BASICS OF FIRST AID
Other emergencies

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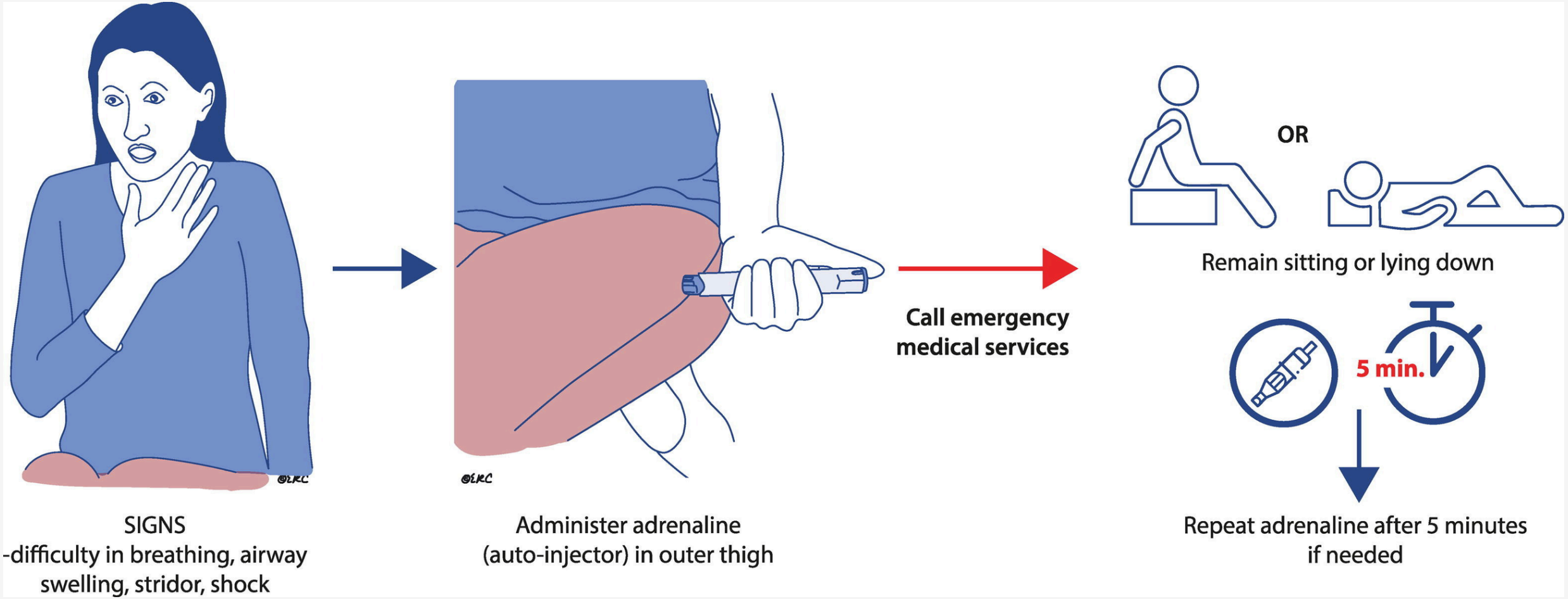
Anaphylaxis



Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. *Resuscitation*. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

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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.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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- 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.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

Heat stroke

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

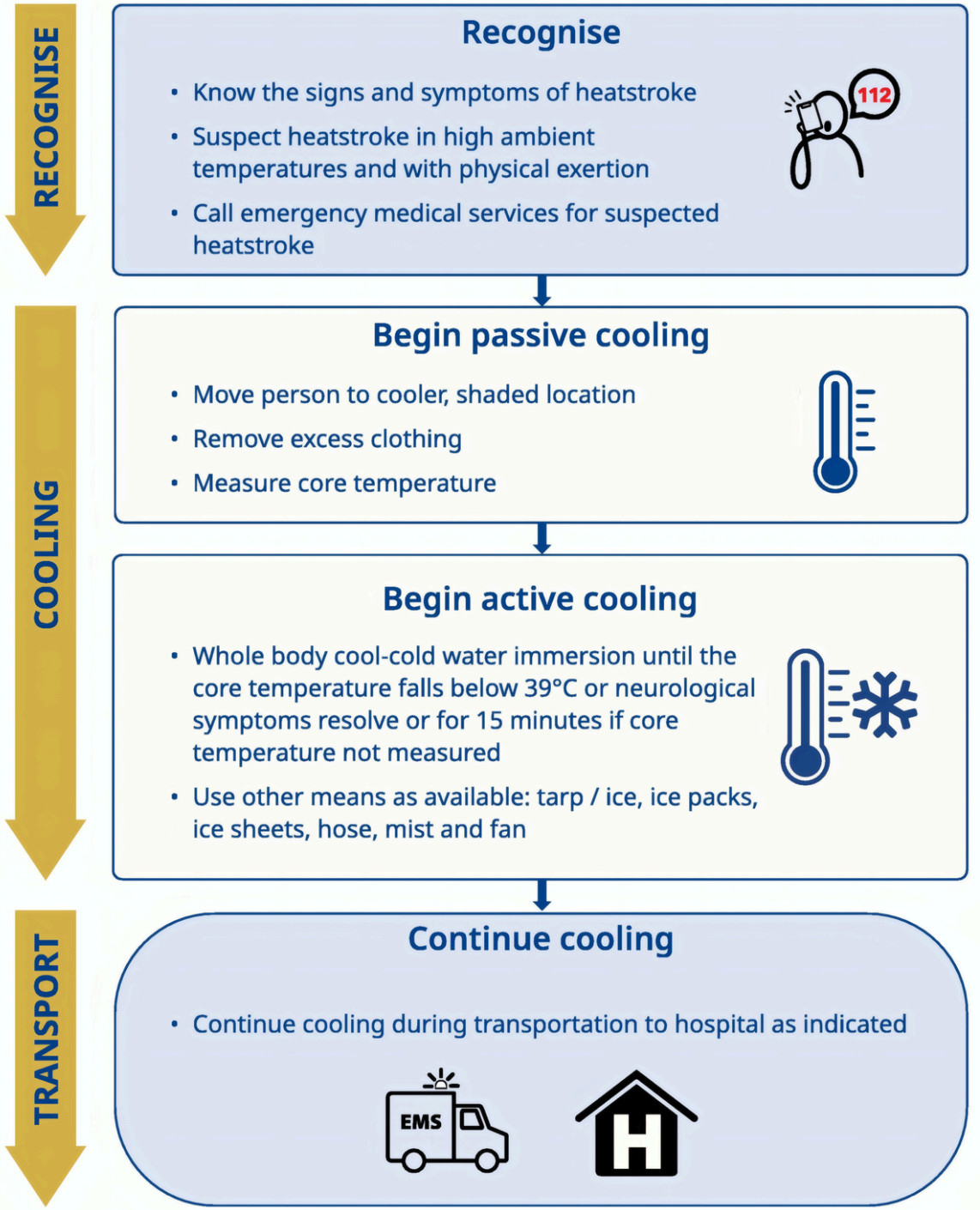
Consider heat stroke in the presence of high ambient temperature and symptoms such as

- elevated core body temperature,
- confusion,
- agitation,
- disorientation,
- seizures, or
- unresponsiveness.

Heat stroke

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

- Prevent exertional heat stroke during prolonged sporting events in hot climates through adequate preparation, and provide tools that support recognition, such as rectal temperature probes, and cooling, such as ice water immersion baths.
- In suspected heat stroke, remove the person from the heat source and start passive cooling by removing excess clothing and placing the person in a cooler or shaded location.
- **Use any immediately available technique to start active cooling if the core temperature exceeds 40 °C.**



Heat stroke

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

- **Prefer whole body cold water immersion, neck down, using water at 1 to 26 °C, and continue until the core temperature falls below 39 °C.**
- Alternative methods include tarp assisted cooling oscillation, ice sheets, commercial ice packs, a fan alone, a cold shower, hand cooling devices, cooling vests or jackets, and evaporative cooling using mist and fan.
- Where possible, monitor core temperature with a rectal thermometer.
  If core temperature measurement is not possible, continue cooling for 15 minutes or until neurological symptoms resolve, whichever occurs first.
- **Prioritise cooling before transport.**
- Continue cooling as needed during transport to a medical facility for further evaluation.

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TACO METHOD OFFERS RAPID COOLING
Health Care

Management of presyncope

FIRST AID
RESYNCOPE

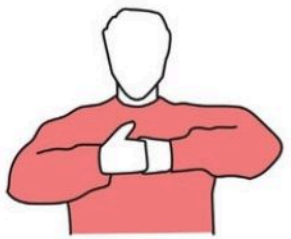
EUROPEAN RESUSCITATION COUNCIL GUIDELINES 2021

- 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.

1. Squatting

2. Arm tensing



3. Leg tensing

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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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

Figure 1A: Loss of tooth (Source: Dental Trauma Guide, 2010)

Figure 1B: Empty socket appearance (Source: Dental Trauma Guide, 2010)

Figure 1C: Radiographic image (Source: Dental Trauma Guide, 2010)

- 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).

https://endopracticeus.com/wp-content/uploads/2016/12/CE_Patel_Fig1.jpg

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

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- 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).

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

IDENTIFICATION OF LIFE-THREATENING HEMORRHAGE

There is **PULSATILE** or **STEADY BLEEDING** from the wound

Traumatic **AMPUTATION** of the **arm** or **leg**

BRIGHT RED BLOOD is pooling on the ground

Overlying clothing becoming **SOAKED WITH BLOOD**

Bandages or makeshift bandages used to cover the wound are **INEFFECTIVE** and steadily becoming **SOAKED WITH BLOOD**

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Apply direct pressure on external wounds with sterile cloth or your hand, maintaining pressure until bleeding stops

A.D.A.M.

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.

Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

INITIAL DIRECT PRESSURE BEFORE INTERVENTION

DIRECT PRESSURE can and **should be used** as a temporary measure **until** a **tourniquet** or **dressing** is in place

It is hard to use direct pressure alone to control significant bleeding or while moving the casualty

Direct pressure can be **used** if a treatment no longer maintains control of the bleeding **while a new treatment is started**

REMEMBER to ask other first responders to assist as needed

TACTICAL COMBAT CASUALTY CARE

TCCC

HIGHLIGHTS

MASSIVE HEMORRHAGE CONTROL IN TACTICAL FIELD CARE

Committee on Tactical Combat Casualty Care (CoTCCC)

EUROPEAN RESUSCITATION COUNCIL

Tourniquets

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

- Use a manufactured tourniquet if available.
- Place the tourniquet around the injured limb 5 to 7 cm above the wound, avoiding joints.
- Tighten the tourniquet until bleeding slows and stops. This may cause pain.
- Do not loosen or remove the tourniquet once applied unless directed by medical
- professionals.
- Record the time of tourniquet application and communicate this information to emergency services.
- Arrange rapid transport to a medical facility for definitive care.

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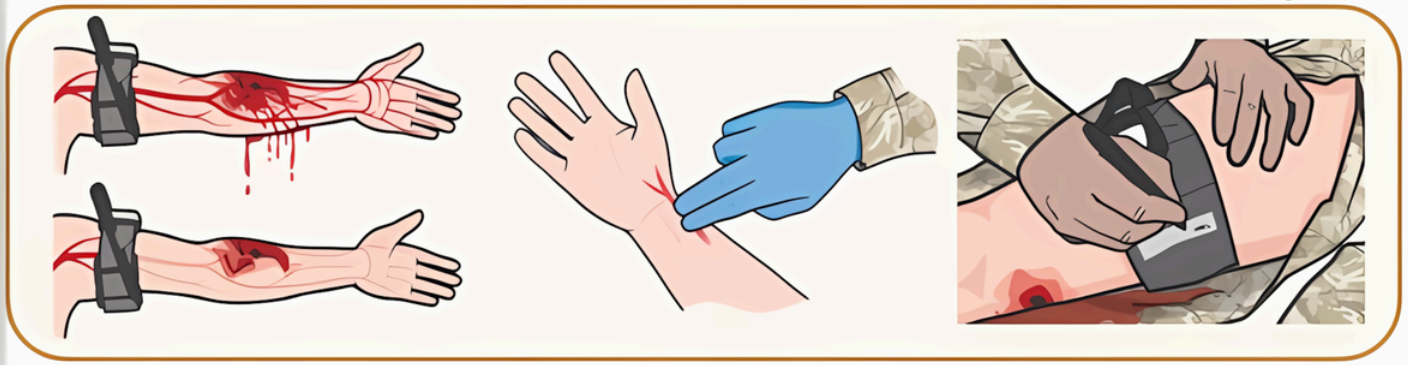
TOURNIQUET EFFECTIVENESS AND DOCUMENTATION

Is there a role for intermittent tourniquet loosening in TFC?	
Answer	**Rationale**
NO	Periodic loosening of tourniquets for the purpose of reperfusing the limb has resulted in incremental exsanguination and has no role on the battlefield. Additionally, periodic reperfusion of the ischemic limb may increase the amount of damage to the limb by worsening of the ischemia-reperfusion injury.

TQs can be assessed for effectiveness by:



Ensuring that the **BLEEDING** has Stopped

Checking a pulse distally on the limb where the TQ is applied to ensure there is **NO PULSE**

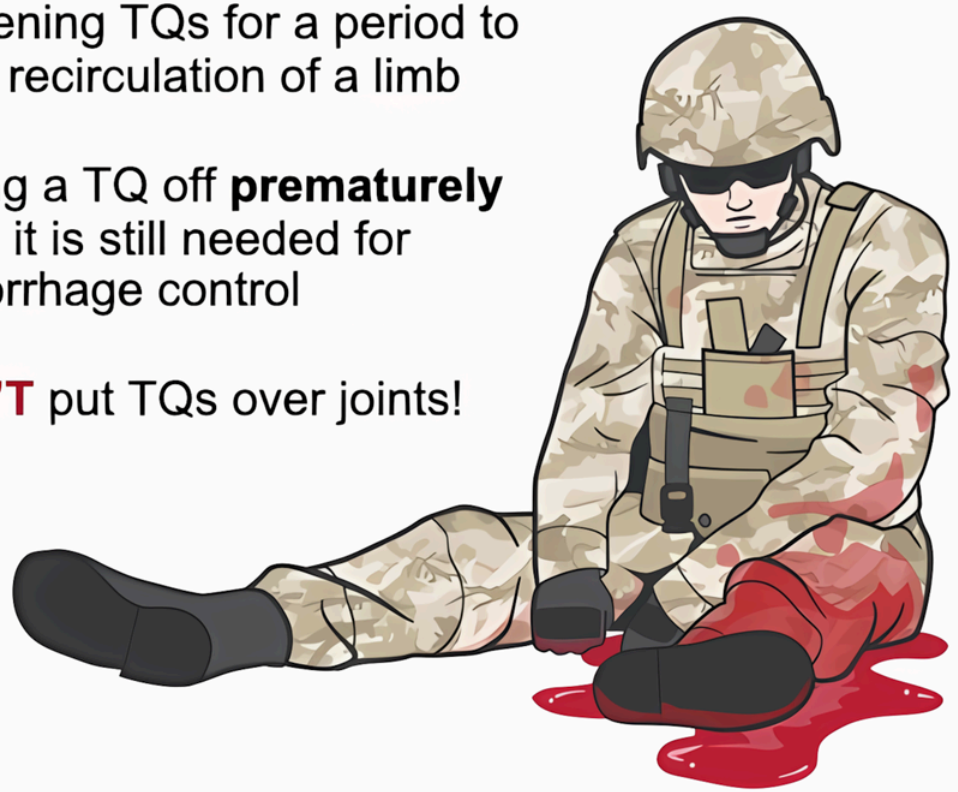
Time of TQ that is placed should be **documented** during the TFC and **NOT** the CUF phase

TQ application time is **important** in overall casualty care

https://books.allogy.com/web/tenant/8/books/3f274639-3bbc-4530-8ed0-569fb9e7721f/

COMMON TOURNIQUET ERRORS

- **NOT** using one when you should or waiting too long to put it on
- **NOT** pulling all the slack out before tightening
- **NOT** making it tight enough – the TQ should stop the bleeding **AND** eliminate the distal pulse
- **NOT** using a second TQ, if needed
- Using a TQ for minimal bleeding *(However, **when in doubt**, apply a TQ)*
- Putting it on too proximally if the bleeding site is clearly visible
- Loosening TQs for a period to allow recirculation of a limb
- Taking a TQ off **prematurely** when it is still needed for hemorrhage control
- **DON'T** put TQs over joints!



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HEMOSTATIC DRESSINGS

INDICATIONS for **Hemostatic Dressing** use are compressible (external) hemorrhage not amenable to limb tourniquet use or as an adjunct to tourniquet removal

- **Hemostatic dressing** is safe and contains active ingredients that assist with blood-clotting at the bleeding site
- **Hemostatic dressings** can be used with or without a pressure bandage
- JFAK contains **one hemostatic** dressing and **one dry sterile gauze**

⚠ **DO NOT** pack hemostatic dressings into chest wounds

CoTCCC-Recommended Hemostatic Dressings:

- **Combat Gauze**

Alternative hemostatic adjuncts:

- **Celox Gauze**
- **ChitoGauze**
- **XStat** (best for deep, narrow-tract junctional wounds)
- **iTClamp** (may be used alone or in conjunction with hemostatic dressing or XStat)

STOP THE BLEED®

SAVE A LIFE

American College of Surgeons
Inspiring Quality:
Highest Standards, Better Outcomes
100+years

THE COMMITTEE ON TRAUMA

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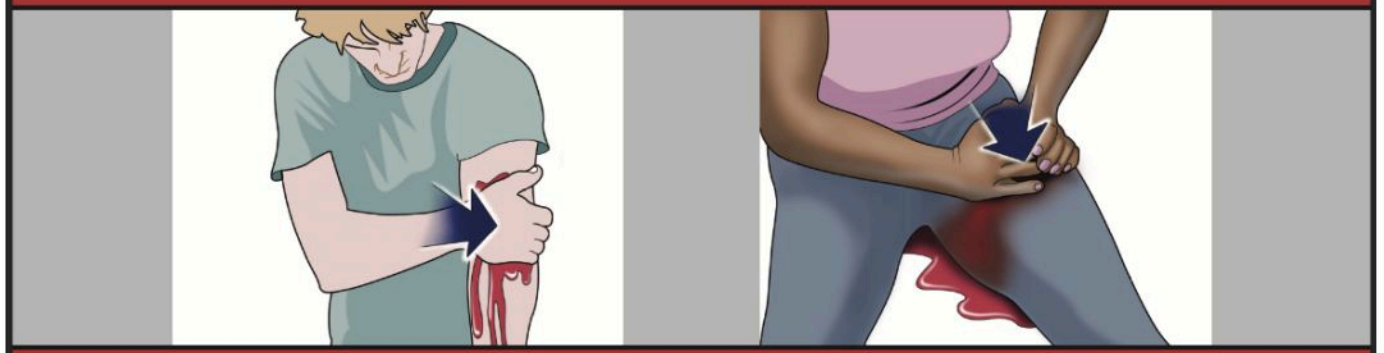
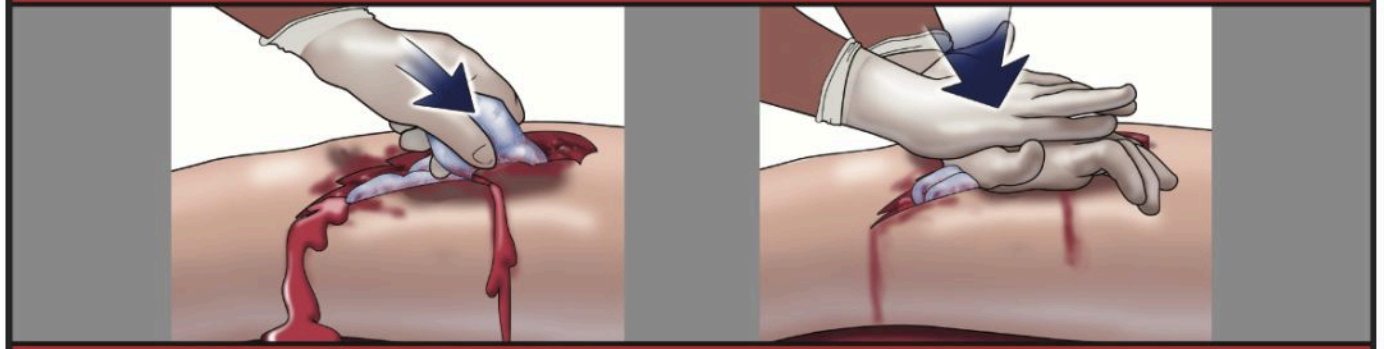
SAVE A LIFE
STOP THE BLEEDING

https://www.stopthebleed.org/resources-poster-booklet

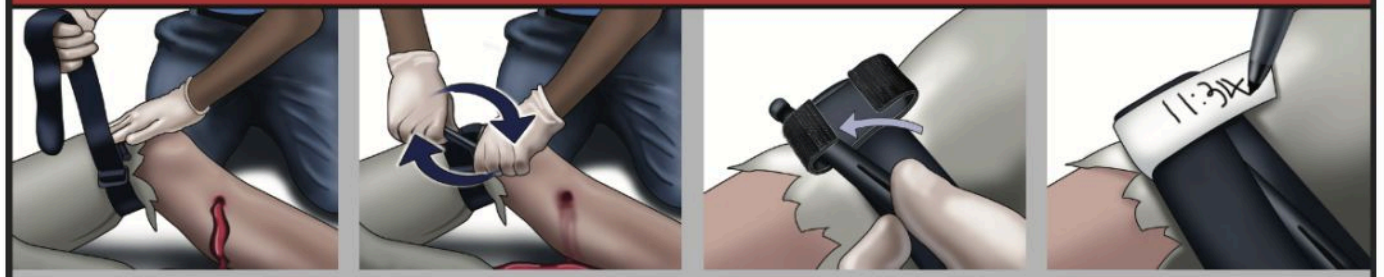
1 APPLY PRESSURE WITH HANDS



2 APPLY DRESSING AND PRESS



3 APPLY TOURNIQUET



WRAP WIND SECURE TIME

CALL 911

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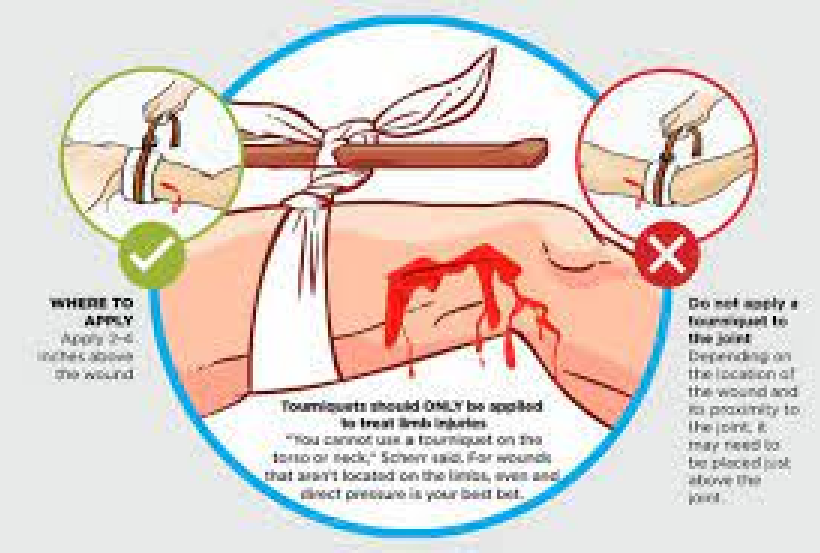
- If a manufactured tourniquet is not immediately available, or if bleeding is uncontrolled with the use of a manufactured tourniquet, apply direct manual pressure, with a gloved hand, a gauze dressing, or if available, a haemostatic dressing.
- Consider the use of an improvised tourniquet only if a 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.



Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

What Is a Tourniquet?

A **tourniquet** is a device that is placed around a bleeding arm or leg. Tourniquets work by squeezing large blood vessels. The squeezing helps stop blood loss.

How Do I Put a Tourniquet On?

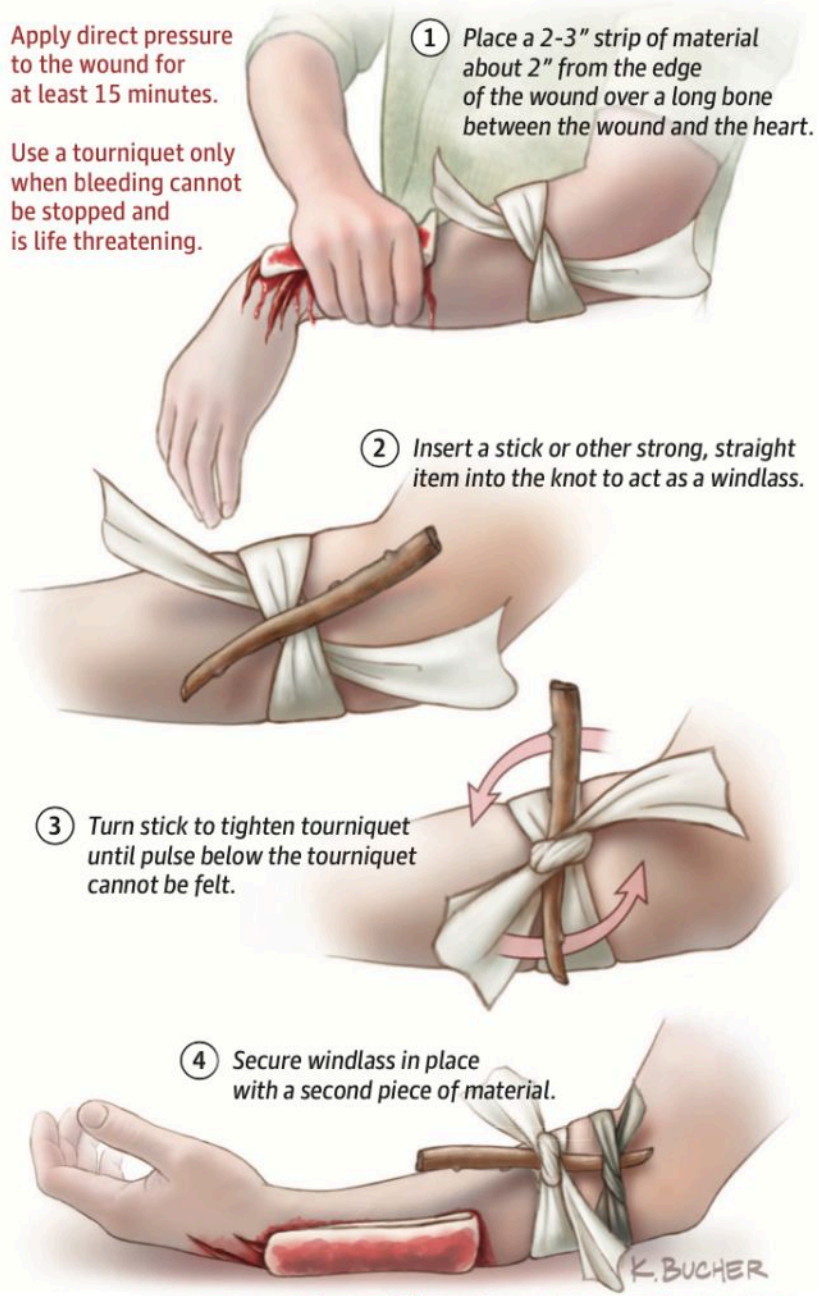
Tourniquets can be made out of any available material. For example, you can use a bandage, strip of cloth, or even a t-shirt. The material should be at least 2 to 3 inches wide. The material should also overlap itself. Using thin straps or material less than 2 inches wide can rip or cut the skin.

Tourniquets often use a windlass device to increase tightening. Inflated tourniquets (for example, those made from blood pressure cuffs) can work well. But they must be carefully watched for small leaks.

The injured blood vessel is not always right below the skin wound. Place the tourniquet between the injured vessel and the heart, about 2 inches from the closest wound edge. There should be no foreign objects (for example, items in a pocket) beneath the tourniquet. Place the tourniquet over a bone, not at joint.

Galante JM. Using Tourniquets to Stop Bleeding. JAMA. 2017;317(14):1490-1490. doi:10.1001/jama.2015.8581

Applying a tourniquet with a windlass device



Keep tourniquet visible and monitor wound for bleeding. Note time and watch for swelling below tourniquet.

What Else Do I Need to Know?

All bleeding should stop soon after you tighten the tourniquet. You must place a second tourniquet above the first if bleeding does not stop and you cannot tighten the tourniquet, or if the arm or leg swells above the tourniquet.

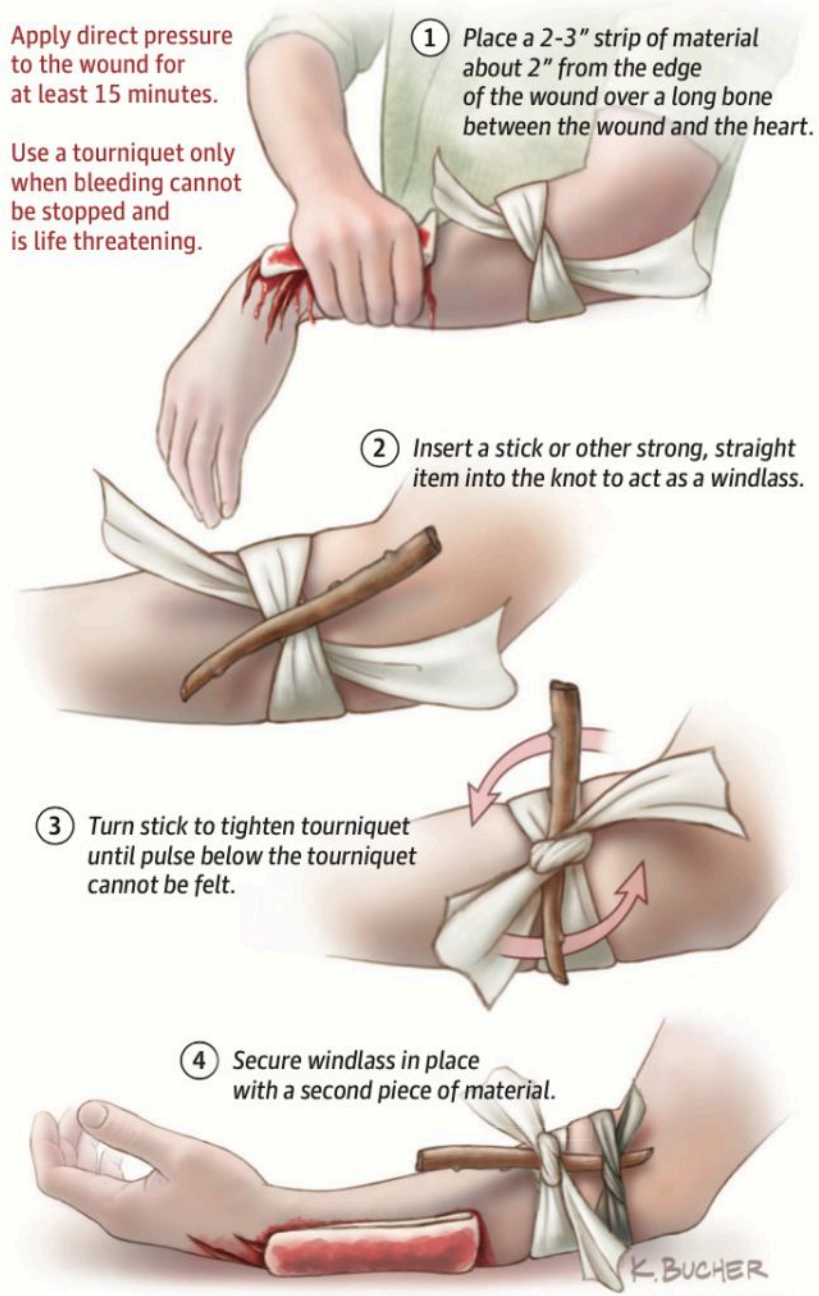
Once bleeding is controlled

- Mark the time on the arm or leg
- Keep the tourniquet visible
- Check the arm or leg every 2 hours for
  - Swelling
  - New bleeding
  - Increased muscle stiffness

Do not remove or loosen the tourniquet until professional care is available.

Galante JM. Using Tourniquets to Stop Bleeding. JAMA. 2017;317(14):1490-1490. doi:10.1001/jama.2015.8581

Applying a tourniquet with a windlass device



Keep tourniquet visible and monitor wound for bleeding.
Note time and watch for swelling below tourniquet.

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Open chest wounds

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

- Leave an open chest wound exposed so that it can freely communicate with the external environment.
- Do not apply a dressing or cover the wound.
- If necessary, control localised bleeding with direct pressure.
- If you are trained and the equipment is available, apply a specialised non occlusive or vented dressing, ensuring free outflow of air during expiration.
- Observe the wound for airflow obstruction caused by bleeding or clotted blood.

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FIRST AID
Chest Wound

Cervical spinal motion restriction

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

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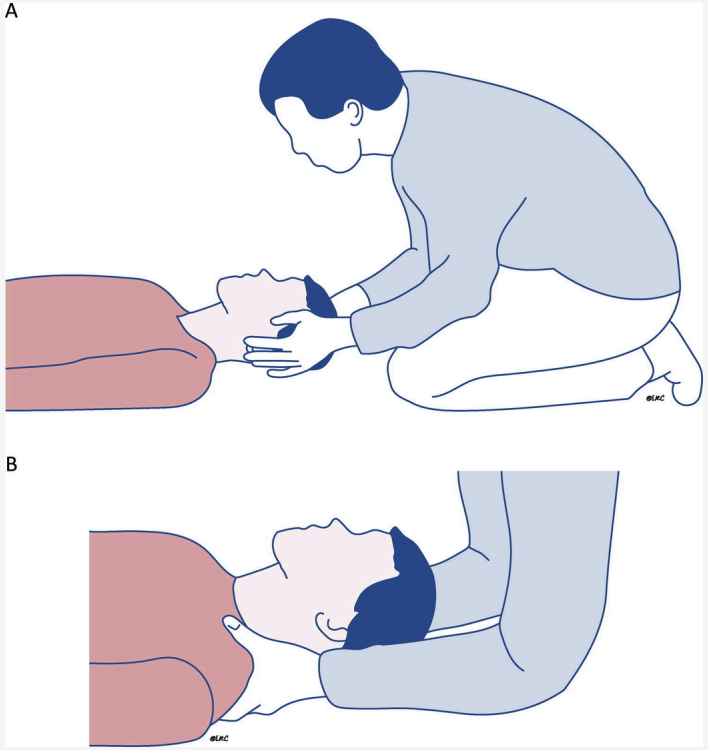
- Suspect a cervical spine injury in a person who has fallen or dived from a height, has been crushed by machinery or a heavy object, or has been involved in a road traffic or sporting accident.
- Minimise neck movement if the person is awake and alert, and encourage self maintenance of the neck in a comfortable and stable position.
- Never force an uncooperative person into any position, as this may worsen an injury.
  In unresponsive persons lying on their back, kneel behind the head and immobilise the head and neck using a head or trapezius squeeze.
- Consider whether airway opening is required using the jaw thrust technique.
  If the person is unresponsive and lying face down, check whether the airway is open and maintain the neck in a stable position.
- If airway opening is required, ask others for assistance and carefully roll the person as a single unit onto their back, keeping the neck aligned with the body and as stable as possible. Then apply the head or trapezius squeeze.
- First aid responders with specialised training, such as ski patrol or lifeguards, may consider selective use of spinal motion restriction according to their established protocols.



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Center for Prehospital Care

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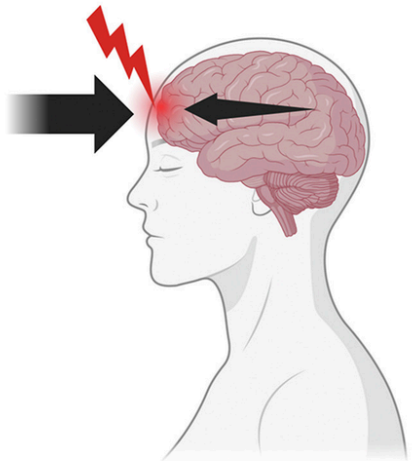
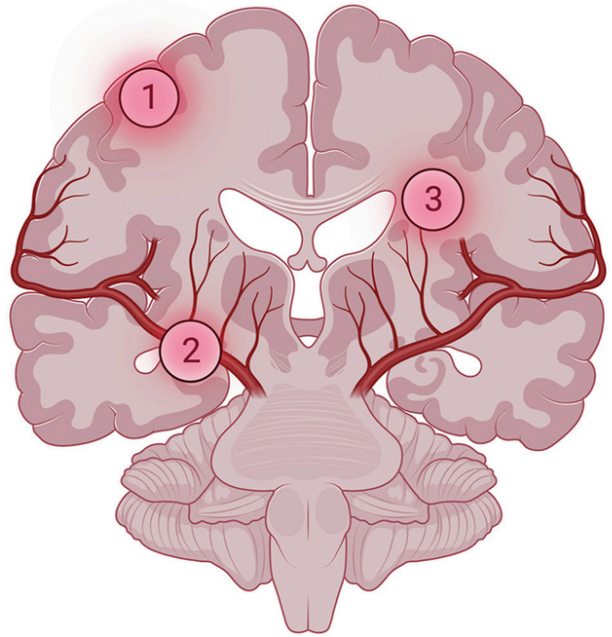
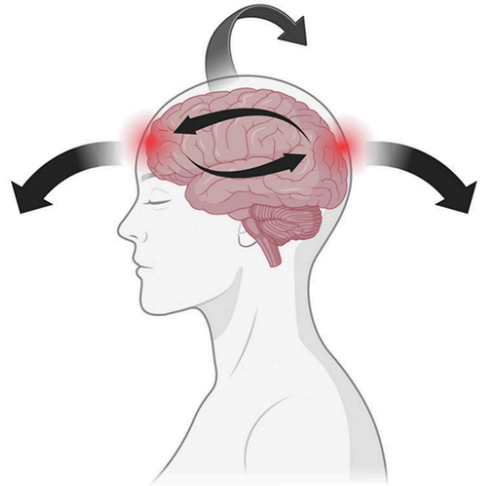
Spinal Motion Restriction


YouTube

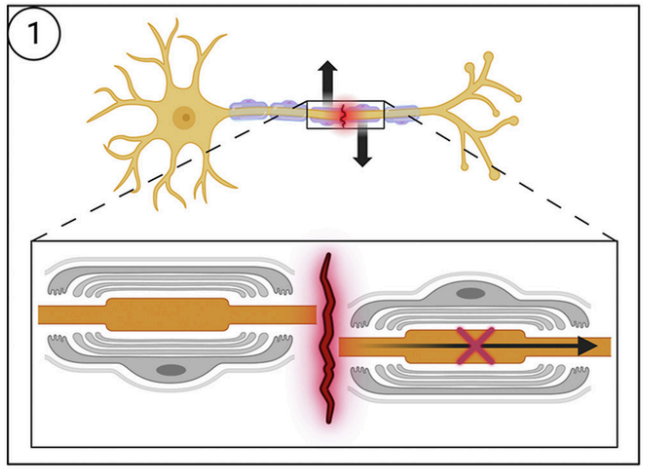


Direct Impact Loading

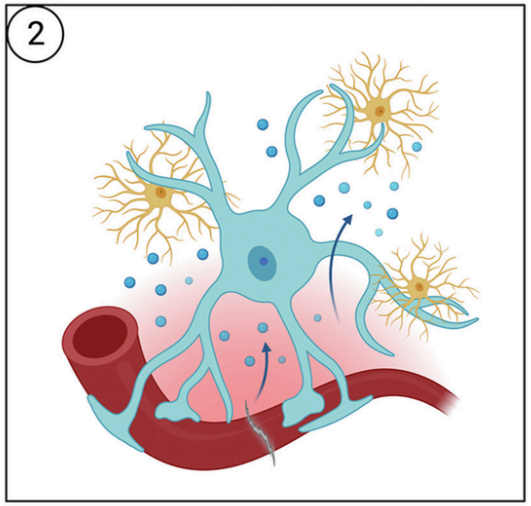




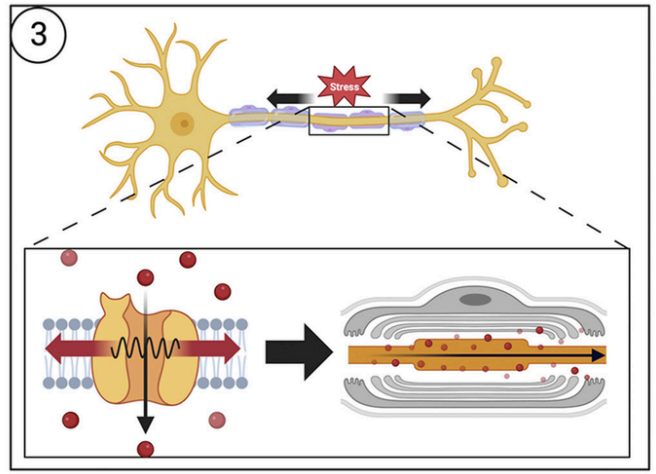
Rotational/Angular Inertia



Gray-White Matter Junction
Shearing Forces - Differences in stiffness leading to diffuse axonal injury



Cerebrovasculature
Shearing & Tensile Forces - Leads to BBB damage & neuroinflammation

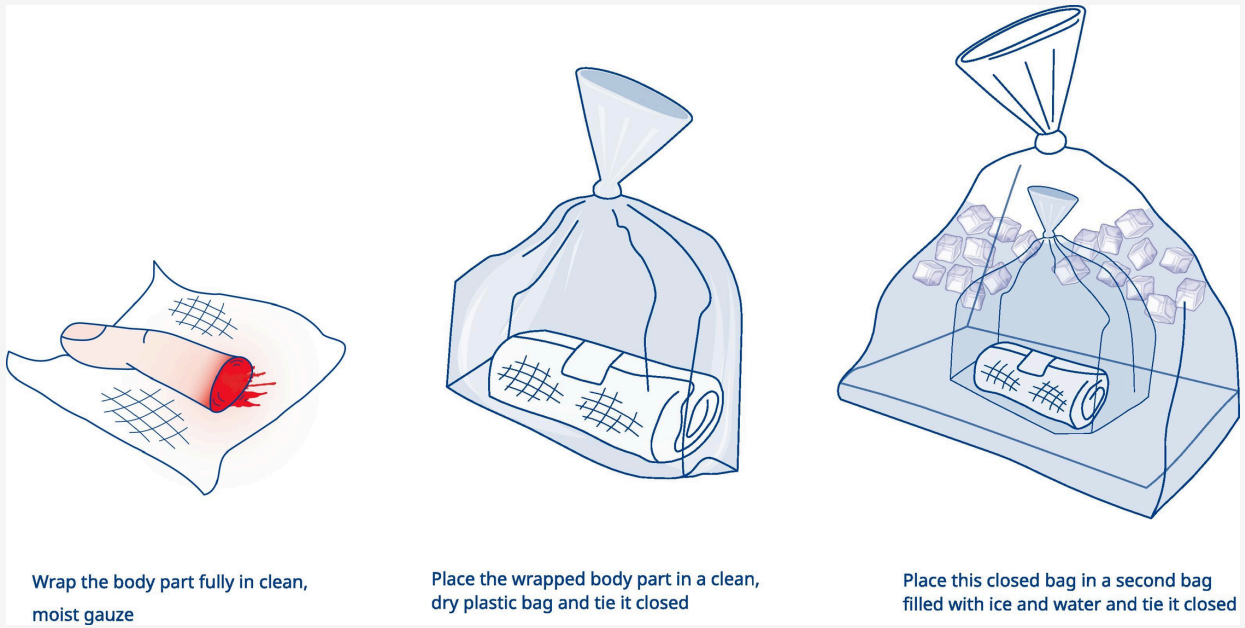


White Matter Axonal Tracts
Tensile Forces - Mechanotransduction leading to aberrant signaling & excitotoxicity

Orr TJ, Lesha E, Kramer AH, et al. Traumatic brain injury: a comprehensive review of biomechanics and molecular pathophysiology. *World Neurosurg*. 2024;185:74-88. doi:10.1016/j.wneu.2024.01.084

Preservation of an amputated body part

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752



- Manage any severe bleeding first, according to guidance for control of life threatening bleeding.
- Retrieve the amputated body part as quickly as possible and keep it cold without freezing.
  Wrap the part in a sterile dressing or a clean cloth moistened with saline or water.
- Place the wrapped part in a clean, watertight plastic bag or container.
  Put this bag or container inside another bag containing ice or ice water.
  If ice is unavailable, keep the part cooled using the coldest means available, while avoiding freezing.
- Avoid direct contact between the body part and ice.
- Label the container with the person's name and the time the part was stored.
- Transport the body part with the injured person to the same hospital as quickly as possible.

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Concussion

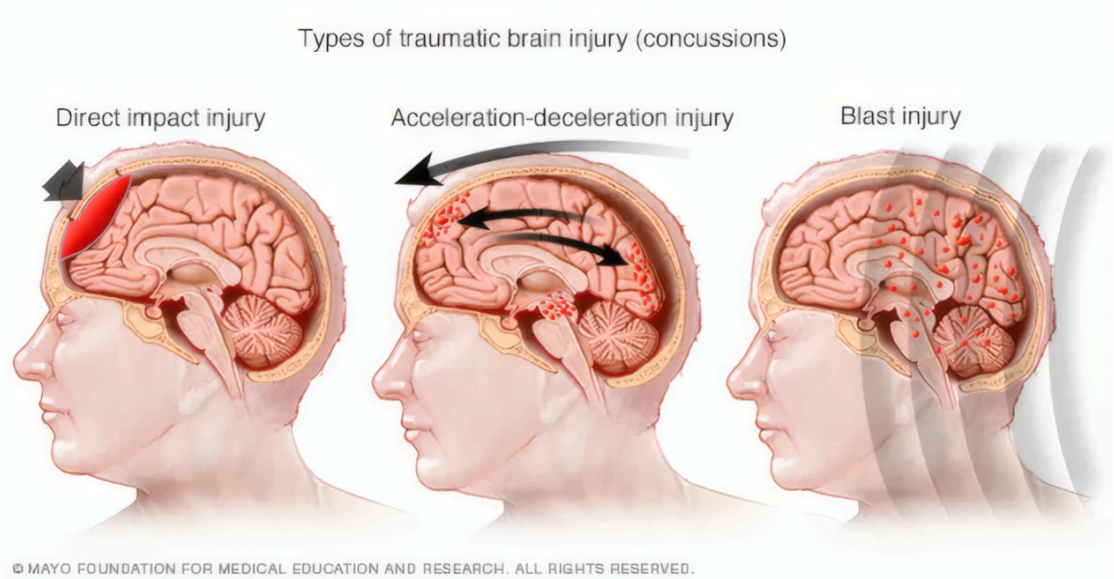
Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

Suspect a concussion if a person has difficulty with thinking or memory, shows physical symptoms such as

- headache,
- visual disturbance,
- dizziness,
- nausea or vomiting,
- seizures, or sensitivity to light or noise,
- or has emotional or behavioural changes including increased sleepiness,
- reduced participation in usual activities,
- loss of responsiveness,
- or confusion.

Remove the person from physical activity.

Refer the person to a healthcare professional for assessment and further advice.



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Hypoglycaemia

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

- Suspect hypoglycaemia in a person with diabetes or chronic malnutrition who develops sudden impaired responsiveness or behavioural change.
- Give glucose or dextrose tablets, 15 to 20 g, by mouth if the person is awake and able to swallow.
  If feasible, measure capillary blood sugar using a blood glucose meter and treat if low, defined as a value below 4.0 mmol/L or 70 mg/dL.
- Repeat the measurement after treatment.
  If glucose or dextrose tablets are not available, give other dietary sugars such as a handful of sugary sweets or 50 to 100 ml of fruit juice or sugar containing soda.
- If oral glucose is not available, give a glucose gel, partially held in the cheek and partially swallowed.
- Repeat oral glucose administration if symptoms persist and do not improve after 15 minutes.

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Hypoglycaemia

Djärv T, Rogers J, Semeraro F, et al. European resuscitation council guidelines 2025 first aid. Resuscitation. 2025;215:110752. doi:10.1016/j.resuscitation.2025.110752

EUROPEAN RESUSCITATION COUNCIL

- If the person has a prescribed glucagon autoinjector, administer it subcutaneously in the outer thigh. Administration may be self performed or done by trained individuals. Some people with diabetes may have glucagon preparations for nasal use.
- For children, consider administering half a teaspoon of table sugar, approximately 2.5 g, under the tongue if the child does not cooperate with swallowing oral glucose.
- Call the emergency number 112 if the person is or becomes unresponsive, or if the condition does not improve.
- After symptom recovery, usually 5 to 10 minutes after sugar intake, encourage the person to eat a light snack.
- For unresponsive persons, do not give oral sugar because of aspiration risk. Call the emergency number 112.

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EPILEPSY FOUNDATION
END EPILEPSY® TOGETHER

1

STAY with the person until they are awake and alert after the seizure.

- ✓ **Time** the seizure
- ✓ Remain **calm**
- ✓ Check for **medical ID**

2

Keep the person **SAFE**.

- ✓ Move or guide away from **harm**

3

Turn the person onto their **SIDE** if they are not awake and aware.

- ✓ Keep **airway clear**
- ✓ **Loosen tight clothes** around neck
- ✓ Put **something small and soft** under the head

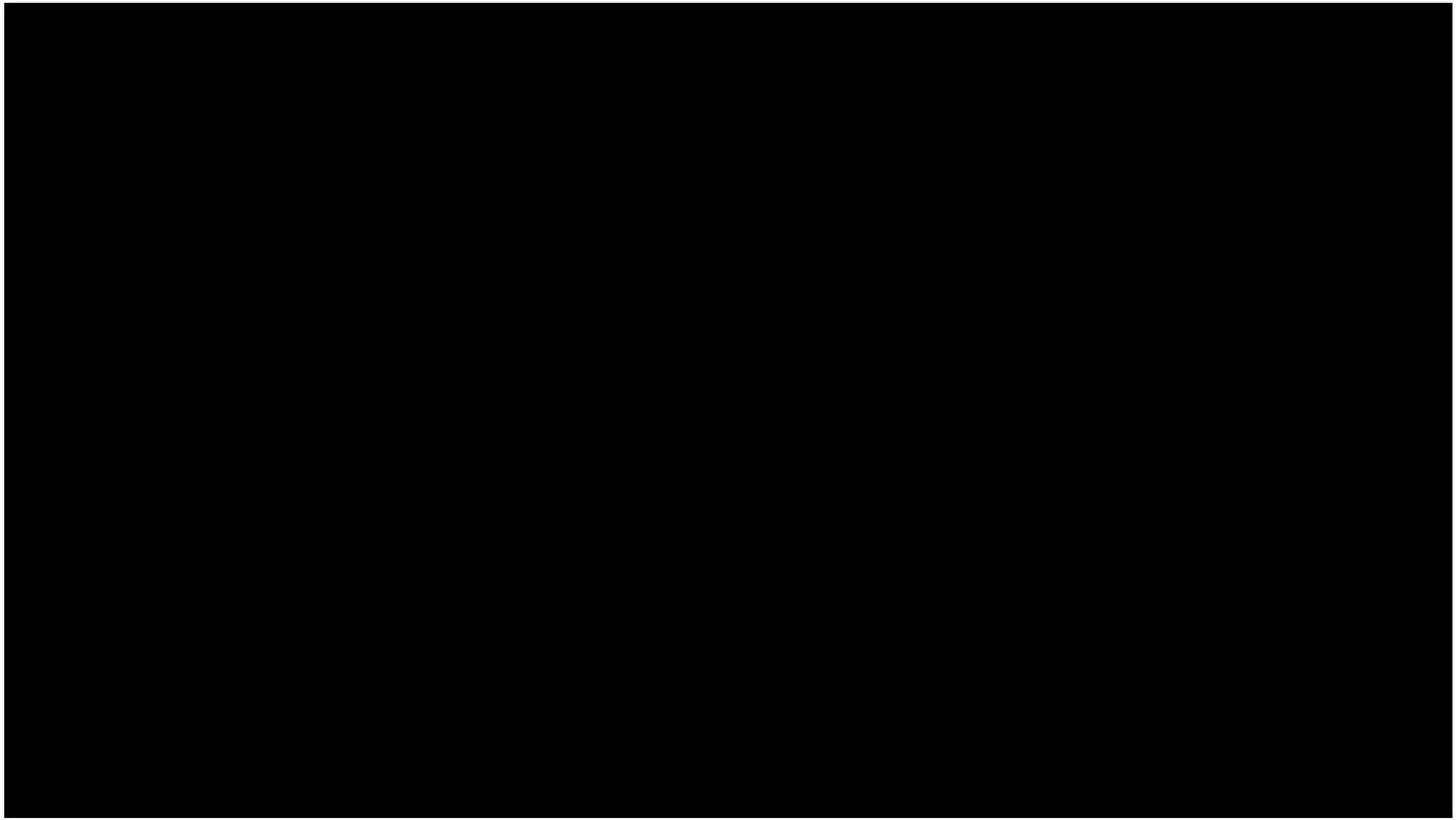
Call 911 if...

- Seizure lasts longer than 5 minutes
- Person does not return to their usual state
- Person is injured, pregnant, or sick
- Repeated seizures
- First time seizure
- Difficulty breathing
- Seizure occurs in water

Do NOT

- ✕ Do **NOT** restrain.
- ✕ Do **NOT** put any objects in their mouth.
- **Rescue medicines can be given** if prescribed by a health care professional

https://www.epilepsy.com/living-epilepsy/seizure-first-aid-and-safety/first-aid-seizures-stay-safe-side



https://www.youtube.com/watch?v=JbRYXnQiSRo

F.8 Button battery ingestion

Any child who has ingested or is suspected of ingesting a button battery is a **time critical emergency**. Ingestion of button batteries can kill even if the child is asymptomatic. It is also important to suspect button battery ingestion in any presumed 'coin' or other foreign body ingestion.

Button battery ingestion affects all age groups, although most cases involve children under the age of 6 years who mistake the battery for a sweet, or older people with confusion or poor vision who mistake the battery for a pill. Older children, young people and adults may ingest batteries as a means of self-harming (Box F.1). There may be no history of foreign body ingestion (20–40% patients).

Box F.1 Safeguarding and mental health

- For all children of any age it is important to investigate circumstances around the ingestion of a button battery
- Any potentially vulnerable children or young people must be referred to the local safeguarding team
- Consider the possibility of attempted suicide in the older child or adolescent who will need a full CAMHS (Child and Adolescent Mental Health Services) assessment in addition to medical management

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

Children at greatest risk are:

- Those younger than 6 years of age
- Ingested battery over 20 mm diameter, which is more likely to become lodged in the oesophagus, and have been found to be responsible for more fatal or serious ingestions (Litovitz et al., 2010)
- Multiple batteries ingested or co-ingestion with strong magnets

Consider the possibility of battery ingestion in those with:

- Acute airway obstruction (stridor), drooling, wheezing or other noisy breathing
- Vomiting, abdominal pain or diarrhoea
- Chest pain or discomfort
- Difficulty swallowing
- Decreased appetite or refusal to eat, or coughing, choking or gagging with eating or drinking

In severe cases, there may be severe abdominal pain, bloody stools, irritability, fever and haemorrhage with subsequent stricture or fistula formation, even after removal of the battery.

Early use of a metal detector may help to confirm the presence of an ingested button battery.

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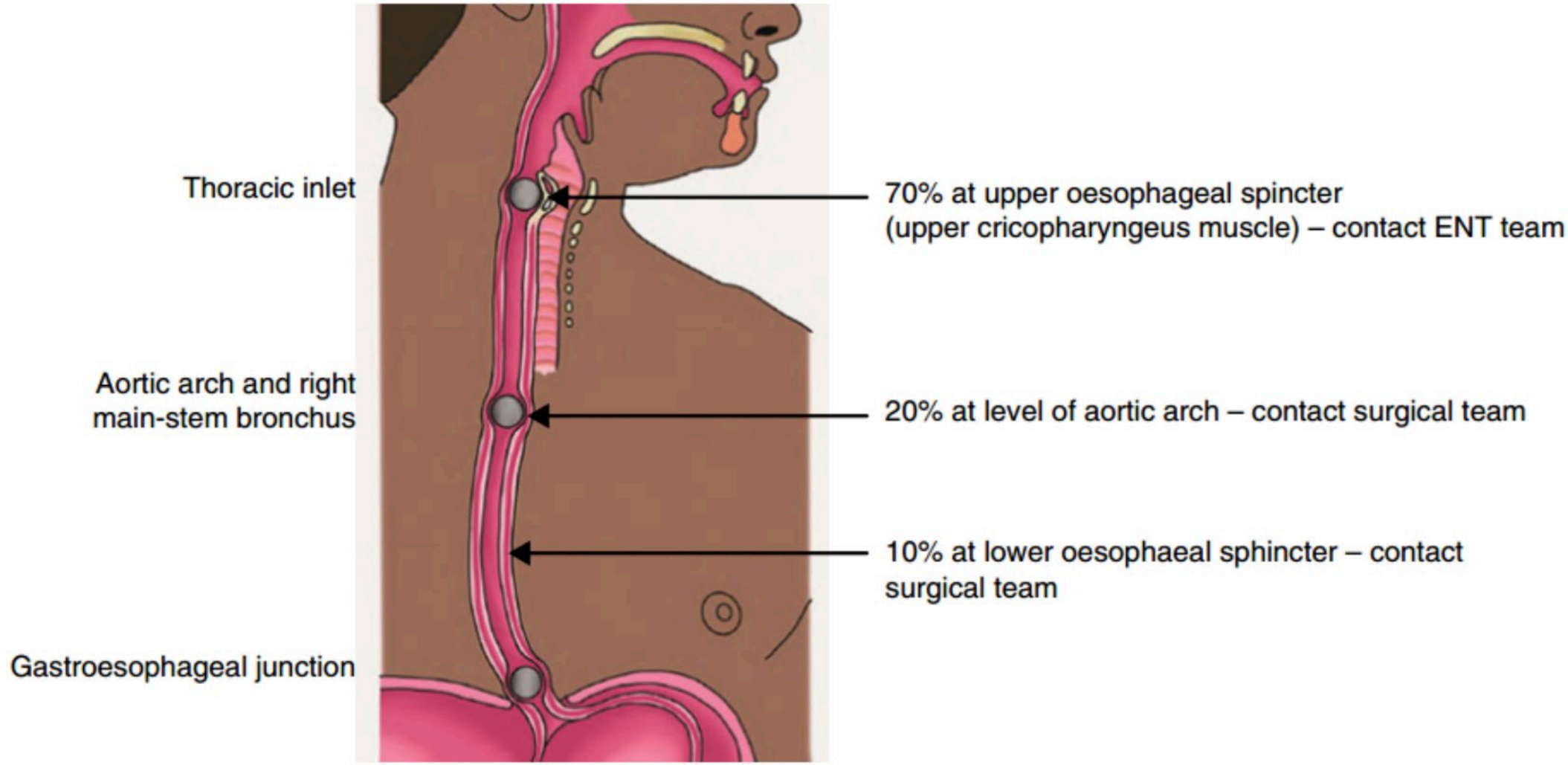
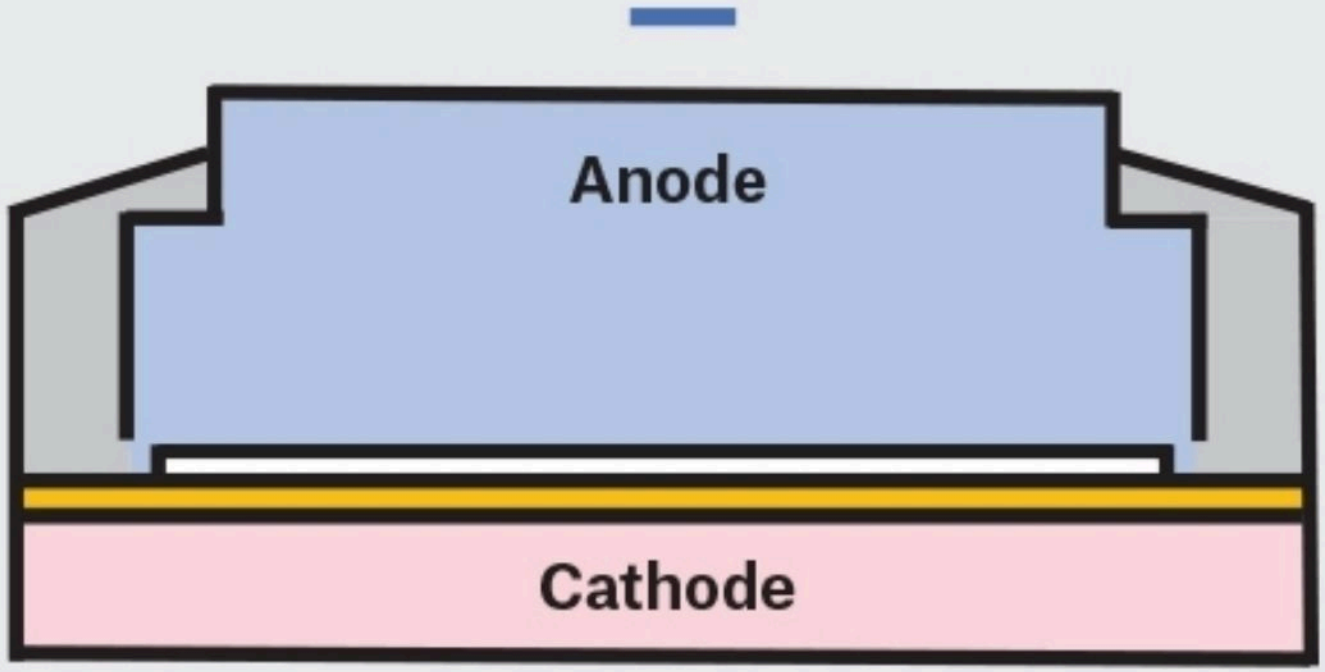


Figure F.3 The most common sites for button batteries to become lodged in children and young people

Smith S, Advanced Life Support Group (Manchester, England), editors. Advanced paediatric life support: a practical approach to emergencies. Seventh edition. Hoboken, NJ: Wiley-Blackwell; 2023.

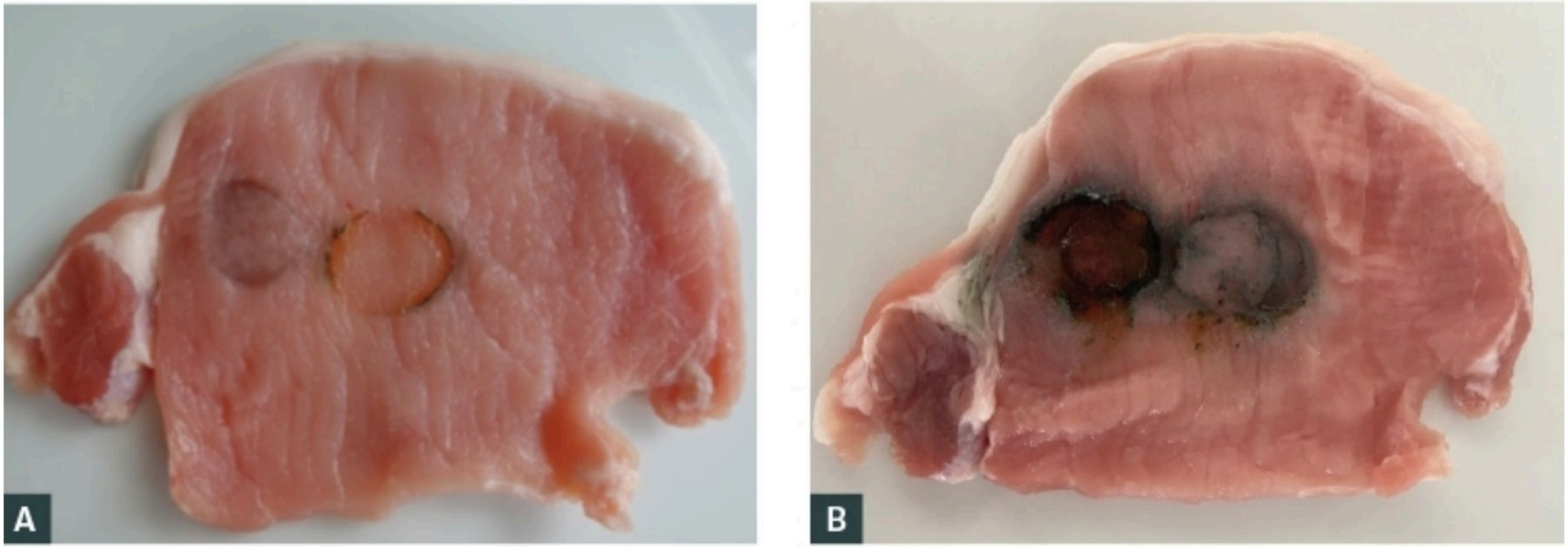
$$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$$

$$Na + OH^- \rightarrow NaOH \rightarrow \text{Liquefactive necrosis}$$



$$2Cl^- \rightarrow Cl_2 + 2e^-$$

Park S-J, Burns H. Button battery injury: An update. Aust J Gen Pract 2022;51:471–5. https://doi.org/10.31128/AJGP-03-21-5873.



Park S-J, Burns H. Button battery injury: An update. Aust J Gen Pract 2022;51:471–5. https://doi.org/10.31128/AJGP-03-21-5873.

Animal studies have been helpful in understanding the pathophysiology of BBI-caused injury[10] to be caustic rather than thermal. When a BB becomes entrapped in the digestive tract, mucosa bridges the positive and negative terminals of the battery, thus completing a circuit and allowing current to flow. Electrical current from the battery results in generation of hydroxide radicals in the esophageal tissue. The presence of hydroxide radicals rapidly raises the pH of the tissue leading to caustic injury and associated coagulative necrosis. Depending on the site of battery impaction, necrosis weakens the esophageal wall over a short period of time and may extend through to adjacent tissue, such as the trachea or great vessels. The process of coagulative necrosis has been demonstrated to start within 15 minutes of contact.[10] Even with batteries that have been ingested after use (and presumably without significant residual capacitance), significant injury may still be possible.[6] This reality provides further evidence of the power of the newer lithium cells, which have a much longer storage life than traditional alkaline cells.

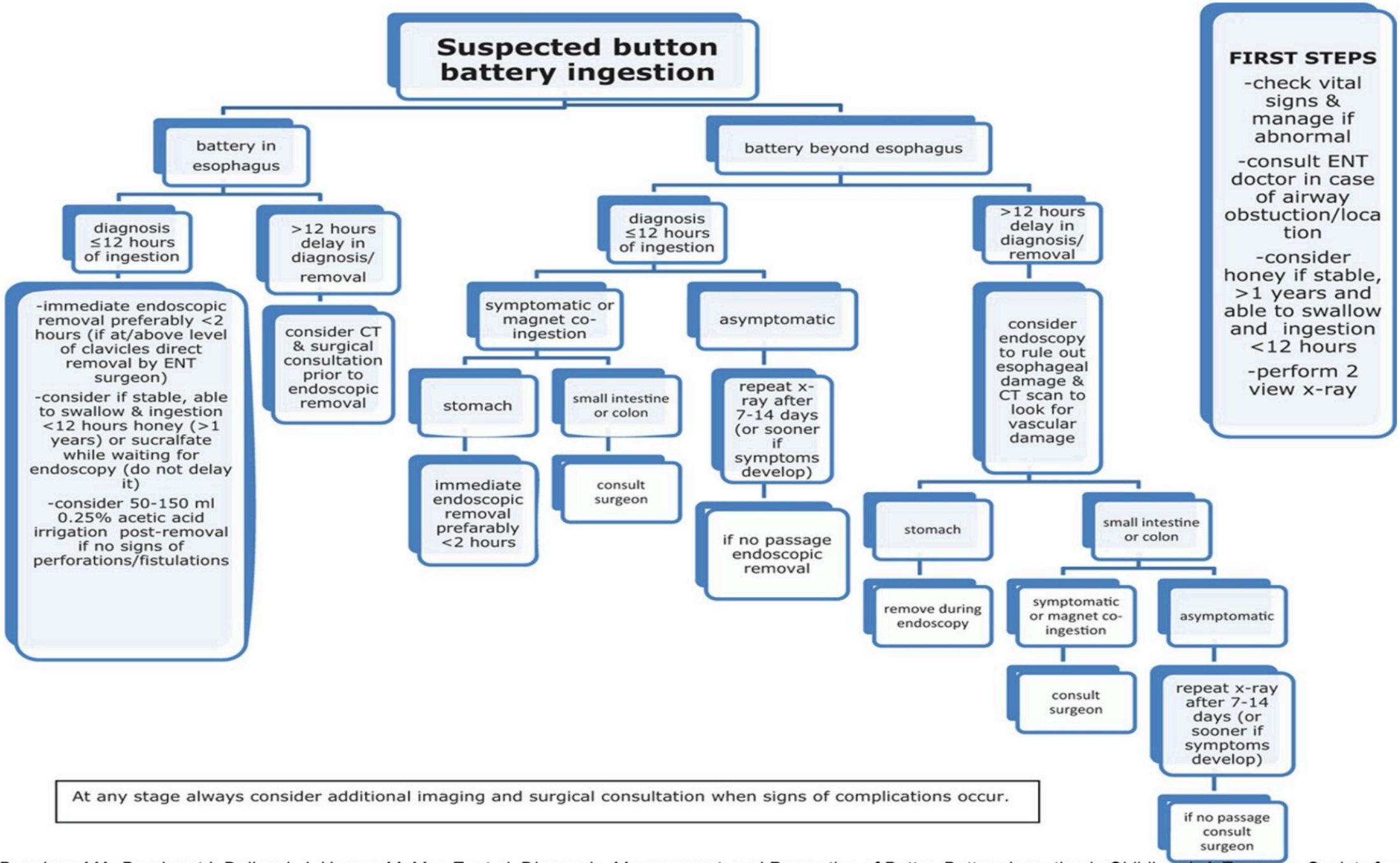
Leinwand K, Brumbaugh DE, Kramer RE. Button Battery Ingestion in Children. Gastrointest Endosc Clin N Am 2016;26:99–118. https://doi.org/10.1016/j.giec.2015.08.003.

Khalaf RT, Ruan W, Orkin S, Wilsey M, Fishman DS, Mallon D, et al. Gastric injury secondary to button battery ingestions: a retrospective multicenter review. Gastrointestinal Endoscopy 2020;92:276–83. https://doi.org/10.1016/j.gie.2020.04.037.

TABLE 1. Button battery complications

Respiratory tract
Nasal septal perforation
Intranasal synechiae
Tympanic membrane perforation
Facial nerve paralysis
Recurrent laryngeal nerve injury
Thyroid hemorrhage
Tracheo-esophageal fistula
Battery aspiration
Pulmonary hemorrhage
Bronchial stenosis
Pneumonia
Gastrointestinal tract
Esophageal perforation
Esophageal stenosis
Stomach perforation
Small intestine perforation
Other
Aortoesophageal or other major arterial branch fistula
Massive hemorrhage
Mediastinitis
Spondylodiscitis
Periorbital cellulitis

Mubarak A, Benninga MA, Broekaert I, Dolinsek J, Homan M, Mas E, et al. Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood: A European Society for Paediatric Gastroenterology Hepatology and Nutrition Position Paper. J Pediatr Gastroenterol Nutr 2021;73:129–36. https://doi.org/10.1097/MPG.0000000000003048.



Mubarak A, Benninga MA, Broekaert I, Dolinsek J, Homan M, Mas E, et al. Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood: A European Society for Paediatric Gastroenterology Hepatology and Nutrition Position Paper. J Pediatr Gastroenterol Nutr 2021;73:129–36. https://doi.org/10.1097/MPG.0000000000003048.

On the basis of the available data, the ESPGHAN task force for BB ingestions concludes that:

1. Presence of a BB in the esophagus is considered to be a medical emergency and endoscopic removal is necessary as soon as possible (<2 hours).
2. Mitigation strategies with honey and sucralfate can be considered in specific cases while waiting for endoscopy, but should not delay it.
3. Imaging (CT scan) is important to uncover vascular injury and should be performed in case of delayed (>12 hours after ingestion) diagnosis/removal (before removal) or if severe mucosal damage is seen during endoscopy.
4. Removal of gastric BB is necessary in symptomatic cases, in case of co-ingestion with a magnet or in delayed diagnosis.

Mubarak A, Benninga MA, Broekaert I, Dolinsek J, Homan M, Mas E, et al. Diagnosis, Management, and Prevention of Button Battery Ingestion in Childhood: A European Society for Paediatric Gastroenterology Hepatology and Nutrition Position Paper. J Pediatr Gastroenterol Nutr 2021;73:129–36. https://doi.org/10.1097/MPG.0000000000003048.