carbohydrate-electrolyte solutions (CES), beer of different alcohol percentages, milk, coconut water or high alkaline water, yoghurt drink or tea with regular water. The best available evidence was of low to very-low certainty due to limitations in study design, imprecise results and strongly suspected conflict of interest.[4,5]

Evidence for carbohydrate-electrolyte solutions (CES) compared with water

8−12% CES compared with water
Very-low-certainty evidence from 2 RCTs[92,93] could not demonstrate benefit from 8−12% CES for cumulative urine output when compared

with water. Furthermore, very-low-certainty evidence from 2 RCTs[89,92] showed benefit from 8−12% CES for fluid retention after 1 and 2 h and on dehydration after 1 and 2 h when compared with water. Low-certainty evidence from 1 RCT could not show benefit for the development of hyponatremia.[93]

3−8% CES compared with water
Very-low-certainty evidence from 3 RCTs[94−96] and 3 non-RCTs[97−99] showed benefit from 3−8% CES for cumulative urine output when compared with water. In addition, benefit for cumulative urine output could not be demonstrated in 3 RCTs.[100−102] Very-low-certainty evidence from 6 RCTs[94−96,100,102,103] and 2 non-RCTs[98,99] showed benefit from 3−8% CES for fluid retention when compared with water. In addition, a beneficial effect for fluid retention or rehydration could not be demonstrated in 4 RCTs.[89,101,104,105].

0−3% CES compared with water
Low-certainty evidence from 2 RCTs[106,107] showed benefit from 0−3% CES for cumulative urine output, fluid retention and serum sodium concentration when compared with water. A benefit for serum potassium concentration could not be demonstrated.

Evidence for milk compared with water
Very-low-certainty evidence from 3 RCTs[92,100,101] showed benefit from skimmed milk for cumulative urine output, fluid retention and dehydration when compared with water.

Additionally, very-low-certainty evidence from 1 RCT[101] showed benefit from skimmed milk with 20 mmol/L sodium chloride for cumulative urine output and fluid retention.

Evidence for regular beer compared with water
Very-low-certainty evidence from 1 RCT[108] showed harm from regular beer (4.5−5% alcohol) for cumulative urine output and fluid retention when compared with water. Additionally, in 2 other RCTs,[102,109] benefit for cumulative urine output, fluid retention and serum sodium and serum potassium concentration could not be demonstrated.

Other rehydration solutions compared with water
For the following rehydration solutions, insufficient evidence is available to recommend their use: coconut water,[96,104] maple water,[110] yoghurt drink,[93] rooibos tea,[111] Chinese tea plus caffeine,[93] high alkaline water,[112] deep ocean[113,114] or commercial bottled water,[115] 3% glycerol,[116] low- or non-alcoholic beer[102,108] or whey protein isolate solution.[117]

Management of heat stroke by cooling

Heat stroke occurs when the core body temperature exceeds 40 °C. It is a medical emergency and can lead to severe organ damage and death if the core temperature is not reduced promptly.[118] Non-exertional heat stroke is typically seen after prolonged exposure to the sun and is often seen during heat waves.[119−121] However, it may be seen during hot weather in individuals with impaired heat regulation such as in the elderly or children. Exertional heat stroke is associated with physical exertion in a hot or warm environment.

In 2020 the ILCOR First Aid Task Force published a systematic review of cooling methods for heat stroke.[122] A total of 3289 records were identified with 63 studies included in the quantitative GRADE analysis. A detailed analysis of the science supporting various cooling techniques was made and summarised by the ILCOR First Aid Task

Force.[4,5] In the systematic review most of the evidence was from studies of healthy adult volunteers with induced exertional heat stroke, although cohort studies and case series from exertional heat stroke casualties were also used by the task force to inform their recommendations. This review found that the fastest rate of cooling was achieved with use of whole body (neck down) water immersion, at a temperature between 1−26 °C. Of surprise, cooling was nearly as fast with the use of temperate water for immersion as it was for ice water. Water immersion cooled faster than all other forms of active cooling, including the use of ice packs to the axillae, groin and neck, use of showers, ice sheets or towels, and misting/fanning. Passive cooling was slightly faster than evaporative cooling and was felt, by the Task Force, to be an essential component of cooling for heat stroke or exertional hyperthermia.

A Task Force consensus opinion was that core temperature (rectal or oesophageal) should be measured if possible when evaluating or managing heat stroke. For adults with exertional or non-exertional heat stroke actively, cool the casualty using whole body (neck down) water immersion at 1−26 °C until a core body temperature below 39 °C has been reached (weak recommendation, very low certainty evidence). If cold water immersion is not available use any other cooling technique immediately available (weak recommendation, very low certainty evidence) that will provide the most rapid rate of cooling (weak recommendation, very low certainty evidence). No recommendation was made for non-exertional heat stroke (no recommendation, very low certainty evidence) as only scientific evidence was found for exertional heat stroke. No recommendation was made for cooling children with exertional or non-exertional heat stroke (no recommendation, very low certainty evidence) as all the science referred to adult subjects.

Fig. 3 shows cooling techniques reviewed in the systematic review, in decreasing order of effectiveness, included ice water immersion (1−5 °C), temperate water immersion (20−25 °C), cold water immersion (14−17 °C), colder water immersion (8−12 °C), commercial ice packs, showers (20 °C), ice sheets and towels (3 °C), hand and feet cold water immersion (16−17 °C), cooling vests and jackets, cold intravenous fluids, fanning, passive cooling, hand cooling devices and evaporative cooling.[122]

Use of supplemental oxygen in acute stroke

The use of supplemental oxygen in acute stroke is controversial. The ILCOR First Aid Task Force undertook a systematic review and published a CoSTR.[4,5] The treatment recommendation suggested against the routine use of supplementary oxygen in the first aid setting compared with no use of supplementary oxygen (weak recommendation, low to moderate certainty of evidence).

Direct evidence was provided by one prehospital observational study[123] supported by 8 in-hospital randomised controlled trials[124−131] comparing supplementary oxygen, at different flow rates and delivery methods, to no supplementary oxygen. The overall majority of these studies failed to show any improvement in survival, quality of life or neurologic outcome, including National Institutes of Health Stroke Scale (NIHSS) score. One retrospective observational study did report that when comparing three acute stroke groups (oxygen provided for hypoxia, routine provision of oxygen, no oxygen) there was no increase in respiratory complications or neurologic complications at hospital discharge suggesting that early supplementary oxygen may be safe.

The Task Force also considered that the provision of supplemental oxygen may not be considered as routine first aid. Oxygen administration does require the provision and use of equipment and an understanding of the mechanisms and risks of oxygen administration. It was recognised that this may not be available or applicable to all first aid providers and that further specific training would be required for providers.
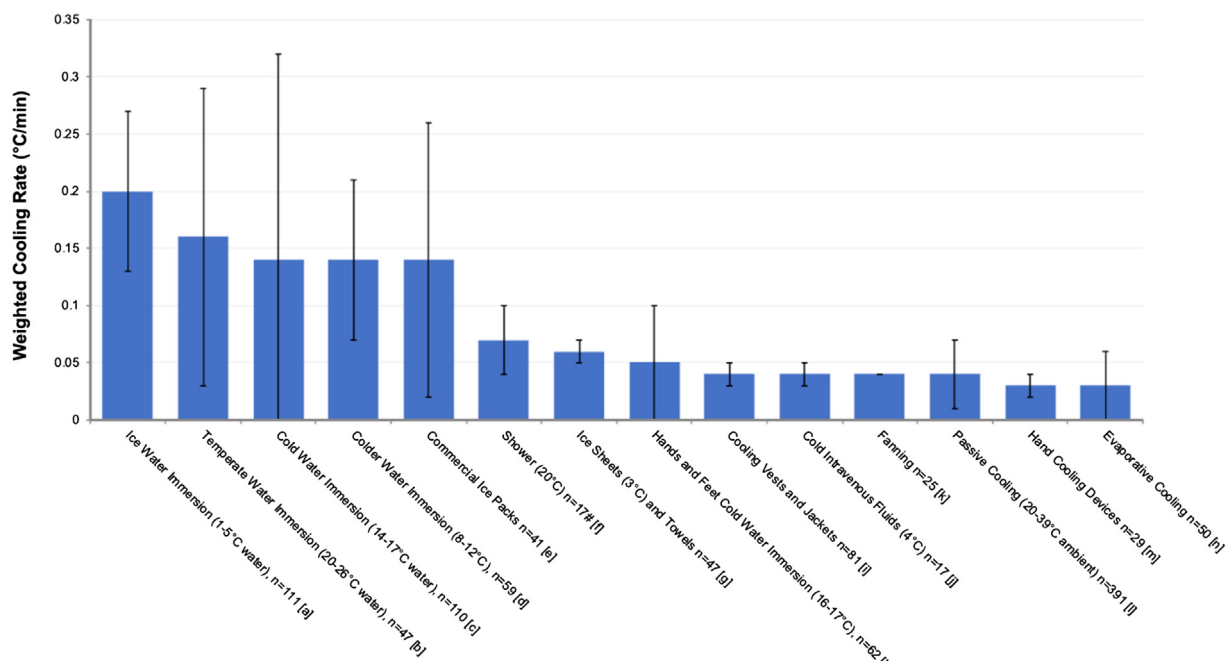

Fig. 3 – Weighted mean cooling rates (°C/min) by cooling method.

Management of presyncope

Syncope (fainting) is a temporary loss of consciousness. In many cases it is preceded by a prodromal phase, presyncope, which is characterised by light-headedness, nausea, sweating, black spots in front of the eyes and an impending sense of loss of consciousness. The estimated worldwide incidence is between 15 and 39%, 50% of females and 25% of males having a syncopal event in their lifetime.[132][−134] Injuries from syncope related falls include fractures, intracranial haemorrhage, internal organ injury and neurologic injury and accounts for approximately 30% of patients admitted to emergency rooms.[135] Syncope may be of vasovagal (50%) or orthostatic (7%) or cardiac (7%) origin[136] and there is laboratory evidence to suggest that physical counterpressure manoeuvres may abort syncope if applied in the presyncopal phase.[137−140] Physical counterpressure manoeuvres (PCM) include muscle contraction of the large muscles of arms, legs and abdomen - leg-pumping, tensing, crossing, squatting, handgrip, and abdominal compression (Fig. 4).

In 2020 the ILCOR First Aid Task Force published a systematic review of immediate interventions for presyncope of vasovagal or orthostatic origin[7] and a CoSTR statement.[4,5] Of 5160 citations initially identified, 81 studies were included for full text review and eight studies were ultimately included in the GRADE analysis (two randomised controlled studies[141,142] and six prospective cohort studies.[143−148] All studies investigated the effects of physical counter-pressure manoeuvres with six of the eight studies examining presyncope of vasovagal origin[141,143,144,146−148] whilst the other studies examined presyncope of orthostatic origin.[142,146] All eight studies showed mostly beneficial results for key outcomes for both the combined vasovagal and orthostatic presyncope group, as well as for those with presyncope of vasovagal origin alone. Pooled observational studies of various types of PCM did not show a benefit for aborting syncope, but several studies comparing the use of one method of PCM compared with an alternate method, or compared to control, showed benefit for aborting syncope. There was low-certainty evidence suggesting a modest benefit with the use of PCM for aborting syncope, and there was also low-certainty evidence showing a strong association of the use of PCM with symptom reduction.[141−148] No adverse events were reported, suggesting that the use of PCM may be a safe and effective first aid intervention in the specific population of individuals with suspected or recurrent vasovagal or orthostatic presyncope origin.[143,144]

The ILCOR First Aid Task Force recommended the use of any type of physical counter-pressure manoeuvre by individuals with acute symptoms of presyncope due to vasovagal or othostatic origin (strong recommendation, low and very-low-certainty evidence). Lower body physical counter-pressure manoeuvres (squatting, squatting with leg crossing, marching action) were recommended in preference to upper body manoeuvres (hand gripping, neck flexion, core tensioning) (weak recommendation, very low certainty evidence).[7] The Task Force acknowledged that many of these studies were laboratory studies in individuals with pre-existing vasovagal or orthostatic syncope. They also acknowledged that to promulgate this recommendation, first aid providers would need to be trained in coaching techniques so that the provider could instruct the victim in how to perform the physical counter-pressure manoeuvre.

Control of life-threatening bleeding

Trauma is the leading cause of injury-related morbidity and mortality across the globe. Uncontrolled bleeding is the primary cause of death in up to 35% of victims of trauma.[149,150] Exsanguination can occur in as little as 5 min, making the immediate control of life-threatening bleeding a critical skill for first aid. Life-threatening bleeding can be recognised by rapidly flowing or spurting blood from a wound, pooling of blood on the ground, or bleeding that cannot be controlled by direct manual pressure alone. Although direct manual pressure has been the gold standard for the initial control of bleeding, alternative techniques such as the use of tourniquets and haemostatic dressings are being applied more commonly for life-threatening bleeding in the prehospital military and civilian settings.

A recent systematic review by the International Liaison Committee on Resuscitation (ILCOR) evaluated multiple methods for the control of life-threatening external bleeding.[151] Evidence included for this review was identified from the prehospital civilian setting, supplemented by studies from the military prehospital setting, the in-hospital setting, and some simulation studies. Although evidence was identified to support recommendations for the use of direct pressure, tourniquets, and haemostatic dressings, the sequence of application has yet to be studied. In addition, no comparative evidence was identified for the use of pressure points, ice (cryotherapy) or elevation for control of life-threatening bleeding. There was inadequate evidence to support the use of junctional tourniquets or wound clamping devices by lay providers.

Direct pressure, pressure dressings, haemostatic dressings, pressure points and cryotherapy for life-threatening bleeding

Despite being considered the traditional 'gold standard' for bleeding control, the evidence supporting the use of direct manual pressure for the control of life-threatening bleeding is limited and indirect, with 3 three in-hospital randomised controlled trials of endovascular procedures in 918 patients showing a longer time to haemostasis with the use of mechanical pressure devices compared with direct manual pressure.[152−154]

The use of pressure dressings for maintaining haemostasis following control of life-threatening bleeding is also supported by limited, low certainty evidence. A cohort study of 64 patients with arteriovenous fistula puncture reported bleeding cessation in 45.5% with the use of direct manual pressure compared with 82% with the use of a commercial elastic compression bandage, while a case series of 62 victims of penetrating wounds in the prehospital civilian setting reported control of bleeding with the use of a commercial pressure dressing in 87% and reduced bleeding in the remaining 11%.[155,156]

Haemostatic dressings vary in design or mechanism of action, but typically are specially treated gauze sponges containing an agent that promotes blood clotting. These dressings are applied to or packed inside a wound and work when combined with direct manual pressure. First aid providers have demonstrated the ability to use haemostatic dressings in addition to direct manual pressure for the treatment of life-threatening bleeding.[157] Although primarily indirect, evidence supports the use of haemostatic dressings, with direct manual pressure, for control of life-threatening bleeding.

One low-certainty randomised controlled trial of 160 patients with stab wounds to the limbs demonstrated cessation of bleeding in less than 5 min in 51.2% of those who had a chitosan-coated haemostatic dressing applied with direct pressure compared with 32.5% of those who had direct pressure alone.[158] Fourteen in-hospital RCTs with 2419 civilian adults undergoing endovascular procedures also demonstrated more rapid haemostasis (4.6−17.8 min) with the use
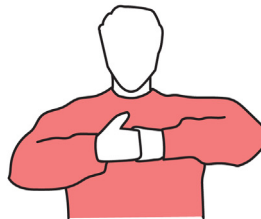
FIRST AID
PRESYNCOPE

1. Squatting

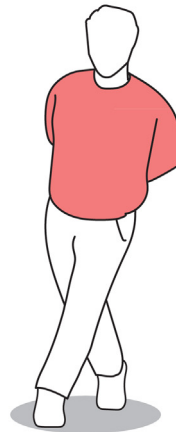**2. Arm tensing**

3. Leg tensing

Fig. 4 – Physical counterpressure manoeuvres to prevent syncope.

of a haemostatic dressing compared with direct manual pressure (12.4−43.5 min).[159−172]

While haemostatic dressings may be considered costly, the First Aid Task Force felt strongly that the cost of a single dressing in a first aid kit would not compare with the value of a life lost to uncontrollable bleeding.

Tourniquets

Tourniquets have been shown to stop life-threatening bleeding from wounds to the limbs and to improve survival.[173,174] In a cohort study of 281 adults with traumatic extremity injuries, use of a tourniquet in the prehospital setting was associated with a lower mortality rate compared with the use of a tourniquet after hospital arrival [3% (8/252) vs 14% (2/29); p = 0.01].[173] A second, larger cohort study of 1025 adults with traumatic peripheral vascular injury reported a

reduction in mortality rate associated with use of a tourniquet (7/181 [3.9%]) compared with no tourniquet use (44/845 [5.2%], adjusted OR, 5.86; 95% CI, 1.4−24.5)

Manufactured tourniquets may be of a windlass, ratcheting or elastic design and are intended to distribute pressure circumferentially in a manner that prevents tissue damage while effectively stopping blood flow when properly tightened. There are no randomised trials in the prehospital setting that show superiority in control of bleeding or survival based on the design of a manufactured tourniquet.[175−181]

Compared with improvised tourniquets, a manufactured tourniquet has been shown to have a higher success rate for cessation of bleeding in simulation studies with healthy volunteers.[182,183] A manikin study reported 100% cessation of simulated bleeding with the use of a Combat Application Tourniquet (CAT), 40% with the use of an improvised bandage tourniquet and 10% with the use of an

improvised bandana tourniquet.[184] There is some evidence that trained first aid providers are capable of proper and successful application of an improvised tourniquet to stop bleeding.[182–184]

A tourniquet may not be immediately available. In this case, direct manual pressure remains the initial means of controlling life-threatening bleeding, although when combined with use of a haemostatic dressing it may be more effective than direct pressure alone.[152–154,173,174]

There is concern that manufactured tourniquets designed for adults may not be able to be tightened adequately on the very small limbs of young children or infants. A 2020 ILCOR scoping review[4,5] identified one recent human study in children that demonstrated successful occlusion of pulses with use of a manufactured windlass tourniquet in children as young as two years of age.[185] When caring for children younger than two, if a first aid provider has difficulty with tightening a manufactured tourniquet, it may be reasonable to use direct manual pressure with or without a haemostatic dressing to control life-threatening bleeding from an extremity wound.

Management of open chest wounds

This topic was not reviewed in the 2020 round of CoSTR reviews. The correct management of an open chest wound is critical, as inadvertent sealing of the wound through use of occlusive dressings or devices may result in the potential life-threatening complication of a tension pneumothorax.[186] The 2015 ILCOR CoSTR treatment recommendation suggested against the application of an occlusive dressing or device by first aid providers to individuals with an open chest wound (weak recommendation, very-low-quality evidence)[2,3] based on one animal study[187] showing benefit from applying a non-occlusive dressing for respiratory arrest, oxygen saturation, theraputic endpoint (tidal volume) and the vital signs heart rate and respiratory rate but not mean blood pressure. The Task Force considered that any recommendation on this subject was being made based on a single animal study. They concluded that not recommending the use of any dressing or an occlusive device would protect against the occurence of a potentialy fatal tension pnuemothorax.[4,5]

However if a specialised non-occlusive dressing is available and the first aid provider has been trained in the application of the device and its subsequent management, including close monitoring of the casualty's condition, it could be used.[4,5]

Cervical spine motion restriction and stabilisation

In trauma patients, cervical spine injuries are rare but may be present.[188,189] First aid interventions aim to minimise additional movement of the neck in order to prevent potential injury of the cervical spine.

Definitions:
- Spinal immobilisation is defined as the process of immobilising the spine using a combination of devices (e.g. scoop-stretcher and cervical collar) intended to restrict spinal motion.
- Cervical spinal motion restriction is defined as the reduction or limitation of cervical spine movement using mechanical devices such as cervical collars and/or sandbags with tape.
- Spinal stabilisation is defined as the physical maintenance of the spine in a neutral position, such as by manual stabilisation, prior to the application of spinal motion restriction devices.
- Manual stabilisation is defined as any technique used to hold the neck in a consistent position using a provider's hands or arms, i.e. no use of devices.

In a suspected cervical spine injury, it has historically been routine to apply a cervical collar to the neck in order to avoid a cervical spine injury. However, this intervention has been based on consensus and opinion rather than on scientific evidence.[190,191] The 2015 ILCOR CoSTR suggested against the use of cervical collars by first aid providers (weak recommendation, very-low-quality evidence).[2,3] This recommendation was made in 2015 and upheld in 2020 as the Task Force felt that it was consistent with the first aid principle of preventing further harm compared with the potential benefits of applying a cervical collar.[4,5] Adverse effects have been reported from the use of cervical collars such as delayed transportation to definitive care,[192,193] patient discomfort and pain,[194] raised intracranial pressure[195,196] and reduced tidal volume.[197]

In 2019 the First Aid Task Force undertook an extensive scoping review of cervical spinal motion restriction. A total of 3958 records were screened of which six studies were identified as relevant.[198–203] These studies included three which did report the ability to restrict cervical spine movement to varying degrees[199,202,203] but also found one case report[200] showing worsening of neurologic signs until the collar was removed and one small cohort study[201] reporting the development of false midline cervical pain from the use of a cervical collar and rigid backboard. One literature review[198] of five studies reported that alert casualties exhibited proficient self-immobilisation and protective mechanisms. Furthermore, they reported that a casualty who self-extricates from a vehicle may move their neck up to four times less than a casualty who is extricated by traditional methods.

The Task Force did not feel that there was sufficient evidence to prompt a further systematic review and that the recommendation made in 2015 still stands. Where manual stabilisation is being considered, there is insufficient evidence to recommend one manual stabilisation technique (head-squeeze, trapezium squeeze).[4,5]

Recognition of concussion

Minor head injuries without loss of consciousness are common in adults and children. First aid providers may find it difficult to recognise concussion (minor traumatic brain injury (mTBI) due to the complexity of the symptoms and signs. The recognition of concussion is important as not recognizing it can lead to serious consequences including further injury and even death. Some of the symptoms of concussion may present immediately following the event. Others may not be noticed for days or months after the injury, or until the person resumes their everyday life preceding the injury.[204] In certain circumstances individuals do not recognise or admit that they are experiencing symptoms of a concussion. Others may not understand the different ways they have been affected and how the symptoms they are experiencing impact on their daily activities.

In 2015 the ILCOR CoSTR[2,3] made no recommendation but acknowledged the role that a simple, validated, single stage concussion scoring system could play in the recognition of concussion by first aid providers.

First aid providers are often faced with situations where they must decide what advice to offer an individual following head trauma,[1,205] especially during sport. One study[206] identified insufficient confidence and knowledge in lay responders to make a decision about how to act in a head injury scenario other than seeking medical assistance, but this varied according to contextual and situational factors.

An extensive scoping review carried out in late 2019 did not find any published manuscript reporting the use of a single stage

concussion assessment tool.[4,5] The following validated concussion assessment tools were identified but they do not fulfil the requirements for reliable concussion assessment to be made by first aid providers.

Sport Concussion Assessment Tool (SCAT 5)

Sport has taken the subject of concussion very seriously and the fifth version of the Sport Concussion Assessment Tool (SCAT 5) together with the rationale for it, has been published for use by healthcare professionals.[207,208] The implementation of SCAT 5 has resulted in fundamental changes in many sports which has improved both the recognition of concussion and its subsequent management for participants of all ages in sport. However, SCAT 5 is a two-stage concussion scoring system and is not appropriate in the first aid environment by first aid providers.

Concussion Recognition Tool (CRT 5)

In 2017 the Concussion Recognition Tool, CRT 5,[209,210] was introduced to be used by non-healthcare professionals but, to date, there are no published validation data for this tool.

Glasgow Coma Scale (GCS)

The adult and paediatric Glasgow Coma Scales (GCS) are commonly used to assess for and grade, a minor traumatic brain injury. However, the Glasgow Coma Scale was first designed with 3 scale components with which to determine the level of consciousness of patients with an acute brain injury.[211] The three components of the scale were eventually combined into a single index despite losing some of the detail and discrimination conveyed by the full scale[212] and this is now commonly used in the prehospital setting and emergency department by healthcare providers to assess and monitor a person's level of consciousness following a head injury. The GCS is not an appropriate tool for use by first aid providers to assess for a possible concussion following a head injury as the majority of concussion events do not result in a loss or alteration in consciousness.

AVPU scale

The Alert, Responds to Verbal Stimuli, Responds to Pain, Unresponsive (AVPU) Scale is another commonly used scale in the prehospital setting that was discussed. This simple assessment scale is used to establish a person's level of responsiveness but should not be used to establish the presence of a concussion.[213] Using this tool, anyone who does not score 'A' (alert) requires immediate evaluation by a healthcare provider. It is not an appropriate tool to be used by first aid providers to assess for a possible concussion following a head injury.

2-Stage concussion scoring scales

The Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT), the Standardized Assessment of Concussion (SAC), and the Sport Concussion Assessment Tool (current version, SCAT 5) were explored. These scales are designed for use by trained healthcare providers who are able to establish baseline normative data. They are not suitable as a single-stage scoring system for first aid.

Thermal burns

Cooling of thermal burns

The 2015 ILCOR CoSTR recommended immediate cooling of burns (strong recommendation, low-quality evidence).[2,3] Cooling thermal burns will minimise the resulting depth of the burn[214,215] and possibly decrease the number of patients that will eventually require hospital admission for treatment.[216] The other perceived benefits of cooling are pain relief and reduction of oedema (swelling), reduced infection rates and a faster wound healing process. There are no scientifically supported recommendations for the specific cooling temperature or the method of cooling (e.g. gel pads, cold packs or water). This CoSTR was not repeated in 2020.

The 2015 ERC Guideline recommended a cooling period of at least 10 min that was the perceived minimum acceptable length of cooling.[1] Although there have been multiple studies of cooling burns in porcine models,[217−220] it is well recognised that the differences between porcine and human skin makes these findings unreliable.[221] One human model study has subsequently shown that cooling burns at 16 °C for 20 min favourably modified the injury.[222]

The ILCOR Task Force, when discussing its 2019 Scoping Review of the management of burns,[4,5] made an additional recommendation as a good practice point to actively cool burns by cool or cold (but not freezing) water for at least 20 min. The ERC guideline has therefore been updated to lengthen the recommended cooling time for burns to at least 20 min. The ERC acknowledges that this may be challenging in practice in some instances and urges any cooling as opposed to no cooling as circumstances allow.

Thermal burn dressings

The 2015 ILCOR CoSTR compared wet and dry dressings for burns but failed to find any supporting evidence for either type of dressing for thermal burns in the prehospital setting[2,3] and the subsequent ERC guideline recommended loosley covering a burn with a dry sterile dressing as a good practice point.[1]

A subsequent 2020 ILCOR scoping review[4,5] of 1482 citations looked at first aid dressings for superficial thermal burns. The review showed that most publications concentrated on the in-hospital management of partial or full-thickness burns (ILCOR First Aid CoSTR) and that no one burn dressing could be recommended above any other for the first aid management of superficial burns. Task Force discussions did reflect that, following initial cooling, cling wrap could be used to protect the wound, reduce heat and evaporation, reduce pain and to allow the wound to be visualised more easily.[223] It was also noted that the risk of infection from using cling wrap was extremely low.[224]

Dental avulsion

Avulsion of permanent teeth is one of the most serious dental injuries and accounts for 0.6 to as much as 20.8% of all traumatic dental injuries.[225,226] The avulsed tooth should be replanted as quickly as possible for a good healing prognosis, but first responders such as parents[227] and teachers[228] lack knowledge regarding appropriate emergency treatment after tooth avulsion. This undoubtedly leads to delayed replantation and extensive desiccation of the tooth with subsequent necrosis of the periodontal ligament (PDL) which progressively may cause the loss of the tooth.[229] Although immediate replantation of the avulsed tooth at the site of the accident has been suggested to result in the greatest chance of tooth survival,[230] first aid providers may lack the required skills and the willingness to attempt this painful procedure, and may choose to temporarily store the tooth until professional care is available. The use of a suitable temporary storage solution or technique for an avulsed tooth should not delay efforts at replantation, but it may aid in preserving PDL viability in avulsed teeth prior to receiving professional assistance and improving long-term tooth

survival. This urges the need to identify the most effective storage methods for avulsed teeth which are available to laypeople.

This guideline is based on a new 2020 systematic review conducted by the ILCOR First Aid Task Force.[4,5,12] They reviewed the best available evidence on the effectiveness of any technique available to laypeople for storing an avulsed tooth compared with storage in milk or saliva, which are currently the most recommended temporary storage solutions in a prehospital setting. Out of 4118 references (search date September 2019), 33 studies were included and reported on 23 comparisons of which 10 were synthesised in a meta-analysis. It was found that the following techniques demonstrated higher efficacy at preserving tooth cell viability compared with milk: HBSS, propolis, ORS, rice water or cling film. Furthermore, cow's milk (any form or fat percentage) was shown to extend the tooth cell viability before replantation compared with saline, tap water, buttermilk, castor oil, turmeric extract and GC tooth mousse. There is insufficient evidence to recommend for or against temporary storage of an avulsed tooth in saliva compared with alternative solutions. The evidence has a low to very low certainty due to limitations in study design, indirect study populations (extracted teeth instead of avulsed teeth) and outcome measures (cell viability as a measure for tooth viability) and imprecise results and led to weak recommendations concerning the use of storage techniques for an avulsed tooth when immediate replantation is not possible.[12]

Compression wrap for closed extremity joint injuries

A lateral ankle sprain is a common closed joint injury encountered by first aid providers.[231,232] Approximately 23,000 to 27,000 ankle sprains are estimated to occur each day in the United States (US)[233,234] while the crude incidence rate of ankle sprains in accident and emergency (A&E) units in the United Kingdom is approximately 52.7 injuries per 10,000 people.[235] This may be less disruptive in people with a sedentary lifestyle; nevertheless for athletes and those working in more physically demanding jobs, these injuries may have life-long critical effects.[236]

Different acronyms are known for the treatment of simple acute closed joint injuries in the prehospital, hospital, and primary care setting, such as *RICE* (either "Rest, Immobilization [requires compression], Cold, and Elevation" or "Rest, Ice, Compression, Elevation"), *PRICE* (adding "protection" to *RICE*), or *POLICE* (Protection, Optimal Loading, Ice, Compression, Elevation.[237] More recently, *PEACE & LOVE* was introduced (Protection, Elevation, Avoid anti-inflammatories, Compression, Education & Load, Optimism, Vascularization, Exercise),[238] where *PEACE* focuses on the prehospital setting, while *LOVE* is the care during the subsequent days. All these acronyms have compression in common.

A new 2020 systematic review was conducted by the ILCOR First Aid Task Force, where they reviewed the best available evidence for the use of a compression wrap as a treatment for closed extremity joint injuries.[4,5] A total of 1193 references were identified, of which finally six randomised controlled trials[236,239–243] and two non-randomised controlled trials[244,245] were included. Benefit could not be demonstrated for reduction of pain, being free from walking pain, pain at rest, pain at walking, and reduction of swelling or oedema when comparing a compression bandage with no compression (in the form of not using a compression bandage, or using non-compressive stockings, a splint or a brace [Air Stirrup® ankle brace]).[236,239,241,243–245] Also, benefit could not be demonstrated for range of motion and recovery time, when using compression bandage compared with an ankle brace.[240,242] In one study[242] less benefit was shown for time to

return to work, when comparing compression bandage with an Air Stirrup® ankle brace, whereas in two other studies,[236,239] a difference could not be demonstrated. Finally, one RCT[239] showed benefit for time to return to sports when using a compression bandage compared with using non-compressive stockings. In summary, a clear beneficial effect could not be demonstrated for any of the studied outcomes. All evidence is of low to very low certainty, due to limitations in study design, indirect study population (all studies were performed in a hospital setting) and imprecise results.[11]

The 2020 ILCOR First Aid Task Force CoSTR made a neutral recommendation suggesting either the application of a compression bandage or no application of a compression bandage for adults with an acute closed ankle injury. (weak recommendation, very low certainty evidence).[4,5,11] Furthermore, the Task Force was unable to recommend for or against the use of a compression bandage for other closed joint injuries, apart from ankle injuries, due to the lack of available evidence. The Task Force recognised that all studies were performed in-hospital and that there were none from the out-of-hospital setting. They also acknowledged that it may require specific training to be able to apply a compression bandage safely and effectively to an injured joint.[4,5,11]

Straightening an angulated fracture

Fractures, dislocations, sprains and strains are extremity injuries commonly cared for by first aid providers. The first aid management of fractures begins with the manual stabilisation of the fracture, followed by splinting in the position found. Splinting, to include the joint above and the joint below the break, protects the injury from further movement and thus prevents or reduces pain and the potential for converting a closed fracture to an open fracture. Long bone fractures, particularly of the leg or forearm, may be angulated on presentation and severe angulation may limit the ability to properly splint the extremity or move the injured individual.

This topic was reviewed in 2015 but no published data were found that supported the use of splints to immobilise the injured extremity.[2,3] An evidence update, carried out in 2020 also found no published studies and therefore the guideline for 2020 remains the same as for 2015.

Common sense and expert opinion support the use of a splint to immobilise an extremity fracture (Good Practice Statement).

Do not straighten angulated fracture but immobilise in the position found with as little movement as possible to apply the splint (Good Practice Statement).

In some cases, an extremity fracture will present with severe angulation, making the application of a splint and transportation extremely difficult or impossible. Severe angulation may also compromise the vascular supply to the distal limb (absent peripheral pulse, distal to the fracture). In these cases, the first aid provider may request the assistance of a healthcare provider with specific training to perform fracture realignment to facilitate splinting and to re-establish a distal vascular circulation before transportation to a hospital.

Eye injury from chemical exposure

Accidental exposure of the eye to chemical substances is a common problem in both the household and industrial setting and it is often difficult to identify precisely what chemical has entered the eye.

The 2015 ILCOR CoSTR suggested that first aid providers use continuous, large volumes of clean water for irrigation of chemical eye

injuries (weak recommendation, very-low-quality evidence). This recommendation was made for alkaline pH solutions entering the eye and was for irrigation treatment only.[2,3] The recommendation was evidenced from a single animal study demonstrating a reduction of the high, alkaline pH with irrigation using water. No difference in maximum alkalinity was found when using equal volumes of water on 0.9% saline. This topic was not reviewed in 2020.

Alkali injury to the cornea has been shown to cause severe corneal injury and risk of blindness.[1−3] In contrast, acidic substances cause protein coagulation in the epithelium, a process that limits further penetration into the eye.[246] Irrigation with large volumes of water was found to be more effective at improving corneal pH as compared to using low volumes or saline irrigation.[247] It has been suggested that the use of solutions such as lactated ringers (LR) or balanced salt solution (BSS) or, in industrial settings, amphoteric - hypertonic solutions (e.g. Diphoterine) have been proposed as the preferred option for emergency neutralisation.[246] However, the choice of aqueous solution is of less prognostic importance than the timing of treatment and any delay in irrigation should be avoided. In addition to accidental and occupational exposure, there has been an increase in the number of violent assaults when acid is thrown in the face. This results in life-changing cutaneous and ocular injuries and may require consideration of more extensive first aid training and the wider provision of specific neutralisation measures.[248]

Conflict of interest

AH declared his role of Medical advisor British Airways and Medical Director of Places for People.

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