



# BTACC

## Basic Trauma & Casualty Care



**D13 &  
D13E & IEC  
Standard**

**Level 1 & 2  
ATACC  
Integrated  
Trauma Package**

**2<sup>nd</sup> Edition 2012**



# **‘BTACC’**

## ***Basic Trauma and Casualty Care***

**Faculty of Anaesthesia, Trauma and Critical Care  
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## **Table of Contents:**

### ***Part 1: Core material***

*Chapter 1 - What is BTACC?*

*Chapter 2 - M - Massive External Haemorrhage*

*Chapter 3 - A - Airway Management*

*Chapter 4 - R - Respiratory*

*Chapter 5 - C - Circulation*

*Chapter 6 - H - Head and other injuries*

*Chapter 7 - Life Support and Automated Defibrillation*

### ***Part 2: BTACC Special Modules***

*Chapter 8 - Special Circumstances*

- *Crush injury*
- *Suspension Trauma*
- *Drowning*
- *Diving accidents & tunnel workers*
- *Major incident and Triage*
- *Pain Management*

*Chapter 9 - Special Casualties:*

- *Pregnancy*
- *Children*

*Chapter 10 - Medical Conditions*

*Appendix A: Patient Report Form*

*Appendix B: BTACC Algorithm*

*Appendix C: BTACC trauma kit*





## The BTACC Course

### Introduction – FAW, IEC or D13?

***‘BTACC offers a highly focused and well researched emergency care course for individuals that may potentially face casualties with life threatening conditions.***

***The course has been developed as the introductory level of the three part ‘ATACC Integrated Trauma Package’ and has been written by specialists in the field of pre-hospital and critical care medicine. The ATACC course has been running for well over 10 years and is internationally renowned.***

***The BTACC course extends far beyond First Aid at Work and provides the students with the skills necessary to save life in difficult situations, environments or until additional support arrives.***

***BTACC was one of the first courses in the UK to meet the new Immediate Emergency Care (IEC) standards produced by the Chief Fire Officer Association (CFOA) and the Assistant Chief Police Officers (ACPO) working with the Faculty of Pre-hospital Care, Royal College of Surgeons Edinburgh. The NPIA has now modified this standard and produced the D13 standard which BTACC comfortably exceeds. (RTACC is the level of D13 enhanced).***

***BTACC is not a simple ‘first aid’ course but it adopts tried and tested casualty care methods used by the UK Military, Special Forces, Emergency Services, Tactical Firearms teams, Mountain Rescue, Lowland Search and Rescue, the RNLI and many others. The skills and information in the course works and will save lives if performed well. ‘***

***Dr Mark Forrest, ATACC Medical Director***

### Prerequisites

Students taking this BTACC course are advised to have previously completed a basic life support (BLS) or FAW course but this is not essential as all of the key elements will be included if the full course is completed.

### Timeline

The following course timeline presents a suggested schedule for the topics covered in a typical BTACC course. The BTACC Trauma Module is 8 hours and the Life support and AED is 4 hours making a total of 12 hours. Some individuals and organisations will require additional training as a foundation to BTACC or as an extension of the course eg Oxygen administration, pulse oximetry and Bag Valve mask - 4 hours, Entonox use and safety – 60 minutes, Medical Emergency Care – 60 minutes.

The Consolidation scenarios can follow directly after the standard course or at a later date, within 6 months.

Based on the specific needs of the students and scheduling considerations, instructors should include time for breaks, meals, and tea, as appropriate. As such this timeline simply provides a guide.

### The course timetable:

15 minutes	Introduction: What is BTACC & the BTACC Algorithm?
35 minutes	Kinematics and Safe Approach
15 minutes	<b>Massive External Haemorrhage Control</b>
30 minutes	<i>Moulage 1: M - Stabbing or shooting scenario</i>
15 minutes	<b>Coffee break</b>
30 minutes	<b>Airway Management</b>
30 minutes	<i>Airway skills: BVM and NP/OP</i>
15 minutes	Cervical spine
30 minutes	<i>Moulage 2: MA -Pedestrian road traffic collision or fall from height scenario</i>
30 minutes	<b>Lunch break</b>
30 minutes	<b>Respiratory Management</b>
30 minutes	<i>Moulage 3: MAR -Penetrating chest wound and unrestrained driver scenario</i>
30 minutes	<b>Circulatory Management</b>
30 minutes	<i>Optional Moulage 4: MARC- Fall from a height scenario</i>
30 minutes	<b>Head Trauma and Other Serious Injuries</b>
60 minutes	<i>Final Moulage 5: MARCH- Pedestrian RTC or other polytrauma</i> <i>Final Moulage 6: Car driver in RTC or other polytrauma</i> <i>Optional 3<sup>rd</sup> Final Moulage – team specific</i>
<b>Total Time:</b>	<b>BTACC Trauma module: 8 hours</b>

***Additional optional BTACC modules:***

**Optional:** ***Life Support and AED module***

2 hours Intermediate Life Support and AED lectures

1 hour BVM refresher  
Use of AED

1 hour Life support exercises (can be just 30 minutes with single exercise)

**Total Time:** **4 hours**

**Total Time: Complete BTACC Course: minimum 12 hours**

**Optional: Medical Emergencies**

60 minutes (Optional Component for Co-responder/Field Medic Training)

**Optional: Entonox module**

60 minutes

**Optional: Oxygen administration, pulse oximeter**

2 hours **Use of Bag Valve Mask Resuscitator**

Optional: Scenario based BTACC consolidation or refresher training

4 hours *Moulage: Applying the complete MARCH and life support algorithms to multiple scenarios relevant to the group*

**Total programme time with all options: 20 hours**

## **EFAW:**

On completion of the BTACC course, as all of the elements of Emergency First Aid at Work are included, if required the course provider can offer an EFAW certificate. This is part of the NPIA D13 standard for Firearms Officers. If a Full FAW certificate is required then an extended BTACC or RTACC course will cover the necessary elements for a full Certificate.

## **Course Consolidation**

After the key topics have been presented, instructors should include approximately 4 to 8 hours of 'consolidation scenarios' based on the typical situations that providers may encounter in their field of operation. (These are included in the RTACC course)

The scenarios will reinforce the knowledge students have acquired in the lectures, skill stations and moulages. They will also allow individual groups and agencies to focus the training appropriately for their organisation.

The consolidation scenarios may be a full- or half-day course will usually takes place within 6-12 months of the main course and can be included as part of an ongoing refresher programme

## **Refresher Training**

Scenario based training as described above, must be provided every 12 months to remain BTACC qualified. This can be incorporated in regular operational training with a focus on trauma care at some point during the session. Alternatively, a dedicated half day refresher training session can be run once a year (4 hours).

Any unit or group providing specialist care or care in difficult or extreme environments needs to carefully focus their refresher training to ensure that a high standard of care is maintained in such situations. Class room based sessions are of little value in terms of clinical management, especially in such situations and they should be limited to skills refreshers.

A new alternative to annual re-certification is to establish an ongoing record to demonstrate competency. Basically, this means that whenever a skill is performed effectively either in training or operationally, under the direct supervision of an instructor, then this is logged as a 'demonstration of competence'. A structured framework needs to exist to ensure that in any given year each individual will get a chance to demonstrate their BTACC skills. If they also demonstrate them earlier during operations then all the better.

Similarly, regular familiarisation with the casualty care kit is an essential part of being prepared to provide a high standard of care in stressful and difficult circumstances. As such the standard BTACC casualty care kit should be opened and used frequently during training.

**If refresher training is completed according to this schedule then a full course is only required every 3 years.**

## Chapter 1:

### What is BTACC?



#### Introduction

Basic trauma and casualty care (BTACC) is designed to introduce participants to the concepts of assessment and care of the seriously injured. *Anyone who has successfully completed a BTACC course will have the knowledge and ability to make a life-saving difference.*

Our courses have been produced by the Anaesthetic Trauma and Critical Care (ATACC) Faculty and approved by numerous bodies including the Association of Fire, Rescue, and Law Enforcement Medical Advisers (AFRLEMA) and the Royal College of Anaesthetists, London. Depending on the needs of each organisation, this course may be integrated with more advanced levels of training (e.g., rescue or anaesthesia trauma and critical care).

BTACC training has been developed to allow easy and rapid identification of casualties who are considered “time critical” (those requiring immediate life-saving actions) and those who are stable enough to simply monitor, delaying further care until medical assistance arrives. BTACC explains how to approach a casualty safely and to use the science of kinematics to identify the type and severity of any injuries. BTACC provides a systematic method of recognising and managing time critical injuries such as massive haemorrhaging, obstructed airway, chest trauma, or other serious injuries.

**Carefully applying the methods outlined in this text—in a focused and deliberate fashion could mean the difference between life and death.**

The secret of BTACC is its simplicity. It does not complicate the training with unnecessary, technical aspects and detailed anatomy or physiology. Simple techniques such as haemorrhage control or airway manoeuvres can prevent many fatalities. Advanced interventions (such as IV drips and endotracheal intubation)



have not been proven to reduce mortality significantly compared to simple measures performed well, as in BTACC.

## Clinical Governance

All trauma care should be supported by an appropriate governance structure. A governance system protects both the casualties and the provider by ensuring that standards of training, care, and follow-up are in place. All emergency services should have a credible medical director or adviser, who is supported by a governance group consisting of trauma instructors, a member of the management team, and local medical and ambulance representatives.

Clinical governance has existed in healthcare systems for many years, but it is now appropriate that any organisation that delivers trauma or casualty care has such a system in place. Initial training is not enough; skills must be monitored and audited on a day-to-day basis. Casualty details and any therapies or interventions must be recorded on a patient report form (see Appendix A). Please note that the administration of oxygen, which is now classed as a drug, must also be approved by a suitable Medical Director or advisor.

## Kinematics

BTACC uses the study of kinematics to guide the process of scene and injury assessment. **Kinematics** is the science of how matter moves and interacts in collisions. It is, essentially, the study of the mechanism of injury. By taking a step back, responders can look at the scene and assess what has happened and what injuries may be present.

Kinematics teaches responders to consider three aspects of the injury:

1. Energy transfer (the amount of energy involved)
2. Point of impact (on the casualty's body)
3. Nature of the insult (e.g. stabbing, fall from height)

Even if the casualty appears uninjured, kinematics may lead a responder to identify a serious injury.

## Energy Transfer

A moving object possesses *kinetic energy*, which directly relates to the weight (mass) and the speed (velocity) of an object. Kinetic energy, measured in units known as joules, can be determined using the equation:

$$\text{Kinetic energy} = \text{mass}/2 \times \text{velocity}^2 \quad \text{or} \quad \text{KE} = \frac{\text{M} \times \text{V}^2}{2}$$

Velocity (which is squared in the equation) is the greatest factor in determining energy. For example, an average sized 80 kg person travelling at 30 mph would produce an impact of 36,000 joules. The same person travelling at 60 mph would produce on impact of 144,000 joules. A person weighing only 40 kg travelling at 60 mph would produce only 72,000 joules. When a moving object impacts another object, the energy of the moving object is transferred to the secondary object. This **energy transfer** is what causes injuries.

For example, if a car hits a fence, the car is designed to dissipate this energy and divert it away from passengers; however, if passengers are not properly restrained, they may be thrown forward until they hit something, such as the dashboard, windscreen, or an external object (**Figure 1-1**). Inside the body, the internal organs are also thrust forward until they hit the body wall. Any loose objects in the car can then move towards the casualty, causing further injury. The transfer of energy from these impacts can cause damage to the car, the driver, and the passengers. BTACC teaches providers to examine the kinematics—the damage to the car and the fence and the rate of deceleration—to determine the extent of energy transfer involved.



**Figure 1-1 Consider the amount of energy transfer to suggest the nature and extent of injuries**

### **Point of Impact**

The point of impact is an important consideration in determining the presence and extent of injury. If energy is transferred over a large area of the body, the energy is dispersed resulting in a potentially less severe injury than if the same energy impacts over a small area of the body.

An simple example of this effect is to consider a woman walking on the snow wearing wide snowshoes, her weight (energy) would be spread over a wider area, and she would not sink into the snow. However, if the same woman wore high-heeled shoes, she would penetrate the snow and sink in.

In terms of injury, if a casualty is punched with a fist the energy is spread over the hand and may cause bruising or fractures, however if the same energy is focused at the point of a knife in a stabbing then it will penetrate into the body and organs.

Another example to consider is an individual falling from height. If he lands flat on his back, the area or point of impact is greater and potentially less damaging than if he lands on a small area such as a railing or narrow object which focuses the energy into a smaller area.

### **Nature of the Insult**

By considering the energy transfer and distribution, a BTACC provider can identify potential injuries that would not otherwise be obvious. These considerations would lead a provider to examine a casualty in a motor vehicle collision for neck injury and one in a pedestrian collision for pelvic injury. Massive blood loss, severe pain, and other obvious injuries can distract the responder, but by considering the kinematics, providers can identify the potential for injuries that could easily be missed. In addition, even when these injuries are difficult or impossible to manage in the field, early identification can facilitate rapid extrication and transfer to definitive care. This urgency may be a life saving measure in itself.

# The BTACC Algorithm

The **BTACC algorithm** is a systematic pathway for the approach and management of any type of traumatic injury (see Figure 1-2). At each stage, as explained in the following chapters, the algorithm helps responders identify concerns, determine if the injury is potentially life-threatening (“time critical”), and determine appropriate treatment measures.

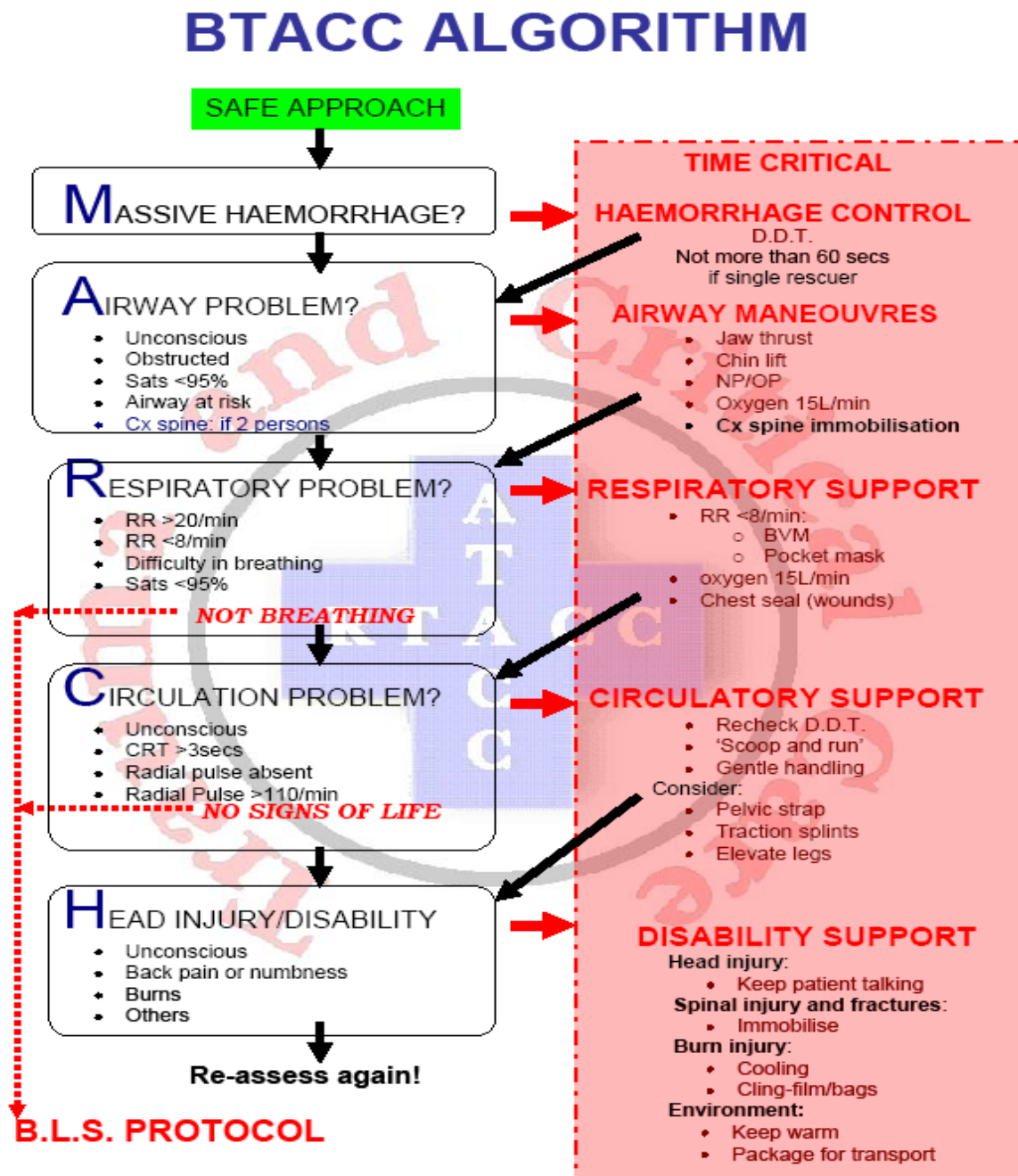


Fig 1-2: The BTACC algorithm



# The BTACC approach to trauma care:

## Safe Approach

The first step in the BTACC algorithm is a safe approach. In any area of trauma management or rescue, it is essential to avoid becoming a casualty yourself. This should be at the forefront of your mind as you arrive at the scene.

Ask yourself:

1. Do I fully understand the hazards in this environment?
2. Do I have adequate information and skills necessary for this situation?
3. Have the Emergency Services been alerted?
4. Have I considered all the medical implications?

The answers to all these questions must be “yes” before you begin caring for the casualty.

**Resisting the overwhelming urge to rush in to help a casualty in danger can be one of the most difficult tasks in casualty care, but establishing a safe approach must take priority.**

It is vitally important to understand the difference between a rescue and a recovery. A *rescue* involves a casualty who can be saved by your intervention and constitutes a true emergency, whereas a *recovery* involves a dead body and should never be considered an emergency. Nothing you do in these situations will reverse the misfortune of the victim. It is best to make sure that you do not add to the problem by placing yourself or others in jeopardy.

## Determining Hazards

As you approach the emergency scene, scan the entire area carefully to determine what hazards are present, such as:

- Traffic (and road traffic collisions)
- Electrical hazards including railways
- Working at height
- Fire
- Chemicals or hazardous materials
- Weapons or sharp objects
- Environmental conditions
- Animals

Always approach a scene cautiously and carefully, scanning for any possible hazards to reduce the potential for injury to yourself and other providers. Obey the advice of your senior officer or team leader if he or she has identified potential hazards at the scene, and always follow your training guidelines or standard operating procedures. In special situations (such as chemical plants, railways, or sewers) the safest option will usually be to wait for maintenance or specialised rescue personnel to ensure your safety.

Discrete hazards are less obvious but may be just as dangerous. Examples include shallow but swift running water, live electric cables, or an unknown powder on casualties. These could easily be missed without careful thought and consideration as you approach the scene and may result in potential injury to yourself.

**If you are in doubt about the safety of a scene, do not approach the casualty. Wait until help arrives and a safe approach has been established.**

## Personal Protective Equipment (PPE)

An important part of a safe approach is assessing the need for **personal protective equipment (PPE)**. This will vary depending upon the situation and your organisation. As an absolute minimum, disposable examination gloves should be worn before making direct contact with a casualty (see Figure 1-3). The need for additional PPE is specific to the situation; further information on appropriate PPE is provided by the Health and Safety Executive (HSE). The Department of Health has also developed guidelines for PPE in conjunction with the Health Protection Agency.

PPE may include:

- Helmet
- Safety specs or goggles
- Ear defenders
- Dust masks
- Breathing apparatus
- High-visibility clothing
- Chemical, waterproof, fire or ballistic protection
- Disposable overalls or aprons
- Gaiters or leggings
- Safety footwear

If you are unsure about the effectiveness of your PPE in a particular environment, seek advice about the proper protocol before proceeding.

**Heavy extrication or rigging gloves can become contaminated with dirt, grease, oil, glass, dust, and other agents. These types of gloves should not be used for direct casualty care.**

Additional PPE and precautions must be taken to protect casualties, rescuers, and bystanders from possible infectious diseases.

All providers should attempt to follow the World Health Organization's "Five Moments for Hand Hygiene" (see Figure 1-3) washing hands:

1. **Before patient contact**
2. **Before an aseptic task**
3. **After body fluid exposure risk**
4. **After patient contact**
5. **After contact with patient surroundings**

Your 5 moments for hand hygiene  
at the point of care\*



**Figure 1-3: WHO 'Five Moments for Hand Hygiene'**

Gloves must also be worn before contacting the casualty and should be disposed of properly in a biohazard bag if

they become contaminated due to contact with blood or other body fluids (see Figure 1-4).

**Figure 1-4: Biohazard waste disposal bag.**



## The 'M.A.R.C.H.' assessment

Traditional resuscitation and trauma courses often use the ABC approach—which stands for airway, breathing, and circulation—to aid the responder in identifying and managing life-threatening issues. BTACC adopts a modified approach which has two significant changes. First, BTACC focuses initially on the life-threatening issue of massive external haemorrhage before addressing ABC concerns. Secondly, BTACC includes an additional step in its algorithm to check for other serious injuries.

The BTACC approach to care can be remembered using the acronym **MARCH**, which stands for:

- **M**assive external haemorrhage control
- **A**irway management
- **R**espiratory management
- **C**irculatory management
- **H**ead trauma and other serious injuries

The MARCH approach includes all the same components as the classical ABC first aid approach (which stands for airway, breathing, and circulation). MARCH also shares the same principles as the updated, alternative cAcBCDE approach, which adds the concepts of catastrophic haemorrhage, cervical spine, disability, and exposure/examination. This mnemonic may be difficult to remember and confusing with three C's. While the principles remain the same, we believe that the MARCH algorithm is the simplest and easiest method to follow.

## The Time Critical Concept

At each stage of the BTACC algorithm, responders should carefully look for signs of any **time critical** injuries. These injuries are serious and potentially life-threatening, such as airway obstruction or falling level of consciousness. Time critical concerns must be addressed and managed as a matter of urgency. A casualty can be deemed time critical for more than one reason. For example, a casualty may have both a severe airway obstruction and a reduced conscious level or both massive external haemorrhage and a penetrating chest wound.

The time critical concept allows responders to not only identify life threatening injuries but to also establish the degree of urgency and, if necessary, indicate the speed of extrication required (see *Special Situations*, Chapter 7). Once a time critical problem has been identified, responders should immediately stop their assessment

to manage this problem. Responders should *not* move to the next stage of MARCH until the time critical problem has been managed effectively.

Once the problem has been addressed, the responder can move to the next step in the MARCH algorithm to look for other time critical concerns. All time critical concerns must be constantly reassessed and reported clearly when care is handed over to other providers (see Figure 1-6).

All relevant information about the casualty and any treatment provided should be given to medical staff who assume care of the casualty.

**After an incident, pass on all information to Emergency Services about any injuries and care provided. Also check yourself for injuries or contamination by bodily fluids.**

### **Handover**

Once paramedics or medical staff are present, responders should work to ensure a succinct and effective handover. They should convey essential information about the scene and the casualty and outline any interventions and any changes in the casualty's condition.

There are numerous ways to provide this information. The simplest may be to go through each stage of the BTACC algorithm and describe what has been found at each step. The patient report form (see Appendix A) may also serve as a useful guide in delivering this information in a systematic and logical manner.

### **Summary:**

- BTACC focuses on assessment and care of the seriously injured.
- The study of kinematics—the science of how matter moves and interacts in collisions—guides the process of scene and injury assessment.
- Kinematics focuses on three key aspects of injury: energy transfer, point of impact, and nature of the insult.
- The BTACC algorithm provides a systematic pathway for the assessment and management of trauma.
- At each stage in the algorithm, responders are asked to identify potential problems, determine the severity of injury, and provide appropriate care.
- The first step in the BTACC algorithm is a safe approach, scanning the scene for potential hazards.
- Personal protective equipment (PPE) varies depending upon the specific emergency and organisational guidelines.
- The acronym MARCH stands for: Massive external haemorrhage control, Airway management, Respiratory management, Circulatory management, and Head trauma and other serious injuries.
- Identifying time critical casualties, those who require immediate life-saving actions, is a central concept in the BTACC method.
- Responders should immediately stop assessment to address time critical problems and should not continue to the next step of MARCH until the concerns has been managed appropriately.

- Finally, the BTACC provider should give a clear and effective handover to ambulance or medical services.



## **Vital Vocabulary**

**BTACC algorithm** A flowchart which guides providers through the BTACC system of assessment and trauma care.

**Energy transfer** The process through which kinetic or potential energy is distributed to an object or person during an impact.

**Kinematics** The science of how matter moves and interacts in collisions.

**MARCH** The BTACC acronym for casualty assessment and care, which stands for massive external haemorrhage control, airway management, respiratory management, circulatory management, and head trauma and other serious injuries.

**Personal protective equipment (PPE)** Specialized equipment worn or used to protect rescuers from injury and infection.

**Time critical** Serious and potentially life-threatening situation.



## Revision:

1. The main focus of the BTACC method is:
  - a. Haemorrhage is the major killer in most trauma situations.
  - b. Airway rather than any respiratory problems.
  - c. A detailed knowledge of anatomy.
  - d. The application of simple but effective treatment measures.
  
2. Injuries which are 'time critical' are:
  - a. Are those which have occurred after a shooting
  - b. Only present in casualties who cannot be rapidly extricated.
  - c. Recognised as serious or potentially life-threatening.
  - d. Can only occur in one system eg respiration or circulation
  
3. Kinematics studies the:
  - a. Calculation of energy at a given speed.
  - b. Amount of blood lost from a trauma injury.
  - c. Type of injuries found inside the body.
  - d. Mechanism or mode of injury.
  
4. Which factor has the greatest effect on increasing the kinetic energy of a moving object?
  - a. Weight
  - b. Mass
  - c. Velocity
  - d. Force
  
5. Which of the following is NOT included in the World Health Organization's Five Moments for Hand Hygiene?
  - a. Before contact with patient surroundings
  - b. Before an aseptic task
  - c. After body fluid exposure risk
  - d. After patient contact

## Answers:

- 1) D                      2) C                      3) D                      4) C                      5) A



## Chapter 2:

### M: Massive External Haemorrhage Control



The term **massive external haemorrhage** refers to a major bleed that is rapidly life-threatening (eg a lacerated femoral artery which can bleed at 1 litre/min). When it occurs, it must be aggressively addressed before any other casualty assessment takes place. The body has only a limited volume of circulating blood (5 litres), and once a large amount is lost (approximately 3 litres), it cannot be simply or effectively replaced with intravenous fluids or a blood transfusion. The BTACC method of care focuses on **circulation preservation** (aiming to preserve circulation rather than replace it).

Massive external haemorrhage control should be a responder's initial focus. However, responders should complete massive haemorrhage control *within one minute* and then move onto the next step in the MARCH algorithm to address other critical concerns, starting with airway, which can also lead to fatalities if not managed rapidly.

The focus of massive haemorrhage control is managing any obvious external bleeding. Responders should look for spurting arterial bleeds, blood soaked clothing, or pools of blood collecting on the floor (see **Figure 2-1**). The source of any major bleeding should be rapidly identified and managed aggressively to minimise further loss.



**Figure 2-1: Massive external haemorrhage.**

Internal massive haemorrhaging (inside the body) may not be easily identified by responders. Internal bleeding may be suspected based on the kinematics of the incident (e.g., penetrating trauma or high-speed blunt trauma).

When internal bleeding is suspected,



providers should continually reassess the casualty, looking for developing signs of shock such as increasing heart rate or deteriorating conscious level. Internal bleeding and shock are discussed in greater detail in Chapter 5.

### **Signs and Symptoms of Haemorrhaging**

Signs and symptoms of haemorrhaging include:

- Obvious major blood loss
- Spurting blood
- Anxiety or confusion
- Deteriorating conscious level or unconsciousness
- Loss of radial pulse or pulse rate > 110 beats per minute
- Capillary refill time > 3 seconds
- Respiratory rate > 20 breaths per minute

**An average adult has approximately 5 litres of blood circulating around the entire body. Blood can be lost into the chest, abdomen, or pelvis without any external sign of bleeding. A significant amount can also be lost into the large muscles of the buttocks, thighs or lower leg.**

### **Managing Haemorrhaging**

For many years, the main focus in the management of blood loss involved replacement with intravenous fluids, but preservation is far better than replacement.

The steps for controlling haemorrhaging can be remembered by the phrase **DiD-iT**, which stands for direct pressure (D), more direct pressure (D) and tourniquet application (T). More skilled providers may include 'indirect pressure' on major arteries, but this is not a core BTACC skill.

**To protect the responder from contamination, gloves and appropriate PPE should always be worn whilst controlling any haemorrhaging.**

### **Applying Direct Pressure**

After PPE is donned, the first step of the DiD-iT technique involves the application of direct pressure to the wound. This is achieved by using a sterile dressing which is either held in place by the responder or through the use of a bandage. The dressing should be of a suitable size to cover the wound and must be absorbent. Common field dressings have a bandage with an absorbent dressing fixed to one end. If a sterile dressing is not immediately available, the thumbs or heel of a gloved hand may be used (see **Figure 2-2**). If a bleeding point is small and obvious (such as a damaged artery), then even a single thumb or finger can often control the bleeding. Thumb or finger pressure can also be used for bleeds in small children. If this initial pressure effectively controls the bleeding, then no further steps are required.



**Fig 2-2: Applying direct pressure is the first step in the DiD-iT technique.**

If bleeding continues and blood soaks through the dressing, more direct pressure should be applied by applying another dressing on top of the existing one and continuing to apply direct pressure. Do not remove the first dressing, as this may reopen the wound and cause further bleeding. If the second direct pressure attempt fails to achieve haemorrhage control and the bleeding still life-threatening, it may be necessary to apply a tourniquet.

Be sure to strive for adequate control of haemorrhaging within one minute. If the first dressing saturates with blood within seconds, apply a second dressing or go straight for a tourniquet.

Controlling Haemorrhaging Using DiD-iT:

**1. Don proper PPE to protect yourself**



**2. Apply firm, direct pressure to the exposed wound using thumbs, hand or a sterile dressing.**

3. If bleeding continues, firmly apply a second sterile dressing to the wound (over the first) and continue direct pressure.



4. If control of bleeding is still not achieved then if possible apply an arterial tourniquet above the wound (tight enough to stop the bleeding)

**90% of external haemorrhaging can be controlled with well performed direct pressure, so application of a tourniquet is rarely necessary.**

### Applying a Tourniquet

A **tourniquet** is a device used to occlude blood supply to a limb by compressing the artery against a bone (see **Figure 2-3**). The indication for using a tourniquet is when haemorrhage cannot be controlled by more basic techniques, and the failure to immediately stop this bleeding would cause a life-threatening situation. The prolonged application of a tourniquet may cause tissue damage, which can result in loss of a limb. However, not applying a tourniquet may mean loss of life, as the casualty could bleed to death.

Military studies have demonstrated that tourniquets on for 2 hours have no demonstrable adverse effect, 4 hours may leave some temporary numbness and only after 6 hours is there a risk of some long term detectable damage.



**Fig 2-3: two modern emergency tourniquets, the SOFFT and the CAT** (research has demonstrated that the latter is a more effective device)

Tourniquets work most effectively in the middle of the limb (mid-shaft), on the long bones of the upper arm and leg. They are also effective in the lower leg and arm, as the arteries run between the bones in this region but can still be compressed by pressure around their surrounding muscle compartments. Tourniquets should be applied approximately 3-4 cm above the injury, although care should be taken with amputations as the injury can sometimes extend up the limb from the stump and may require higher placement of the tourniquet.

Tourniquets are not applied over the wound or dressings, unless this is the only way to maintain effective pressure – essentially using it as a pair of hands.

In some situations it may be appropriate to go straight for a tourniquet where an injury cannot be reached or direct pressure cannot be provided.

Tourniquets must be inelastic and slip-resistant, because the tightness around the limb is the key to controlling bleeding. There are many commercial tourniquets available that are relatively simple and easy to use. Military-style tourniquets are designed so simply they can be applied with one hand by the patient. If a tourniquet is not available, other improvised devices such as belts, ties, or clothing may be used; however, these improvised tourniquets may be difficult to tie-off, allowing bleeding to continue. Many commercial devices are fitted with a windlass, enabling the person applying the device to create enough tension and secure it without it coming loose.

### **To apply a tourniquet to control haemorrhaging** (Fig 2-4 and 2-5)

1. Tell the casualty what you are doing and explain that this device, while potentially uncomfortable, is an essential tool for controlling their bleeding.
2. Slide the tourniquet up or wrap around the limb approximately 3-4 cm above the wound.
3. Pull the tourniquet tight by hand.
4. Secure the retaining buckle (double buckle for the leg to avoid slippage)
5. Use the windlass mechanism to apply tension until the bleeding is controlled.
6. Secure the windlass under the retaining strap



7. Record the time of application and the site of the tourniquet.

### Applying an Emergency Tourniquet



**Fig 2-4: applying a tourniquet to the arm**



**Fig 2-5: Applying a tourniquet to the leg (pass the strap back through the buckle)**

**The pressure of the tourniquet will be VERY uncomfortable for the casualty, but it is a potentially life-saving measure and should not be removed simply due to discomfort**

Tourniquets are not usually applied directly over the wound, but if it is difficult to maintain pressure on the dressing where access is limited or during extrication, then tourniquets can be considered for this purpose.

As discussed above, under normal circumstances, a tourniquet should not be left in place for more than 2 hours due to the potential risk of nerve or muscle damage. However, if the casualty has not reached hospital, it is not appropriate to release the tourniquet unless medical assistance is on hand. In this situation, leave the tourniquet in place and make every effort to get the casualty to hospital as safely and quickly as possible. Every effort should be made to reach hospital within six hours, as the tourniquet could cause serious risk to the limb if it is not released within this timeframe.

### **Haemostatics:**

Some providers may be equipped with some of the latest generation of haemostatic powders and dressings. We retain most of this discussion for the RTACC level training and specialist units such as Firearms teams.

The early agents such as TraumaDex were not very effective, but the later generations such as Haemchon patches and the powdered agents such as Quickclot (Volcanic rock) and Chitosan (Shrimp shells) were found to be highly effective both

in animal experiments and clinical trials. However, they were not without problems, Hemchon was difficult to apply to some cavities and wounds. Similarly, Quickclot had problems as it produced a very exothermic reaction with blood or moisture and could actually produce skin burns, blisters or eye injuries and both agents as powders were difficult to use in windy conditions pre-hospital.

As a result the next generation of agents solved the exothermic problems and also increased the particle size from a powder to a granular form which came in a porous 'tea-bag', which could be packed into wounds or cut open and tipped in before packing.

Since then the technology has moved on still further with hameostatics and they are now being impregnated onto gauze type dressings and pads which avoid the problems with powder and also allow more effective application to wounds. They are constantly in development but current research favours the Chitosan (Shrimp shells) based agents impregnated dressings.

Some US research work has suggested potential serious complications with the powders/granules as they may theoretically enter larger holes in blood vessels and circulate in the body, which could cause dangerous complications. The impregnated dressings avoid this problem.

Such dressings eg Celox gauze and Quickclot 'Combat gauze' are currently considered the most ideal dressings for controlling bleeding as they employ the methods of both **wound packing** and also the **haemostatic** effects of the Chitosan. These agents can control major arterial bleeds very effectively if used properly. The new Quickclot Trauma pads are another useful alternative way to deliver haemostatic agents will applying pressure. These agents and techniques are demonstrated on the courses for candidates with the specific requirement for these skills eg firearms officers, tactical medics etc.

### **Summary:**

- Massive haemorrhage control is the first step in the MARCH assessment and treatment protocol.
- Responders' efforts should focus on control of any massive external bleeding and preserving circulation.
- Massive haemorrhage control should take no more than one minute.
- Gloves and other appropriate personal protective equipment should always be worn before handling the casualty.
- The technique used to control haemorrhaging is DiD-iT, which stands for direct pressure (D), more direct pressure (D), and tourniquet application (T).
- An absorbent pad or dressing should be used to apply direct pressure to the wound. Alternatively, the thumbs or heel of a gloved hand may be used.
- Additional direct pressure (another layer of dressing) may be needed to control bleeding. When necessary, apply this dressing on top of the first and continue focused, direct pressure.
- If the second direct pressure attempt does not successfully control bleeding, a tourniquet may be necessary.
- Tourniquets can be applied to a limb to stop massive blood loss and potentially save lives.
- It is essential that tourniquets are placed above the wound on the injured limb(s) and are applied tightly to ensure any haemorrhage is controlled.

- The tourniquet should not be taken off out of hospital unless medical assistance is present.

### **Vital Vocabulary**

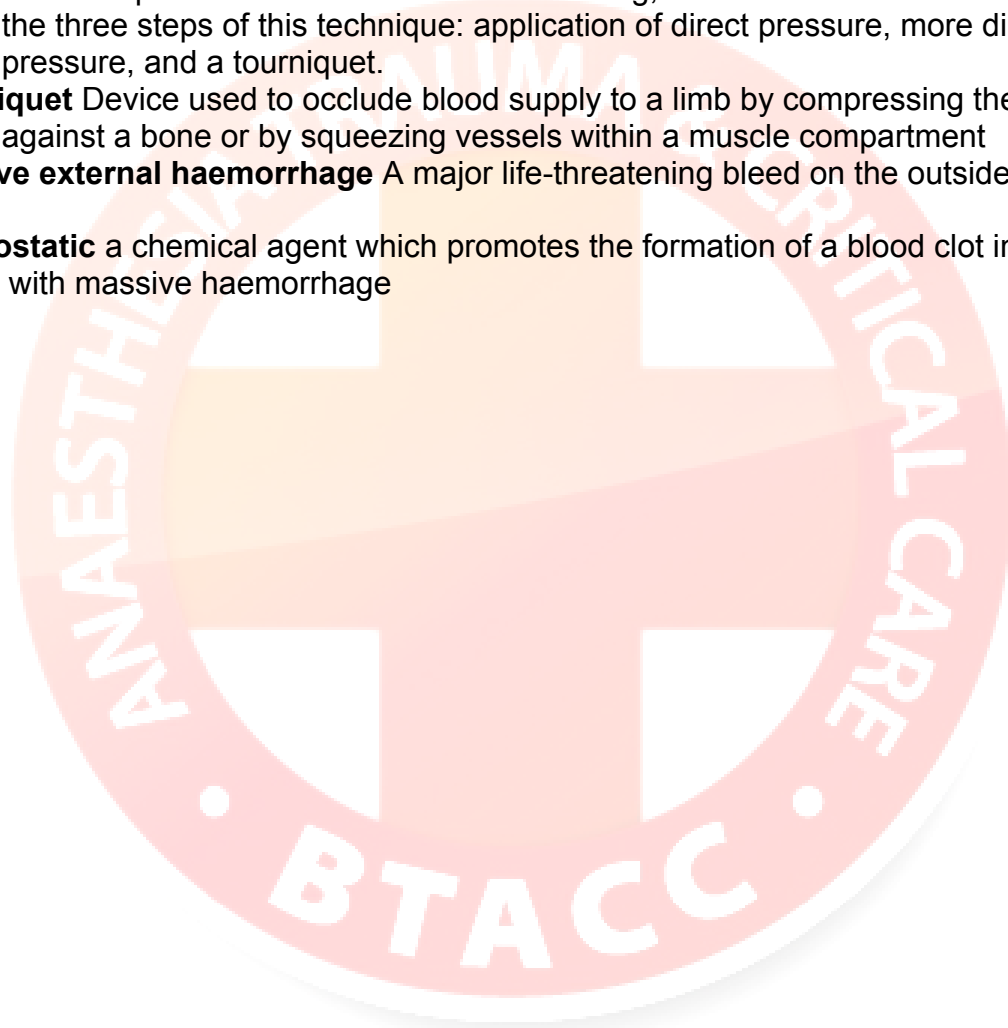
**Circulation preservation** Principle of care focusing on minimizing blood loss rather than fluid replacement.

**DiD-iT** A technique used to control external bleeding; the mnemonic DiD-iT outlines the three steps of this technique: application of direct pressure, more direct pressure, and a tourniquet.

**Tourniquet** Device used to occlude blood supply to a limb by compressing the artery against a bone or by squeezing vessels within a muscle compartment

**Massive external haemorrhage** A major life-threatening bleed on the outside of the body.

**Haemostatic** a chemical agent which promotes the formation of a blood clot in a wound with massive haemorrhage



## Revision:

1. Massive haemorrhage control focuses primarily on:
  - a. Managing external bleeding.
  - b. Recognising signs of shock.
  - c. Bandaging wounds.
  - d. Checking for pulses.
  
2. The entire amount of time devoted to controlling haemorrhaging before moving on to airway care should be as little as possible but ideally:
  - a. One minute.
  - b. Two minutes.
  - c. Five minutes.
  - d. As long as necessary.
  
3. Which of the following is NOT a step in DiD-iT?
  - a. Direct pressure
  - b. Pelvic strapping
  - c. More direct pressure
  - d. Tourniquet application
  
4. Haemostatic powders and dressings are:
  - a. Only for use in hospital
  - b. Must not be used in stabbings
  - c. Will always cause burns to the skin
  - d. Can control potentially lethal bleeding
  
5. Tourniquets are necessary:
  - a. Only to control bleeding in the pelvis and lower limbs.
  - b. In approximately 30% of casualties with massive external haemorrhaging.
  - c. For all casualties who may be in shock.
  - d. When direct pressure fails to control haemorrhaging from a limb

## Answers:

1) A

2) A

3) B

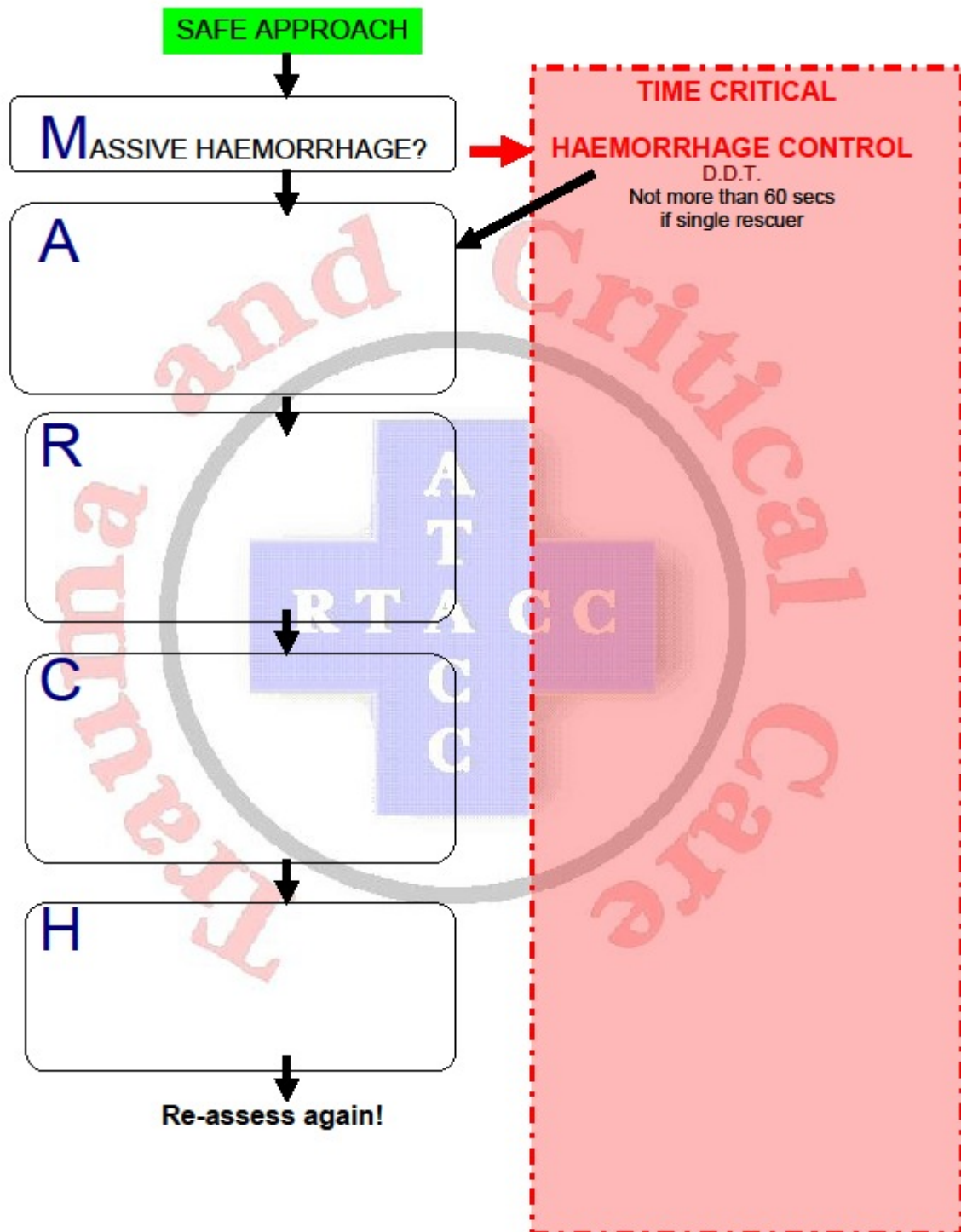
4) D

5) D



Fig 2-6: BTACC Algorithm – MASSIVE HAEMORRHAGE

# BTACC ALGORITHM



## Chapter 3:

### A: Airway Management



Rescuers managing the airway and delivering oxygen

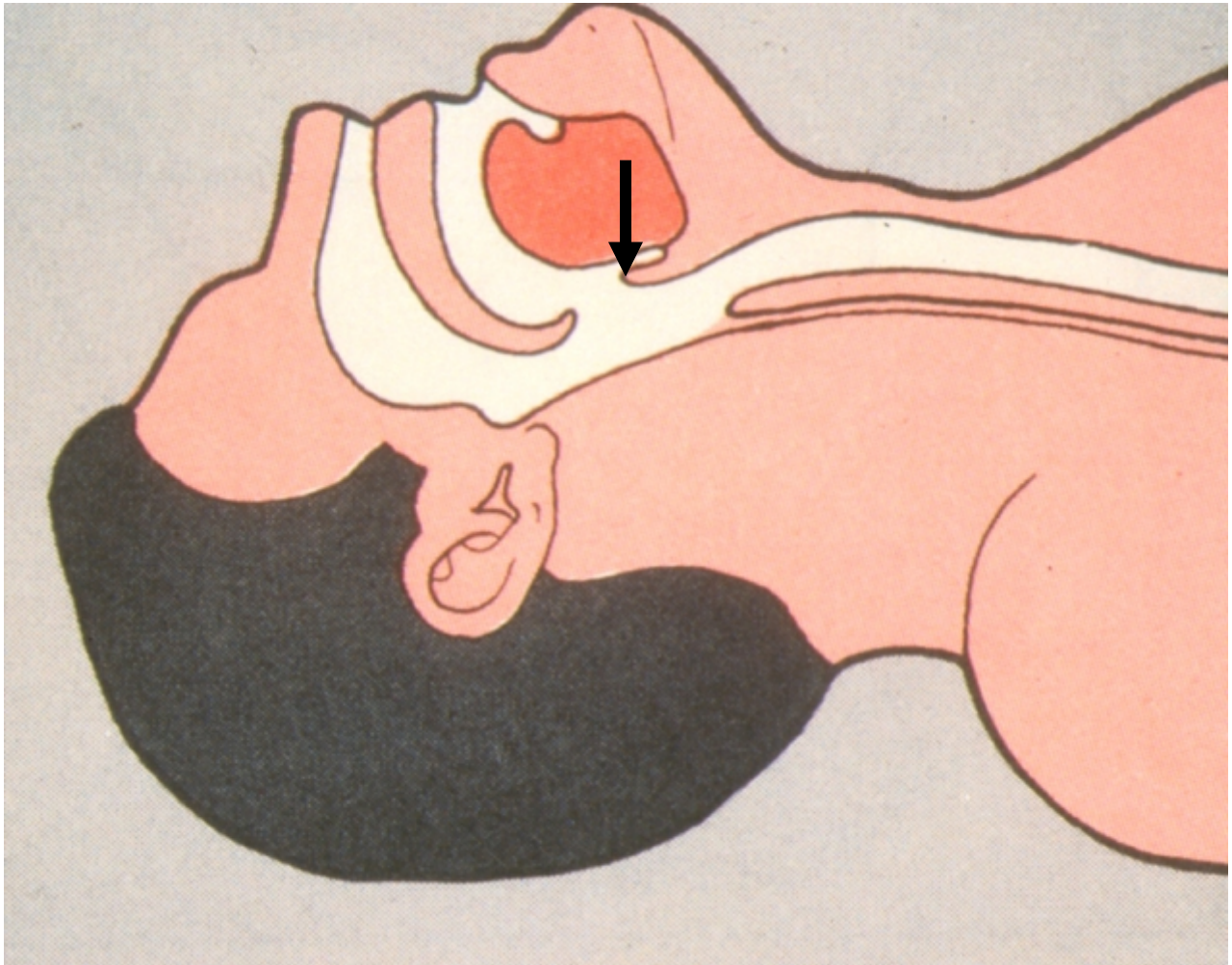
#### Understanding Airway Concerns

Airway compromise is the major cause of preventable deaths in prehospital trauma. Loss of the airway can deprive the brain and organs of vital oxygen and can lead to death in less than five minutes.

The airway is normally open and clear, but in some forms of trauma it can become partially or totally obstructed. In a partially obstructed airway, the flow of air to the lungs is restricted, resulting in a harsh, high pitched noise known as **stridor**. The casualty may also cough and gag (which indicates that some air is passing around the obstruction) and may even be able to speak with difficulty.

In a totally obstructed airway, no sounds of breathing effort can be heard, and no air is able to move in or out, despite good respiratory effort. Speech is impossible, but the casualty may have a silent cough. If the airway is completely obstructed, the patient will lose consciousness in 3 to 4 minutes.

Both types of obstructions are common among trauma victims, especially in unconscious casualties who lose the normal tone and reflexes that protect the airway. When this happens, the tongue may fall backwards and block the airway (see Figure 3-1). This type of airway compromise is common in casualties with head injuries, burns above the shoulders, or smoke inhalation.



**Fig 3-1: the tongue can drop backwards in the throat and is the commonest cause of airway obstruction**

### **Assessing Airway Complications**

All phases of casualty assessment must be reassessed regularly, especially the airway, as conditions may change rapidly. For casualties who appear stable, you should reassess approximately every 5 minutes. If any change or deterioration is noted, then reassessment should be more frequent, as often as once a minute. In casualties with severe injuries, reassessment should be continuous. Any patient who is not breathing requires immediate basic life support (see Chapter 7).

To assess a casualty's airway, use the **look, listen, and feel** approach.

#### **Look**

Look for chest movement and any obvious signs of facial or airway trauma (e.g. bruising, bleeding, swelling, or wounds). Additional warning signs of airway obstruction include:

- Facial burns (e.g. redness, blistering, peeling skin)
- Loss of facial hair
- Swelling of the lips or mouth
- Soot in the airway (smoke inhalation)
- Blood in the mouth

- Foreign bodies in the mouth (e.g. broken teeth, scene debris)

The presence of any of these signs should raise serious concerns about potential airway problems which will require regular reassessment and close monitoring.

When an oxygen mask is used, the mask will fog every time the casualty breathes out through an open airway. This method of airway assessment allows the responder to count the respiratory rate and may be especially useful if access to the casualty is limited.





## Listen

**The ability to talk normally immediately tells you that the airway is clear. This assessment tool can be used when assessing the casualty from a distance.**

One of the best ways in identifying a compromised airway is to listen to the casualty's breath sounds by his or her mouth (see **Fig 3-2**). Normal breathing and respiratory effort indicates a clear airway. If an airway is partially obstructed, the casualty's breathing may be noisy with signs of laboured breathing. A totally obstructed airway often results in no breath sounds with a great deal of respiratory effort.

If no breath sounds are heard, and the casualty shows no signs of respiratory effort, this indicates **apnoea** (not breathing) and is a time critical injury. The casualty's airway must be managed effectively before moving onto further steps in the algorithm. Unless rapidly addressed, apnoea can prove fatal within minutes.

## Feel

Feel for breathing on your cheek as you listen for breath sounds. Alternatively, you may hold the palm or back of your hand over the casualty's nose and mouth. When using supplemental oxygen (see "Using Supplemental Oxygen" below), you can confirm that breathing is occurring by checking for fogging of the oxygen mask.



**Figure 3-2 : Listen and feel for breathing and to confirm and open airway**

## Signs and Symptoms of Airway Concerns

Signs and symptoms of airway concerns include:

- Breathing difficulty
- Inability to speak or vocalise
- Hoarse voice or stridor (noisy breathing)
- Swelling of the lips, tongue, or mouth
- Burns above the level of the shoulders
- Cuts or wounds in the mouth
- Foreign material in the mouth

## Managing Airway Concerns

An obstructed airway must be rapidly managed. Secretions and blood should be removed with careful suction under direct vision or postural drainage (positioning the patient to allow the material to run out of the mouth). For a partially obstructed airway, you should encourage the casualty to cough. Coughing is the most effective way of expelling a foreign object. If the casualty is unable to expel the object by coughing (if, for example, a bone is stuck in the throat) you should arrange for prompt transport and monitor the casualty carefully because a partial obstruction may become a total obstruction at any moment.

When the casualty does not require active intervention but has a reduced conscious level, then the **recovery position** can be employed (see **Figure 3-3**).



**Figure 3-3: the recovery position**

Many fully conscious casualties prefer to remain in a seated position (**Figure 3-4**), though those with facial trauma and bleeding may be better in a prone position, lying on their front and supported by their elbows, or flat on the floor. In hazardous or dangerous environments where it may be difficult to provide more detailed care, the simple act of rolling a

casualty into the prone or semi-prone position until he or she can be effectively extricated may be a life-saving measure.

**If a casualty remains unconscious in the recovery position for more than 30 minutes, then consider turning him or her onto the opposite side to relieve the pressure on the lower arm.**



**Fig 3-4: Casualty receiving high flow oxygen therapy**

When positioning the casualty, consider the possibility of spinal injury and handle the casualty carefully. If more than one responder is present, then cervical spine management (outlined in Chapter 6) should be performed before repositioning the patient; with only one responder, assessment of spinal injury and immobilisation should be delayed until the “H” step of the algorithm.

In an unresponsive, unconscious casualty, the most common cause of airway obstruction is the tongue

blocking the airway. Responders should manually move the casualty's head to propel the tongue forward and open the airway. One of two techniques may be used to achieve this—the jaw-thrust manoeuvre or the head tilt-chin-lift manoeuvre.

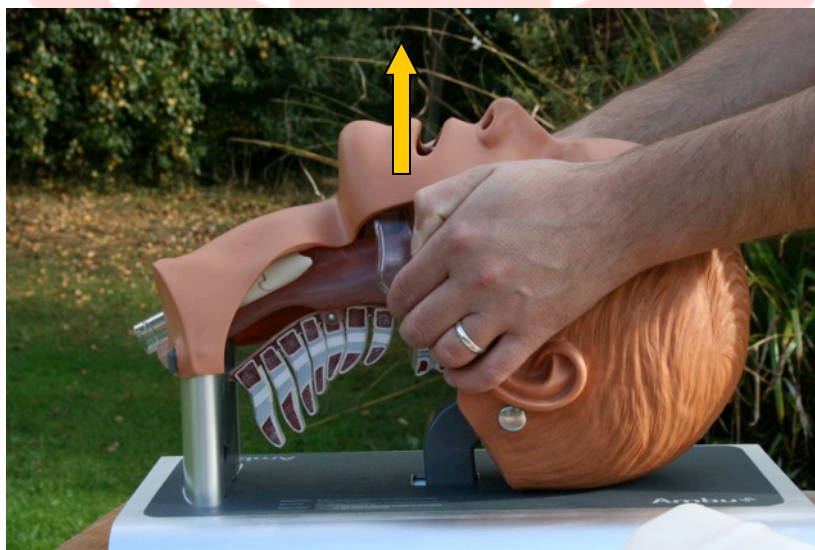
The jaw-thrust manoeuvre is generally the preferred method used to clear the airway because it protects the cervical spine. If this technique is insufficient, there are other airway management techniques which may prove effective, including the head tilt–chin lift manoeuvre or insertion of mechanical airways. While rarely relevant in trauma cases, providers should also be familiar with basic choking treatment. All providers should be skilled in providing supplemental oxygen, which is an important technique for managing casualties with airway concerns.

### Jaw-Thrust Manoeuvre

If you suspect that the casualty has the potential for a cervical spine injury, open his or her airway using the jaw-thrust manoeuvre. (If spinal injury is not suspected, then you may use the head tilt–chin lift manoeuvre presented in the next section.) To perform the **jaw-thrust manoeuvre**, use the following steps (see **Fig 3-5**):

1. With the casualty in a supine position, kneel at the top of the head.
2. Place the meaty portion of the base of your thumbs on their cheekbones. Hook the tips of your fingers under and around the bony angle of the casualty's jaw, in the indent below each ear.
3. While holding the casualty's head still, move the jaw upward and open the mouth with your thumb tips.

**Figure 3-5: Jaw thrust.:** The jaw-thrust manoeuvre should open the airway without extending the casualty's neck significantly.

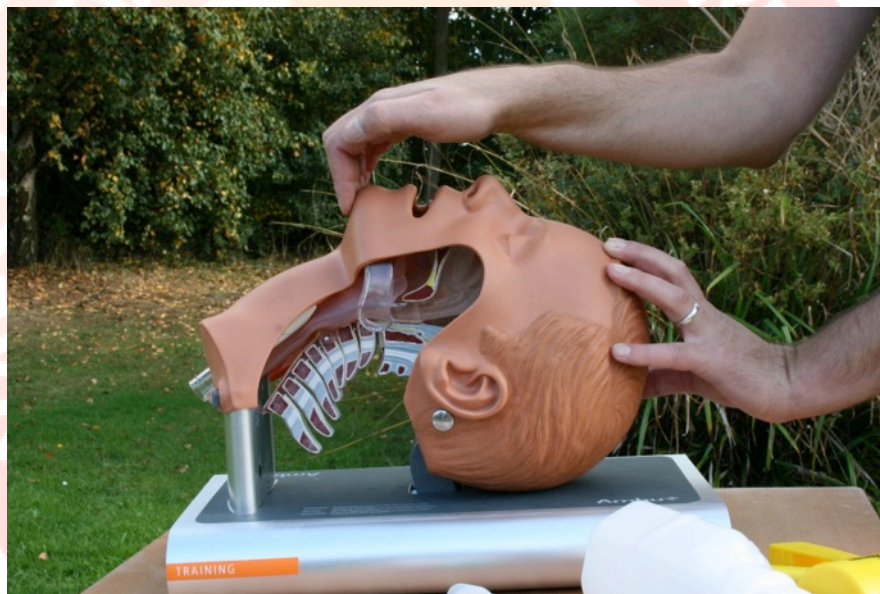




## Head Tilt–Chin Lift Manoeuvre

The **head tilt-chin lift manoeuvre** is a very simple, yet effective way of opening a casualty's airway and is used when there is no potential for a cervical spine injury. To perform the head tilt-chin lift manoeuvre (see **Figure 3-6**):

1. With the casualty in a supine position, kneel beside the head.
2. Place one hand on the casualty's forehead, applying firm, backwards pressure with your palm to tilt the head back and extend the neck, propelling the tongue forward.
3. At the same time, place your finger tips of the other hand under the bony part of the chin. Taking care to avoid compressing the soft tissue under the chin, as this may block the airway.
4. Lift the chin upwards, bringing the entire lower jaw with it, and helping to tilt the head back.



**Fig 3-6: opening the airway with a chin life manoeuvre is usually very effective but it does extend the neck considerably and therefore is avoided in potential neck injuries unless there is no other option.**

## Mechanical Airways

If these manoeuvres are not successful, it may be necessary to use a mechanical airway device to keep the casualty's airway open. There are two main types of mechanical devices: nasal (NP) and oral (OP) airways.

A **nasal airway** is a soft plastic tube which is inserted through the nostril into the back of the throat, thereby allowing passage of air from the nose to the lower airway (see **Figure 3-7**). It is often better tolerated than an oral airway in unresponsive casualties who still have an intact gag reflex or who are biting or have clenched teeth.

This type of airway should only be used gently with caution on a casualty with suspected skull fracture. (if blood or fluid is coming out of nose or ears)



To insert a nasal airway, use the following steps :

1. Ensure you have selected the appropriate size; measure the distance from the tip of the nose to the tragus of the ear. The diameter of the tube is often compared to that of the casualty's little finger in training manuals, but simply looking at the nostril is probably a far more reliable indicator.
2. Lubricate the airway with a water-soluble gel and place the airway in the largest nostril (usually the right), with the curvature of the device following the curve of the floor of the nose, and the bevel facing the septum.
3. Place the bevel to the septum and insert it gently along the nasal floor, parallel to the mouth.
4. When completely inserted, the flange should rest against the nostril.

Do not force the airway. If you feel any resistance, remove the airway and try to insert it in the other nostril.

**Fig 3-7 Inserting a Nasal Airway**



Step 1: size and then lubricate the airway with gel



Step 2: introduce airway into the best nostril, which appears clear and large enough for the airway. (commonly the right one because of the angle on the airway tip)



Step 3: gently advance the airway along the floor of the nose. This should not require anything more than finger and thumb pressure. The lining of the nose is delicate and has some thin bones called turbinates which can produce a slight crunching feeling. If the airway passes with minimal pressure then proceed. **DO NOT FORCE THE AIRWAY**



Step 4: nasal airway fully inserted. The airway stays in place and the safety cuff avoids the need for safety pins to stop the airway slipping further into the nose. If the casualty coughs or gags excessively then pull the airway out slightly and also check the mouth for any bleeding from the back of the nose. If there is some bleeding then suck it out of the mouth, but leave the airway in place if it is working well.

An **oral airway** is a hard, curved plastic device that extends from the lips to just over the back of the tongue. It is designed to hold the tongue away from the back of the throat, enabling good passage of air into the lower airway. It should only be used on a casualty who is unresponsive and does not have a gag reflex (see **Figure 3-8**).

To insert an oral airway, use the following steps:

1. To select the proper size, measure the horizontal distance from the angle of the jaw to the centre of the casualty's incisors or the corner of the mouth to the tragus of the ear.
2. Open the casualty's mouth with the fingers of one hand. (Avoid putting your fingers in the mouth)
3. Suck out any debris from the mouth that can be seen
4. Insert the airway **OVER THE TONGUE** from below, the natural curve of the device will bring it in over the chin (see below)
5. Alternatively, hold the airway upside down and insert the airway with the tip facing the roof of the mouth. Mid mouth rotate the airway 180°, flipping it over the tongue. (this does require good mouth opening) **Fig 3-9**
6. When inserted properly, the airway will rest in the mouth, with the curvature of the airway following the contour of the tongue. The flange should rest against the lips outside the mouth.

**Fig 3-8 Sizing and inserting an Oral Airway conventionally or inverted**



Step 1 – size the airway from the corner of the mouth to the angle of the jaw or the tragus of the ear



Step 2 – insert the airway over the chin and into the mouth, ensuring that it passes **OVER** the tongue and does not push it backwards



Step 3 – as the airway reaches the back of the mouth it may just drop into place, but sometimes a gentle jaw thrust is required. Note, that the plastic rim stays outside of the mouth and lips.



Step 4 – oral airway in place and then feeling for breathing with the wrist. This airway must now be constantly monitored as it can pop-out or fall out if unattended. If the patients gags or coughs repeatedly then they are not tolerating the airway and it should be removed, then consider a nasal airway if necessary

**Fig 3-9: traditional inverted method of inserting oral airways**



Step 1 – insert the correct size airway upside down along the rough of the mouth over the tongue



Step 2 – at the back of the mouth, rotate the airway and drop into place behind the tongue. This method is not preferred by BTACC as although it avoids pushing the tongue backwards it requires reasonable mouth opening (~2cm) and can be awkward.

## Choking Treatment

Choking occurs when a foreign body lodges and partially or totally obstructs the airway, resulting in an inability to breathe effectively despite good respiratory effort. The first step in managing a conscious person who may have an obstructed airway is to ask, “Are you choking?” If the casualty can answer your question, the airway may only be partially blocked. If the patient is unable to speak or cough, the airway is totally blocked.

### Signs and Symptoms of Airway Obstruction:

*Signs and symptoms of choking include:*

- Attack occurs while eating
- Casualty clutches his or her neck (universal choking sign)

*Signs and symptoms of partial airway obstruction include:*

- Ability to speak, cough, and breathe
- Gagging

*Signs and symptoms of total airway obstruction include:*

- Inability to speak
- Inability to breathe or wheezy breathing
- Silent cough
- Unconsciousness

To treat choking in a conscious victim, first try to **encourage them to cough** but if they are unable to cough or breathe then immediately commence the following rescue techniques.

The rescuers should provide alternating back blows (**Fig 3-10**) and abdominal thrusts (**Fig 3-11**) in blocks of 5 until the obstruction is relieved or the casualty deteriorates and becomes unconscious.

To provide 'back blows'

1. **Stand to the side and slightly behind the casualty.**
2. **Supporting the chest with one hand, lean the casualty forward. This position will make it more likely that the foreign body to come out of the casualty's mouth rather than fall further down the airway once dislodged.**
3. **Position the heel of your other hand between the casualty's shoulder blades and provide up to five sharp back blows to clear the airway obstruction.**
4. **After each blow, check to see if the foreign body has been dislodged.**



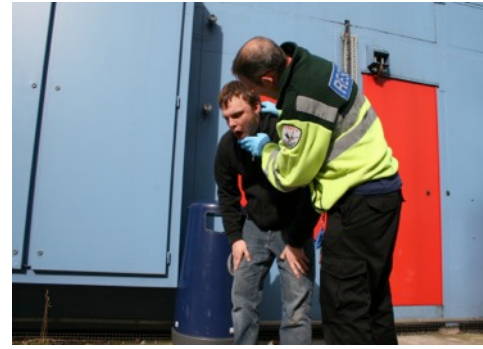
**Figure 3-10: Providing Back Blows and then checking the mouth**

If the five back blows fail do not relieve the airway obstruction, responders should provide up to five 'abdominal thrusts'

To perform **Abdominal thrusts**:

1. **Stand behind the casualty.**
2. **Place both your arms around the upper part of the casualty's abdomen and lean the casualty forwards.**
3. **Place your fist against the casualty's abdomen, with the thumb side facing in, just above the casualty's navel and grasp the fist with your other hand.**
4. **Provide up to five abdominal thrusts, pulling sharply inwards and upwards.**
5. **After each blow, check to see if the foreign body has been dislodged.**





**Figure 3-11: Providing Abdominal Thrusts and then checking the mouth**

If the five abdominal thrusts do not relieve the airway obstruction, responders should continue to provide an alternating sequence of five back blows and five abdominal thrusts.

The ERC/UK Resuscitation Council guidelines for choking treatment are outlined in **Figure 3-11**.

If these efforts do not relieve the airway obstruction and the casualty becomes unconscious, responders should carefully lay the casualty on the ground and immediately call for assistance and begin CPR (see Chapter 7).

### **Choking in children**

**The same algorithm can be used in children down to the age of 1 year of age, below this age (Infants) the abdominal thrusts are replaced with chest thrusts/compressions.**

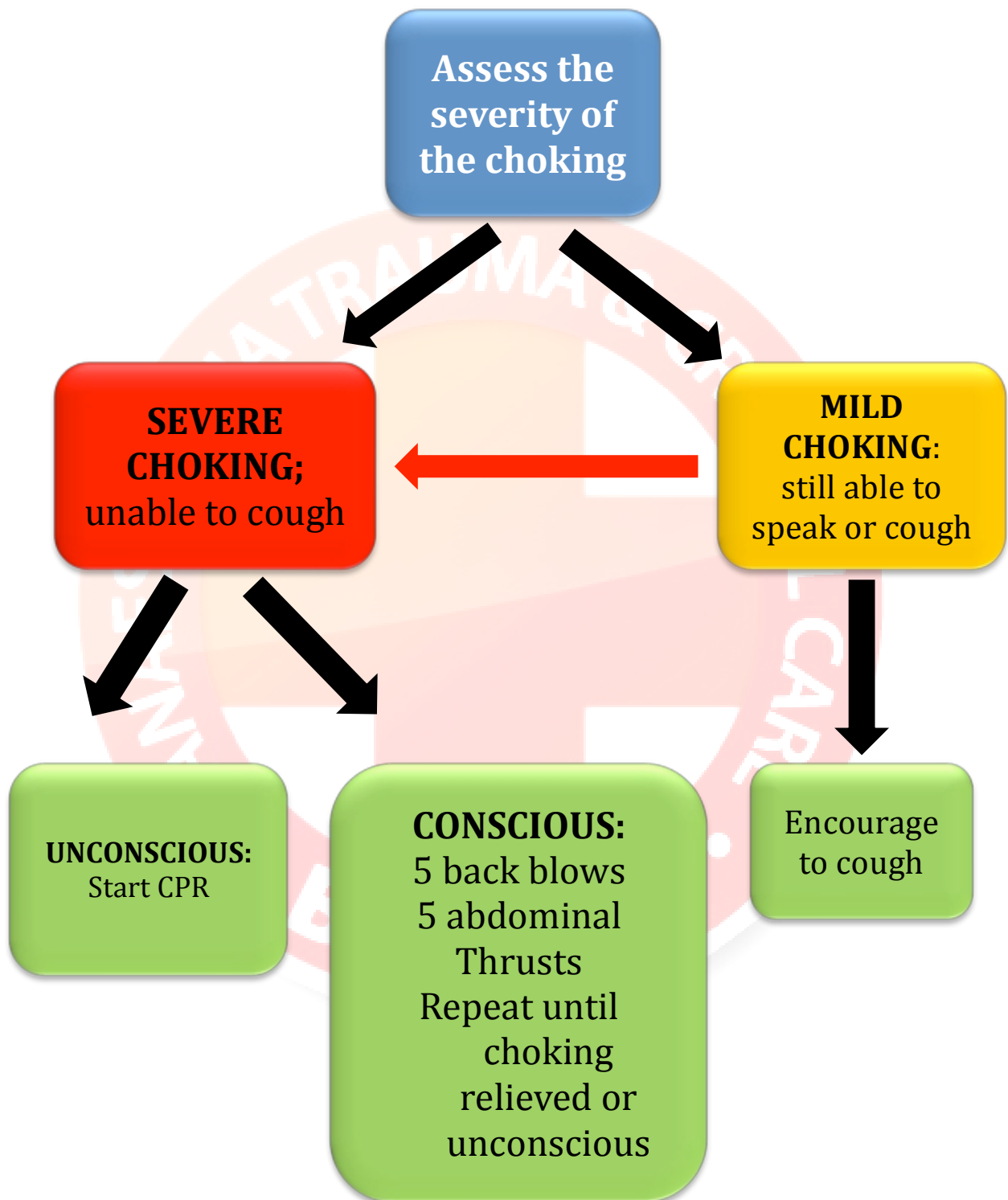
Small children can be placed across the lap for back blows and infants can be cradled in the arms.

One other difference for children is that if the child is unconscious then commence Paediatric life support which starts with 5 rescue breaths before chest compression starts.

Details of paediatric life support are found in Chapter 9.

**In cases of choking abdominal thrusts should not be used in infants (children under 1 year of age) – chest compressions are used instead**

**Fig 3-11; Adult choking algorithm** (based on UK and European Resus Council guidelines)



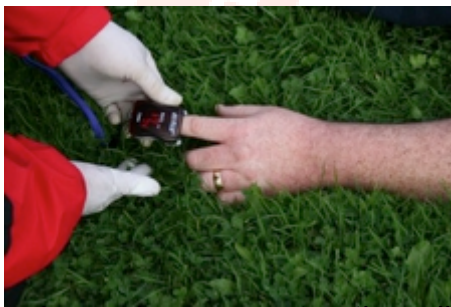


## Supplementary Oxygen

Under normal circumstances, a person's body can operate efficiently using the amount of oxygen found in normal room air. However, the amount of blood lost after a traumatic injury could mean that insufficient oxygen is delivered to the cells of the body, which can result in shock, death, or serious long term disability. Administering supplemental oxygen to a casualty increases the amount of oxygen delivered to the cells of the body and often makes a positive difference to the casualty's outcome.

All casualties suffering major trauma should receive high levels of supplemental oxygen through a reservoir mask at a rate of 10 to 15 L/min. As the casualty becomes stable, you may consider reducing the oxygen flow rate and aim for a target saturation of between 94–98% in the average adult casualty, but if in doubt, then the higher flow rate should be used. Remember that this is trauma and we do not follow the British Thoracic Society guidelines for medical conditions.

**Figure 3-12 Apply the pulse oximeter early, almost like your 'hand-shake', to assess the casualties oxygen status and pulse**



pulse and oxygen saturation will be recorded, but newer models may provide other information as well.

Oxygen should be used to treat hypoxaemia (low oxygen levels in the blood) and not simply breathlessness. A **pulse oximeter** may be used to ascertain the blood oxygen saturation level (see **Figure 3-12**). A pulse oximeter is very simple to use: a sensor probe is clipped on to the casualty's finger and a LED is shone through the finger, giving the findings on the screen. Most commonly the

information as well.

**Ventilation using a pocket mask provides 16–18% oxygen.**

**Bag-valve mask ventilation with room air provides 21% oxygen.**

**An oxygen cylinder delivered at 15 L/min through a non-rebreathing mask with a reservoir bag provides 60–100% oxygen.**

**Bag-valve mask, with oxygen 15L/min and a reservoir provides 100% oxygen**

## Oxygen Equipment

Oxygen is compressed and stored in portable cylinders. Standard oxygen cylinders are filled to 137 barometers, newer Kevlar wrapped lightweight cylinders are charged to 200 to 300 bar pressure, depending on the manufacturer or supplier. In older style cylinders, a gasket is used between the pressure regulator/flowmeter and the cylinder; this ensures a tight seal and maintains the high pressure inside the cylinder). In the new style cylinders (see **Figure 3-13**), the pressure regulator and flowmeter are an integral part of the cylinder apparatus and no assembly is needed prior to oxygen administration

**Fig 3-13: High pressure oxygen cylinder and use of a high flow oxygen mask**



Oxygen is now viewed as a drug and must be prescribed appropriately by a clinician. A generic prescription or SOP/SIS can be written by a Medical Director for emergency care providers who have been suitably trained. All administration of oxygen must be recorded on the patient report form or other documentation.

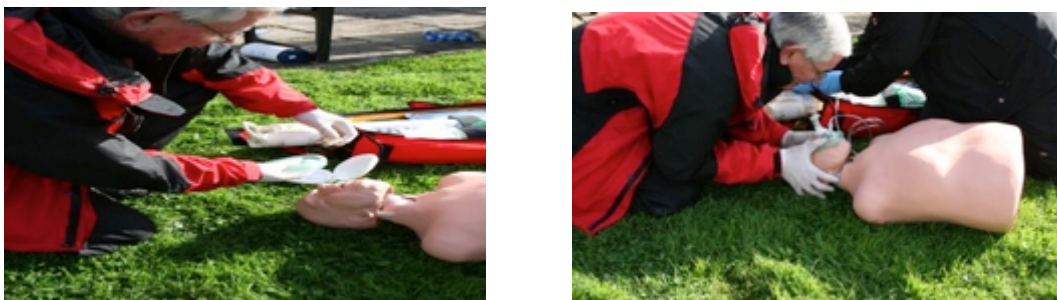
All oxygen supplies should be checked on each shift, including contents, regulator valves, and flow meters. For cylinders with a separate regulator, if it is necessary to change the regulator, ensure that the valves are free of grease, oil, and dust. Before fitting the regulator, the cylinder should be opened slightly for a few seconds to clear any dust or debris from the outlet port.

There is often some confusion produced by the British Thoracic Society Guidelines about oxygen administration but in major trauma our guidelines are very clear:

**ALL MAJOR TRAUMA VICTIMS GET 15L/min HIGH FLOW OXYGEN FROM A NON-REBREATHING MASK (equivalent to 100% oxygen)**

The oxygen saturation is considered 'Time critical' if below 93% on air or 95% on oxygen.

A casualty who is not breathing will require ventilating with a pocket mask or a bag-valve mask (see **Figure 3-14**). Bag-valve masks work by a responder squeezing the bag to push air through a one-way valve, into the mask, and then into the casualty's airway. As the casualty passively exhales, the used air empties back into the mask and escapes through holes before the valve. Bag-valve masks are often single-use, however where they are reused, a disposable filter is used between the mask and valve.



**Fig 3-14: Using a pocket mask with oxygen**

**Paraquat overdose is quoted as the main contraindication for oxygen therapy. In confirmed cases of paraquat overdose, avoid oxygen unless the casualty has sustained a major injury and is in extremis (e.g. has a respiratory rate more than 30/min, is unconscious or in arrest and time critical) in such cases then oxygen should be given.**

## Safety Considerations

Oxygen does not burn or explode by itself. However, it can quickly turn a small spark or flame into a serious fire. Therefore, all sparks, heat, flames, and oily substances must be kept away from oxygen equipment. Smoking should never be permitted around oxygen equipment.

The pressurized cylinders are also hazardous because the high pressure in an oxygen cylinder can cause an explosion if the cylinder is damaged. Oxygen cylinders should be stowed securely to protect the cylinder and regulator/flowmeter (see **Figure 3-15**). At the scene of an incident, ensure the cylinder is handled carefully and not exposed to any damage during an extrication attempt.



**Figure 3-15; Oxygen cylinder safely stowed**

It is important to note the amount of oxygen remaining in the cylinder to ensure that it will not run out while treating a casualty. A normal portable oxygen cylinder contains between 340 and 1,000 L. Responders should monitor the gauge and seek additional cylinders before they are needed. If further cylinders are not available, then providers may reduce the flow rate to 10 L/min (or less), though this will significantly reduce the percentage of oxygen being delivered to the casualty. In this case, the casualty should be monitored with a pulse oximeter if one is available to ensure that the oxygen saturation is kept greater than 90%.

## Providing Supplemental ventilation

Ventilating a casualty with a bag-valve-mask is a core skill for many responders, but it is one that is often performed incorrectly. First, it is important to select the correct size face mask for a good seal between the face and the mask. The mask should sit with the top narrow part over the bridge of the nose and the bottom wider part between the lip border and chin. Second, it is important to achieve an adequate seal

1. Place the thumbs on either side of BVM connector on the mask with the fingers open either side like making a 'butterfly'
2. With the fingers feel for the angle of the jaw on each side and slide the fingers behind to pull the jaw forward (plus if minus a gentle head tilt if required)
3. Press down with the thumbs and pull up with the fingers to seal the mask on the face whilst still keeping the airway open.





**Fig: applying a non-breathing face mask (left) & checking the reservoir bag inflates right)**

With training and practice, one responder can ventilate a casualty using a bag-valve-mask device; however, the two person technique is a much more efficient way of providing supplemental oxygen to the casualty in less experienced hands.

To use a bag-valve mask with two responders

1. Choose the correct size of mask to cover the nose and mouth.
2. Position the mask on the patient's face and ensure an adequate seal.
3. Open the patient's airway and hold the mask in place with two hands.
4. The second responder then squeezes the bag, for approximately one second and both responders watch for a visible chest rise.
5. Then release the bag and watch the chest fall.
6. Allowing the bag to re-inflate slowly and completely.
7. Repeat at 12-15 breaths per minute in an adult.

Ensure that you do not squeeze the bag too hard. Normal chest rise and fall should be observed and used as a guide for how much to squeeze.

**By looking at the amount of chest movement the ventilation volume (squeeze of the bag) can be adjusted so that even a large adult bag can be safely used on small adults and children**

When a single responder uses the BVM, one hand holds the mask onto the casualty's face and the other will squeeze the bag, making sure it is squeezed only enough to make the chest rise in a normal fashion.

**Using the bag-mask device requires proper training and practice, for those who do not use it frequently it should be a two person technique. BTACC recommends that if working alone then use the pocket mask to support ventilation.**



**Figure 3-16; Two person use of a Bag valve and mask**

## **Cervical Spine Management**

During the airway management phase, providers should consider the possibility of spinal injury (discussed in detail in Chapter 6). If more than one responder is present and spinal injury is suspected, providers should manually immobilise the neck— whilst ensuring an open airway— before proceeding on to the next step in the MARCH algorithm. If responding alone then cervical spine management is impossible with other injuries to manage as well. A solo responder should focus on other time critical injuries first. If a second responder is present then the cervical spine cannot be ignored.

### **Summary:**

- Loss of the airway can result in death within minutes if it is not properly managed.
- The airway should be regularly assessed in all casualties, as conditions may change rapidly.
- A partially obstructed airway restricts the flow of air and can result in a harsh, high pitched noise known as stridor.
- A totally obstructed airway allows no sounds of breathing effort to be heard.
  - The look, listen, and feel approach is used to assess airway problems.
  - Look for chest rise and any obvious signs of facial or airway trauma.
  - Listen for breathing effort.
  - Feel for breath.
- Various positions may be used to try and relieve airway obstruction including the recovery position, sitting position, or prone position.
- The tongue may be blocking the airway in unresponsive, unconscious casualties. The jaw-thrust should be used in this situation to open the airway. Alternatively, if there is no potential for spinal injury, the head tilt-chin-lift manoeuvre may be used.
- Nasal or oral mechanical airway devices can be inserted into the mouth or nose to assist breathing.
- Choking occurs when a foreign body lodges and obstructs the airway, resulting in an inability to breathe effectively.
- For a conscious choking casualty, provide up to five back slaps. If these fail to dislodge the obstruction, provide up to five abdominal thrusts. Alternate between back slaps and abdominal thrusts until the obstruction is dislodged or the casualty becomes unconscious.
- For an unconscious casualty who has been choking, inspect the airway (look into the mouth); provide 30 chest compressions and two ventilations. Continue this cycle, checking the airway before delivering the breaths each time.

- All major trauma patients should receive supplemental oxygen at a rate of 15 L/min.
- A hypoxaemic casualty requires high concentration oxygen until the oxygen saturation reaches 94–98%.
- Oxygen equipment includes an oxygen cylinder, pressure regulator, flow meter, and a range of face masks or bag-valve masks.
- Always take proper safety precautions when working with or around supplemental oxygen to avoid combustion or damaging the cylinder.
- If a casualty is not breathing, he or she should be given ventilated breaths with a bag-valve-mask device.
- If more than one responder is present, the spine should be immobilised whilst securing the airway, before proceeding to the next step in the MARCH assessment process.

### Vital Vocabulary

**apnoea** Condition where the casualty is not breathing.

**bag-valve mask** A device used to deliver supplemental oxygen to a casualty who is not breathing. Oxygen is squeezed from the bag, through a one way valve and into the mask applied to a casualty's face.

**head tilt–chin lift manoeuvre** Opening the airway by tilting the head backward and lifting the chin forward, bringing the entire lower jaw with it.

**hypoxaemia** Low levels of oxygen in the blood.

**jaw-thrust manoeuvre** Opening the airway by bringing the jaw forward without extending the neck.

**nasal airway** An airway adjunct that is inserted into the nostril of a casualty who is not able to maintain a natural airway; also called a nasopharyngeal airway.

**oral airway** An airway adjunct that is inserted into the mouth to keep the tongue from blocking the upper airway; also called an oropharyngeal airway.

**pulse oximeter** A machine that consists of a monitor and a sensor probe that measure the oxygen saturation in the blood.

**recovery position** A side-lying position that helps an unconscious patient maintain an open airway.

**stridor** Harsh, unmistakable noise that indicates airway obstruction.



## Check Your Knowledge

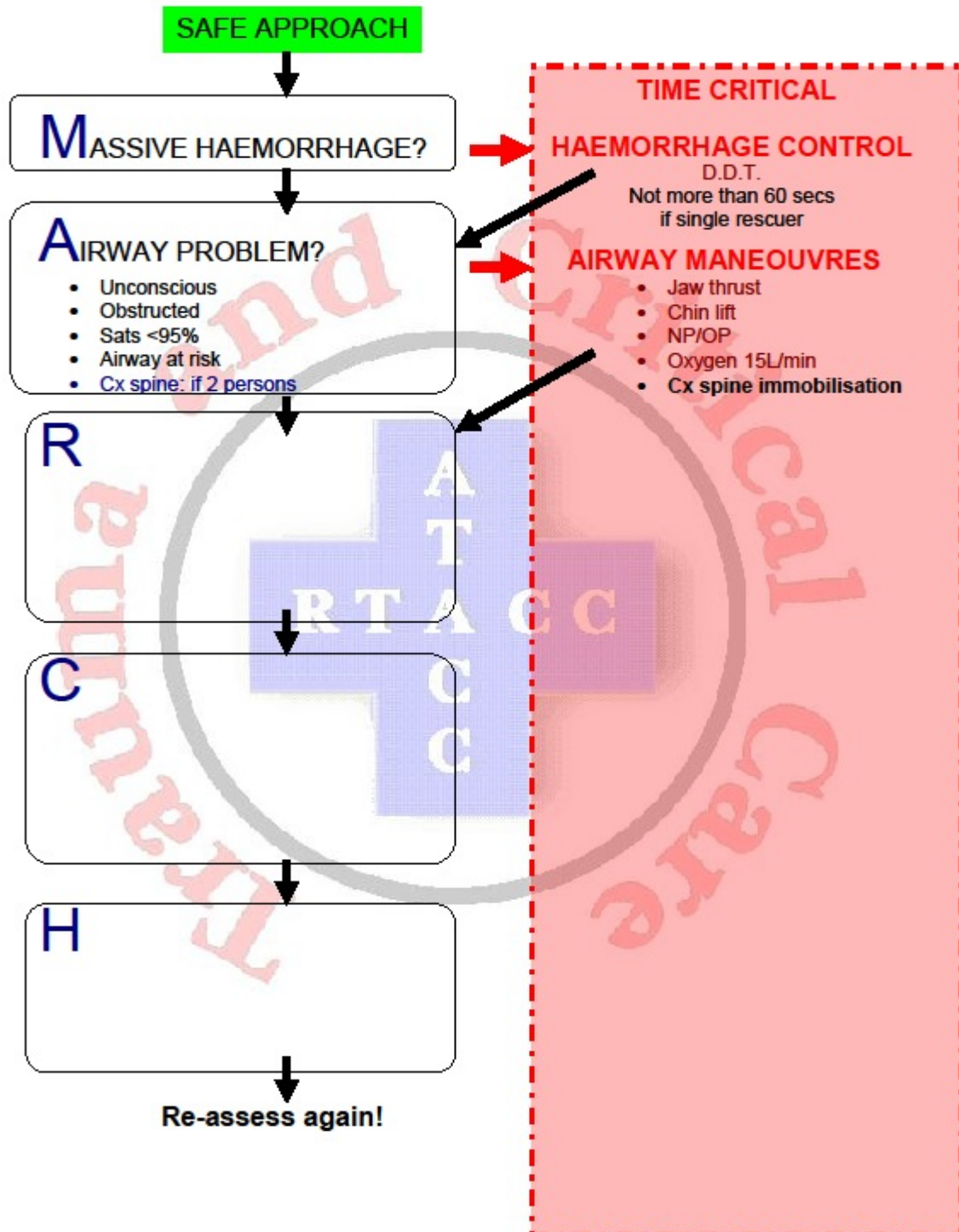
1. A casualty with an airway problem should be assessed:
  - a. Only during the initial MARCH assessment
  - b. Regularly, based on the severity of the casualty's condition
  - c. Every 10 minutes
  - d. Every minute by your watch
  
2. Which of the following is NOT a sign of potential airway obstruction following trauma?
  - a. Swollen lips
  - b. Loss of facial hair following a fire
  - c. Confusion
  - d. Blood in the mouth
  
3. The ability to talk is a sign that the casualty's airway is:
  - a. Clear
  - b. Not at risk
  - c. Totally obstructed
  - d. Is not going to swell
  
4. To treat an unconscious adult who is choking, a responder should first:
  - a. Attempt five back blows followed by five abdominal thrusts
  - b. Attempt one abdominal thrust followed by five back blows
  - c. Encourage the casualty to cough
  - d. Commence CPR
  
5. Oxygen should be provided to a casualty suffering major trauma at a rate of:
  - a. 2000 psi
  - b. 20 breaths/min
  - c. 15 L/min
  - d. Delivery is based on the cylinder size.

## Answers:

- 1) b                      2) c                      3) a                      4) d                      5) c

## BTACC Algorithm - AIRWAY

# BTACC ALGORITHM



## Chapter 4:

### R: Respiratory Management



#### Understanding Respiratory Concerns

Many trauma patients have respiratory compromise as a result of blunt or penetrating chest injuries, head injuries, or shock. Casualties with serious chest trauma often experience obvious distress or difficulty breathing. Where there are injuries to the upper chest, remember that the first and second ribs are very strong and well protected. Therefore if these ribs are fractured, it strongly suggests underlying serious trauma and the potential for numerous other internal injuries and requires careful and regular reassessment.

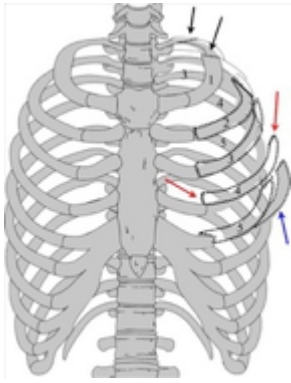
Wounds in the neck or around the collarbone can indicate serious internal injury and may be challenging to manage in the field due to the presence of large blood vessels, nerves, and the trachea. When injured, these structures can retract into the chest or up the neck, making management difficult.

#### Assessing Respiratory Complications

To assess respiratory concerns, use the look, listen, and feel approach. This process must be repeated frequently as part of the regular casualty reassessment. The frequency of the assessments will depend upon the rate of change in the casualty's state and may need to be almost continuous in cases of severe injury or respiratory compromise.

#### Look

If the casualty complains of pain from an injury (such as broken ribs) which restricts respiration and there is no M or A issues to manage, then focus your assessment on the chest. Always fully expose the chest to look for areas of bruising, wounds or flail segments (where broken ribs move in and out abnormally) (see **Figure 4-1**). This injury does not require immediate stabilisation, but must be carefully observed as it may easily become a time critical problem if it causes a considerable increase in respiratory rate or a significant fall in oxygen saturation.



**Figure 4-1: Chest flail segments.: multiple ribs broken in more than one place move independently of the rest of the rib cage and can seriously compromise breathing.**

### Listen

Listen to the casualty's ability to speak. If the casualty is unable to complete full sentences, then this should raise concerns and justifies a more thorough assessment. Consider the situation 'time critical' if the casualty can only speak a few words at a time or only in gasps.

Listen for any wheezing sounds or bubbling noises in the chest, which may indicate existing medical conditions such as asthma or heart failure. In trauma cases, these sounds may indicate serious chest injury and should be regularly reassessed. A stethoscope is not needed to listen to chest sounds; if these sounds indicate serious concerns, they will be easily seen or detected.

Additionally, listen for sucking sounds coming from chest wounds, where air may be entering or leaving a hole in the chest. These types of wounds require urgent care to create a one-way valve to stop air from entering the chest and getting trapped inside (see *Dressing Chest Wounds*, below).

### Feel

Ask if the casualty has any pain in the chest then, starting away from the pain, gently but thoroughly, feel over all **four areas of the chest wall** including the front, both sides and the back for any pain, abnormal sensations, movements (e.g., ribs moving inwards when the casualty breathes in) or wounds. Ideally the chest is fully exposed but in public for modesty this can be performed by exposing selected areas in turn, working around the chest but ensure that all areas including the back and armpits are fully explored (see **Figure 4-2**).



**Fig 4-2: exposure of the chest to look and feel for injuries in the 4 areas**





**Remember to always feel up and down the back of the chest  
and look for blood on your gloves**

If possible, log roll the casualty and examine the back directly. Examine the chest for equal movement on both sides; remember that the chest effectively has **four** sides (front, back and two sides). Gently place your hands on the front left and right sides of the chest and watch that the rise and fall corresponds with breathing. Carefully feel all over the chest and up into the armpits for wounds, areas of boggy swelling, or a crisp, crunchy sensation (like the crushing of fresh snow) which suggest serious chest trauma. If any of these characteristics are present, the casualty may quickly become time critical, so regular reassessment is crucial.

**Signs and Symptoms of Respiratory problems - 'Time critical'**

Signs and symptoms of respiratory concerns include:

- Extremely fast breathing (>20 breaths/min)
- Extremely slow breathing (<8 breaths/min)
- Grossly unequal chest movement when comparing both sides
- Badly deformed chest
- Open or "sucking" chest wounds

In RTACC we use the acronym '**R U IN SHAPE**' to assess the chest: this can be used even by those who cannot use stethoscopes or perform percussion.

**R** – respiratory rate

**U** – unequal chest movement

**IN** – injuries eg wounds, pain

**S** – Search the chest

**H** – Hands to feel all areas

**A** – Auscultate or listen (listen with stethoscope if trained – RTACC)

**P** – Percuss over chest (RTACC skill)

**E** – Everywhere (all four sides of the chest, top to bottom)

## Managing Respiratory problems

Extremely fast breathing ( $> 20$  breaths/min) may simply be due to pain or anxiety, but it may indicate a more serious concern such as chest injury, massive haemorrhaging, or head injury. Supplemental oxygen will not help the casualty who is in pain or anxious, but is essential for those suffering major trauma (see Chapter 3). Providers can use a pulse oximeter to assess the effectiveness of oxygen therapy. This may be the only therapy available to the BTACC provider facing a case of serious chest trauma. (Oximetry is unreliable in smoke inhalation/ CO poisoning)

Any trauma patient breathing at less than 8 breaths/min requires ventilation support with a bag-valve-mask device.

Extremely slow breathing ( $< 8$  breaths/min) may also indicate a serious problem. If the casualty has a decreased level of consciousness or is unresponsive, the responders should support the casualty's breathing by using a bag-valve mask with supplemental oxygen attached (see Chapter 3). Responders should aim to raise the casualty's respiratory rate to normal levels (12–14 breaths/min). For example, if the casualty is breathing at a rate of 6 breaths/min, the rescuers should provide 6–8 breaths/min.

## Dressing Chest Wounds

Open or “sucking” chest wounds (see **Figure 4-3**) indicate air passing in and out of the chest and the possibility of lung collapse. If available, a special dressing for this type of injury, known as an Russell or Bolin **chest seal**, should be applied (see **Figure 4-4**)



**Figure 4-3. Typical open chest wound which may be ‘sucking’ and should be dressed with a 3-sided dressing or a chest seal.**

If a chest seal is not available, a **three-sided dressing (Fig 4-5)** should be applied to the wound. To apply a three-sided dressing:

1. Place a square of non-porous material (such as plastic dressing packaging) over the wound.
2. Tape the dressing on the top and both sides using adhesive tape



3. Leave the bottom of the dressing free, to act as a one-way flap valve and allow any blood to drain out of the chest.

**Figure 4-4: Use of an Russell/Bolin chest seal.**



- a) Assess the chest wall and identify any open wounds (front, sides or back)



- b) Open the chest seal dressing pack



- c) Dry the area around the hole with the gauze swab in the pack to give the dressing the best chance to stick to the skin around the wound



- d) Peel off backing to expose adhesive side of chest seal and apply over the wound



- e) Ensure a good seal of the dressing. If it does not fully cover the wound or is not big enough then a sheet of cling-film or a damp saline soaked swab can be used

If there are multiple wounds or you have no seal then apply an improvised 3 sided dressing:

1. Place a square of non-porous material (such as plastic dressing packaging) over the wound.
2. Tape the dressing on the top and both sides using adhesive tape
3. Leave the bottom of the dressing free, to act as a one-way flap valve and allow any blood to drain out of the chest.

**Figure 4-5: improvised 3 sided dressing in place over a chest wound on the back** (arrow indicates the 'open' edge)



Chest seals and three-sided dressings act as one-way air valves, allowing air to leave the chest cavity without getting sucked back in. These dressings can help prevent more serious complications in the event of a lung collapse. Chest seals may also be applied to penetrating wounds and upper abdominal wounds, especially if a weapon entered the chest cavity.

Chest seals often will not stick to the chest wall effectively unless the chest is thoroughly dried before application. Regularly check that the dressing is still adherent. Manufacturers are working hard to produce alternative dressings which stick more effectively.

In some situations, more than one sucking wound may exist. Multiple seals or dressings should be placed on the casualty's wounds. If the casualty has a very large wound, single chest seals or dressings may not provide adequate coverage. In this case, air trapping in the chest is unlikely so providers can attempt to control any bleeding with dressings and keep the area free from contamination by foreign debris.

### Summary:

The look, listen, and feel approach is used to assess respiratory complications and should be repeated as part of reassessment.

- Look around all four sides of the chest for any wounds, bruising, or flail segments.
- Listen to the casualty's ability to speak and any wheezing or sucking sounds from the chest.
- Feel for any wounds, broken ribs, or signs of chest trauma.
- The following conditions are all considered time critical: extremely high or low respiratory rates, difficulty breathing, inability to complete full sentences, low oxygen saturation rates, penetrating chest wounds, fractures to the first or second ribs and gross chest deformity.
- Open or "sucking" chest wounds may indicate lung collapse and should be dressed with a chest seal or three-sided dressing.
- If a chest wound is too large for a single dressing then aim to control bleeding and keep the area clean.

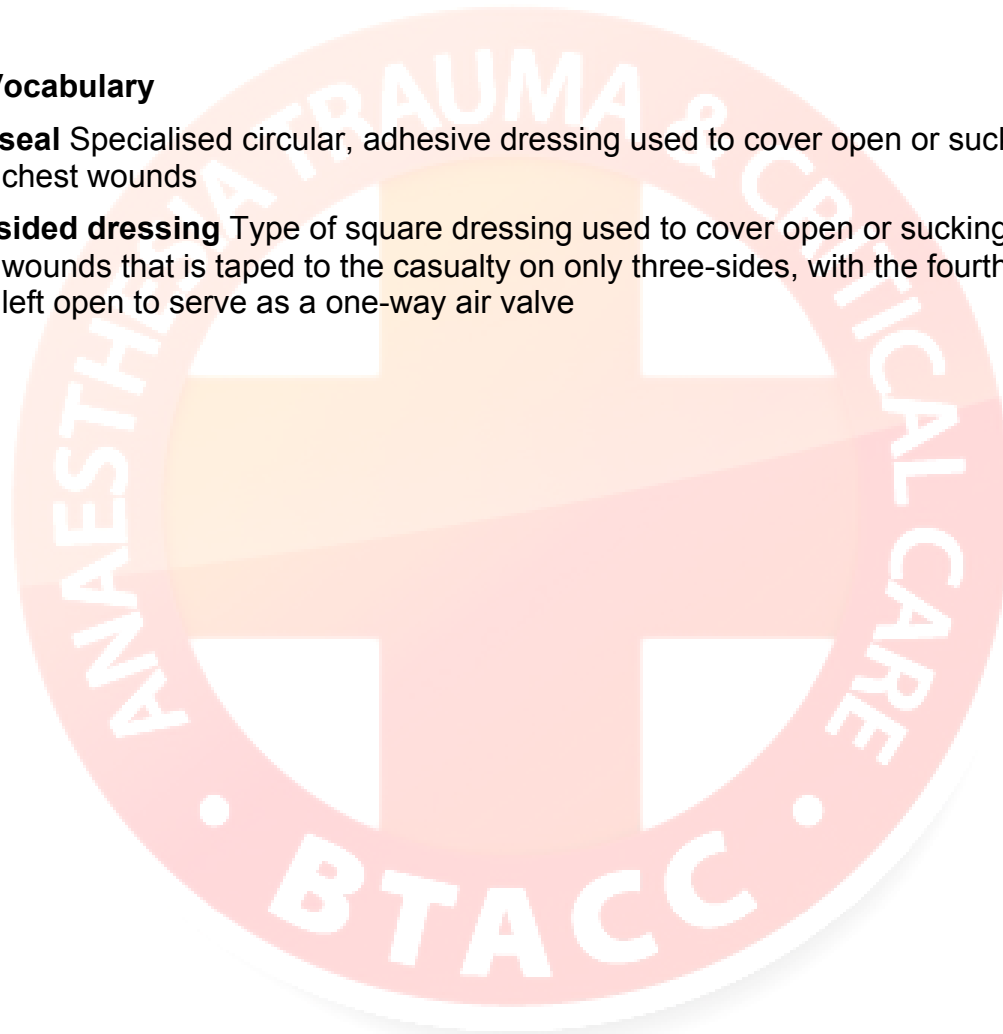
A casualty suffering major trauma with any of the following is considered time critical:

- Respiratory rate > 20 breaths/min
- Respiratory rate < 8 breaths/min
- Difficulty breathing
- Unable to complete full sentences
- Oxygen saturation less than 94% (or 88% with known underlying chest disease)
- Penetrating chest wound
- Fractures to first and second ribs
- Gross deformity to chest wall

### **Vital Vocabulary**

**chest seal** Specialised circular, adhesive dressing used to cover open or sucking chest wounds

**three-sided dressing** Type of square dressing used to cover open or sucking chest wounds that is taped to the casualty on only three-sides, with the fourth side left open to serve as a one-way air valve



## Check Your Knowledge

1. Which of the following is NOT a step in respiratory assessment?
  - a. Look for equal chest movement
  - b. Listen for “noisy” breathing
  - c. Look for head trauma
  - d. Feel for painful broken ribs
  
2. Respiration should be considered time critical if it is:
  - a. Less than 12 breaths/min
  - b. Less than 20 breaths/min
  - c. More than 12 breaths/min
  - d. More than 20 breaths/min
  
3. Which of the following conditions is NOT time critical?
  - a. Ability to talk normally without gasping
  - b. Oxygen saturation less than 92%
  - c. Difficulty breathing
  - d. Penetrating sucking chest wound
  
4. Which of the following should be applied to a sucking chest wound?
  - a. Asherman or Bolin chest seal
  - b. A chest tube
  - c. Four-sided dressing
  - d. No dressing should be applied
  
5. If a wound is too large to be covered, even with multiple dressings, you should:
  - a. Bandage around the chest
  - b. Put the casualty head down
  - c. Control bleeding with dressings and keep the area clean with cling-film
  - d. Wrap clothing or blankets around the wound

## Answers:

1) c

2) d

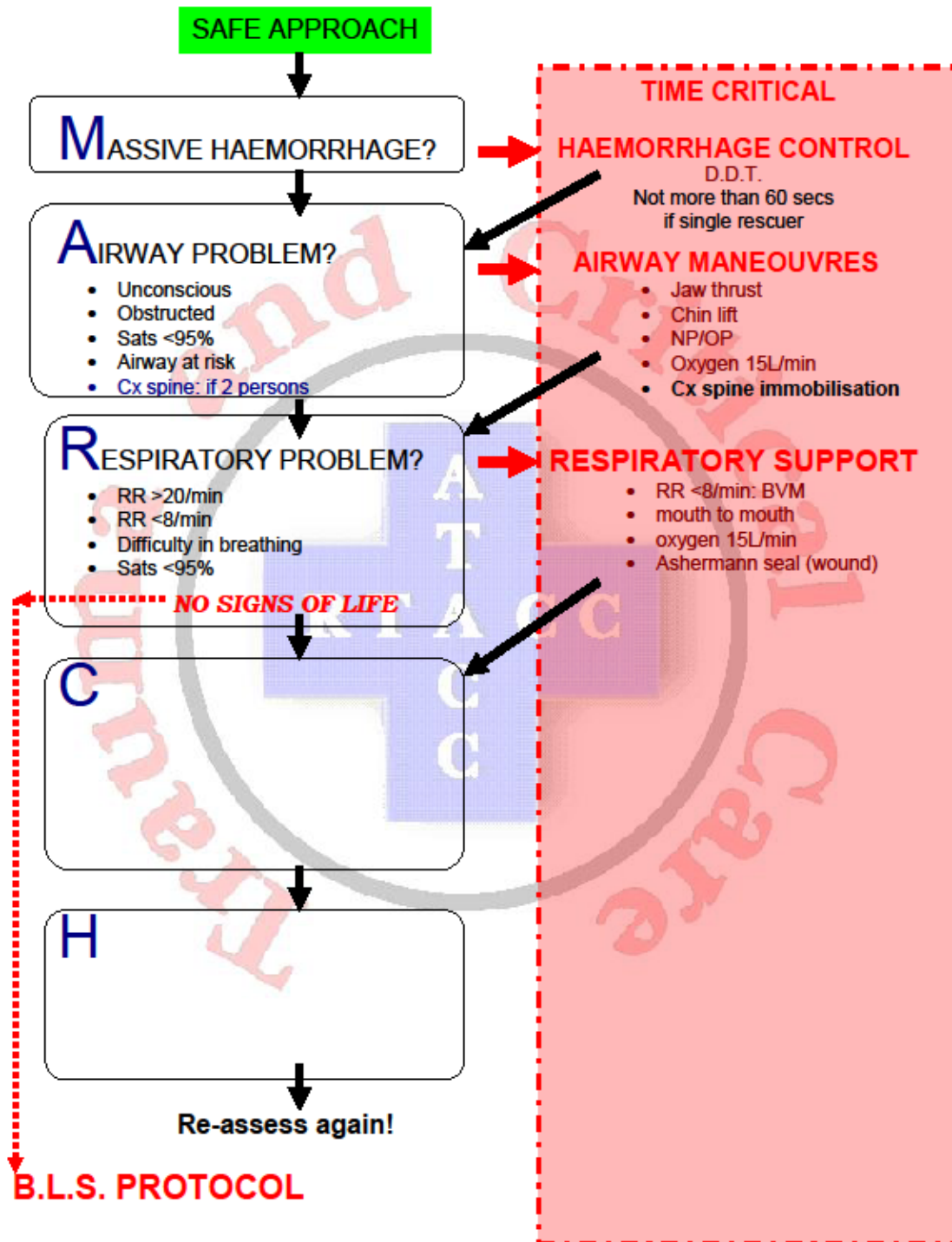
3) a

4) a

5) c

# BTACC Algorithm - RESPIRATORY

## BTACC ALGORITHM







## Chapter 5:

### C: Circulatory Management



#### Understanding Circulatory Concerns

Earlier efforts to control massive external haemorrhaging have taken steps to control any life-threatening external bleeding; if haemorrhaging cannot be controlled, the casualty may go into a state of shock. **Shock** is failure of the cardiovascular system in which the body is not getting the essential oxygen and substrates it needs to survive. Initially the skin is most affected, and eventually the essential organs such as the heart, brain, lungs and kidneys.

The total blood volume of an average adult is approximately five litres. As blood loss reaches 1000 ml, the casualty may show signs of shock. **Table 5-1** outlines the effect that significant blood loss can have on a healthy casualty. The true amount of blood lost may be difficult to estimate based on appearance alone; therefore efforts should be made to assess the casualty's consciousness, capillary refill time, and pulse rate to determine the extent of blood loss.

#### Signs and Symptoms of Blood Loss:

Amount of Blood Loss (in ml)	Signs/Symptoms
<500 ml	Little serious effect, light-headedness
1000–1500 ml	Shock, fast pulse rate, fainting, anxiety, restlessness, agitation
2000–2500 ml	Extremely fast pulse rate, breathlessness, confusion, reduced consciousness
> 3000 ml	Coma and ultimately death

Remember that massive blood loss can occur internally with minimal, if any, external signs. Significant volumes of blood can be lost with long bone fractures (especially in the lower leg) and pelvic injuries. When these injuries are suspected, efforts should be made to handle the casualty gently and immobilise the injured area to prevent further blood loss.

## Signs and Symptoms of Shock

Signs and symptoms of shock include:

- Changes in mental status
- Confusion, restlessness, or anxiety
- Cold, clammy, sweaty, pale skin
- Rapid breathing (as shock progresses, breathing may be rapid and shallow)
- Rapid, weak pulse
- Increased capillary refill time
- Nausea and vomiting
- Weakness or fainting
- Thirst

## Assessing Circulatory Problems

The indicators most commonly used to rapidly assess the circulation are consciousness, capillary refill time, pulses and pulse rate. These can be used in combination to get a reliable assessment of the circulation status:

### Consciousness

Consciousness is a reliable indicator of the severity of shock. If an adult casualty is conscious and fully oriented, then he or she is not in a significant state of shock. However, if the casualty appears confused or agitated, this may be an indication of shock, especially if there is no other obvious cause. Casualties in this state should be considered time critical. Severe confusion or unconsciousness may indicate severe shock and should always be considered time critical.

### Capillary Refill Time

Capillary refill time is the time required to restore blood to the capillary blood vessels after it has been squeezed out of the skin. Because many factors can affect capillary refill time, such as being cold, this indicator alone is not a reliable assessment tool. Capillary refill time should be considered in conjunction with other methods of assessing circulation, such as pulse rate and level of consciousness.

To check a person's capillary refill time, press your thumb on the patient's nailbed or forehead for five seconds. After releasing your thumb the colour should return to the area within two seconds, indicating appropriate blood circulation and volume. A prolonged capillary refill time is anything over two seconds and indicates a possible state of shock (see **Table 5-1**).

### Capillary Refill Time (Table 5-1)

State of Capillary Refill Time	Time Until Normal Colour Returns
Normal	<2 seconds
Prolonged (potentially time critical)	2–4 seconds
Significantly delayed (time critical)	>4 seconds

**It may be difficult to assess capillary refill time in situations with poor lighting, in cold environments, and on casualties with dark skin or severe burns.**

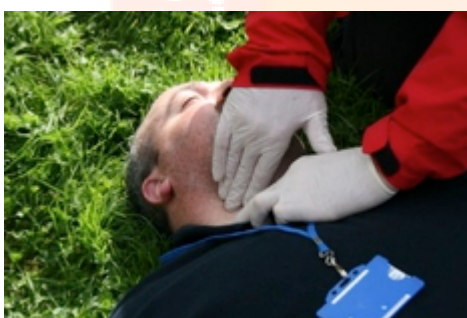
## **Pulses and Pulse Rate**

The **pulses** (pressure waves down an artery) are felt most easily where an artery runs over a bone eg radial pulse at the wrist but may be felt at many different locations on the body.

The most common pulse points used in trauma and resuscitation are the radial (wrist) (see **Figure 5-2**) and carotid (neck) (see **Figure 5-3**). In children, the brachial pulse (inside of the elbow) should be used (see **Figure 5-4**) (see Chapter 9).



**Figure 5-2. Radial pulse** Take the radial pulse if the casualty is conscious or you have successfully found a carotid pulse



**Figure 5-3. Feeling for the Carotid pulse on the right:** Take the carotid pulse if the casualty is unconscious or there is no radial pulse



**Figure 5-4. Locating the Brachial pulse:** here it is located under the fingers of the casualty carers left hand. This is often useful and easier to find in children.

To determine the pulse rate (if a pulse oximeter is not available or recording) find the patient's pulse with your fingers and count the number of beats for 15 seconds, then multiply by 4. In a normal adult, the resting pulse rate is 60–100 beats per minute. If the casualty appears unwell and the pulse rate is faster than 110 beats per minute or there is no detectable pulse, then this indicates a time critical situation.

**If no radial pulse is palpable then immediately feel for a carotid pulse.  
If the carotid pulse is absent and the casualty is unconscious then immediately commence chest compressions and life support (CPR).  
If in doubt then commence CPR in the unconscious casualty.**

**Signs and Symptoms of potential Circulatory problems include:**

- Pallor (pale skin)
- Cold, clammy skin
- Increased pulse rate
- Prolonged capillary refill time
- Loss of a radial pulse
- Confusion or coma

**Managing Circulatory Problems**

The BTACC techniques does not include the use of intravenous fluid replacement therapy (IV drips) and instead concentrates on the fundamental principle of 'circulation preservation' (preventing further blood loss), rapidly identifying the ongoing bleeding, signs of worsening shock, and using external haemorrhage control and **scoop-and-run** rapid evacuation (transport to hospital as quickly as possible) for time critical casualties. These actions are all simple, but potentially life-saving, measures which can minimise serious blood loss and considerable pain.

**Circulation Preservation**

Circulation preservation includes several key steps. The first is to ensure that massive external haemorrhage has been controlled. At this stage in the algorithm, providers should recheck the casualty for any massive external bleeding and use the DiD-iT technique of direct pressure, direct pressure, and tourniquet application to control bleeding (see Chapter 2).

**Gentle handling** is particularly important when massive internal haemorrhaging is suspected, as rough handling may dislodge blood clots which have plugged or reduced the bleeding.

Splinting and immobilising fractures (as outlined in Chapter 6) will also help preserve circulation and minimise blood loss.

**Elevation of legs: BTACC does not recommend elevation of the legs in major trauma unless pelvic and spinal injuries have been excluded.**

In such casualties, if there is no suspected head injury then once the casualty is on a long board a slight head down tilt can be used (raise leg-end of the board by 10-15cm eg a pillow under the end of the board) if they are feeling very faint, but this is rarely effective in major trauma and may just delay rapid transfer to a hospital.



## Identifying Signs of Worsening Shock

The casualty must be continually reassessed for any signs of ongoing blood loss or worsening shock. These signs include:

- Deteriorating conscious level
- Increasing pallor
- Cold, clammy skin
- Increasing breathing rate
- Increasing pulse rate
- Loss of palpable pulses
- Poor or no signal on the pulse oximeter

## Scoop-and-Run Evacuation

For BTACC providers Scoop-and-run, early and rapid evacuation is the currently recommended alternative to the 'stay and play' approach. The aim of providers should be to rapidly collect the casualty and transfer him or her to a hospital or equivalent as quickly as possible (see **Figure 5-5**). Offering advanced medical skills at the scene may delay transfer to hospital significantly and compromise the casualty. Under certain circumstances and with the correct team and equipment complex life saving procedures may be required before transfer, but these skills are beyond the realms of BTACC providers.



**Figure 5-5. Rescuers prepare the casualty for a rapid evacuation in the ambulance.**

**Whilst aiming for a rapid transfer, it is still very important to keep all movements smooth, controlled with gentle handling to avoid increasing bleeding or pain.**

## Summary:

- If bleeding is not adequately controlled, the casualty may go into shock.
- Signs and symptoms of shock include: changes in mental status; confusion or agitation; cold, clammy, sweaty, pale skin; rapid breathing; rapid, weak pulse; increased capillary refill time; nausea and vomiting; weakness or fainting; and thirst.
- The extent of blood loss is difficult to determine based on appearance alone.
- The human body contains about 5 litres of blood. The body compensates well for small amounts of blood loss (under 1000 ml) but large amounts may lead to shock.
- To assess the volume of blood lost, responders should examine the casualty's state of consciousness, capillary refill time, and pulse rate.
- Unconsciousness or severe confusion may indicate severe shock and should be considered time critical.

- To check a person's capillary refill time, press your thumb on the casualty's nailbed or forehead and squeeze for 5 seconds. If it takes more than 2 seconds for colour to return, this may indicate shock.
- The radial (wrist) pulse should be used for conscious casualties. The carotid (neck) pulse should be used for unconscious casualties. The brachial pulse (inside the elbow) should be used for infants and children.
- To determine the pulse rate, either use the pulse oximeter reading or find the patient's pulse with your fingers and count the number of beats for 15 seconds, then multiply by 4.
- In a normal adult, the resting pulse rate is 60–100 beats per minute. More than 110 beats per minute or less than 40 beats per minute indicates a time critical situation.
- The BTACC method does not include the use of intravenous fluid replacement therapy (IV drips) and instead concentrates on circulation preservation using assessment, DiD-iT, gentle handling of the casualty, and immobilising the injured area.
- Providers should examine casualties for signs of worsening shock.
- Rapid, scoop-and-run evacuation is also critical in managing circulatory concerns.

### Vital Vocabulary

**capillary refill time** The time taken for the circulation to return to the capillary blood vessels in the skin after it has been squeezed out by the rescuer

**shock** Failure of the cardiovascular system in which body is not getting the essential oxygen and substrates it needs to survive.

**pulse** The wave of pressure created by the heart as it contracts and forces blood into the major arteries and around the body.

## Check Your Knowledge

1. Why is estimating the volume of blood loss not a reliable assessment tool?
  - a. It is difficult to estimate volume based on appearance alone.
  - b. The total amount of blood volume varies greatly from person to person.
  - c. The source of the blood loss is the major factor rather than the volume.
  - d. A casualty who is very cold will lose less volume.
  
2. If circulation is not preserved, then the patient may:
  - a. Develop a slow pulse rate.
  - b. Always be stabilised with intravenous fluids.
  - c. Become shocked
  - d. Have fewer problems in hospital.
  
3. Which of the following assessment tools should be used to assess circulation?
  - a. The casualty's ability to speak
  - b. Capillary pulses
  - c. Presence of heart sounds
  - d. Conscious level
  
4. Which of the following capillary refill times indicates circulation of a normal volume and status?
  - a. > 2 seconds
  - b. < 2 seconds
  - c. > 4 seconds
  - d. < 4 seconds
  
5. Which pulse should be examined first for conscious, adult patients?
  - a. Carotid pulse
  - b. Radial pulse
  - c. Brachial pulse
  - d. There is no need to check the pulse rate of a conscious patient.

## Answers:

1) a

2) c

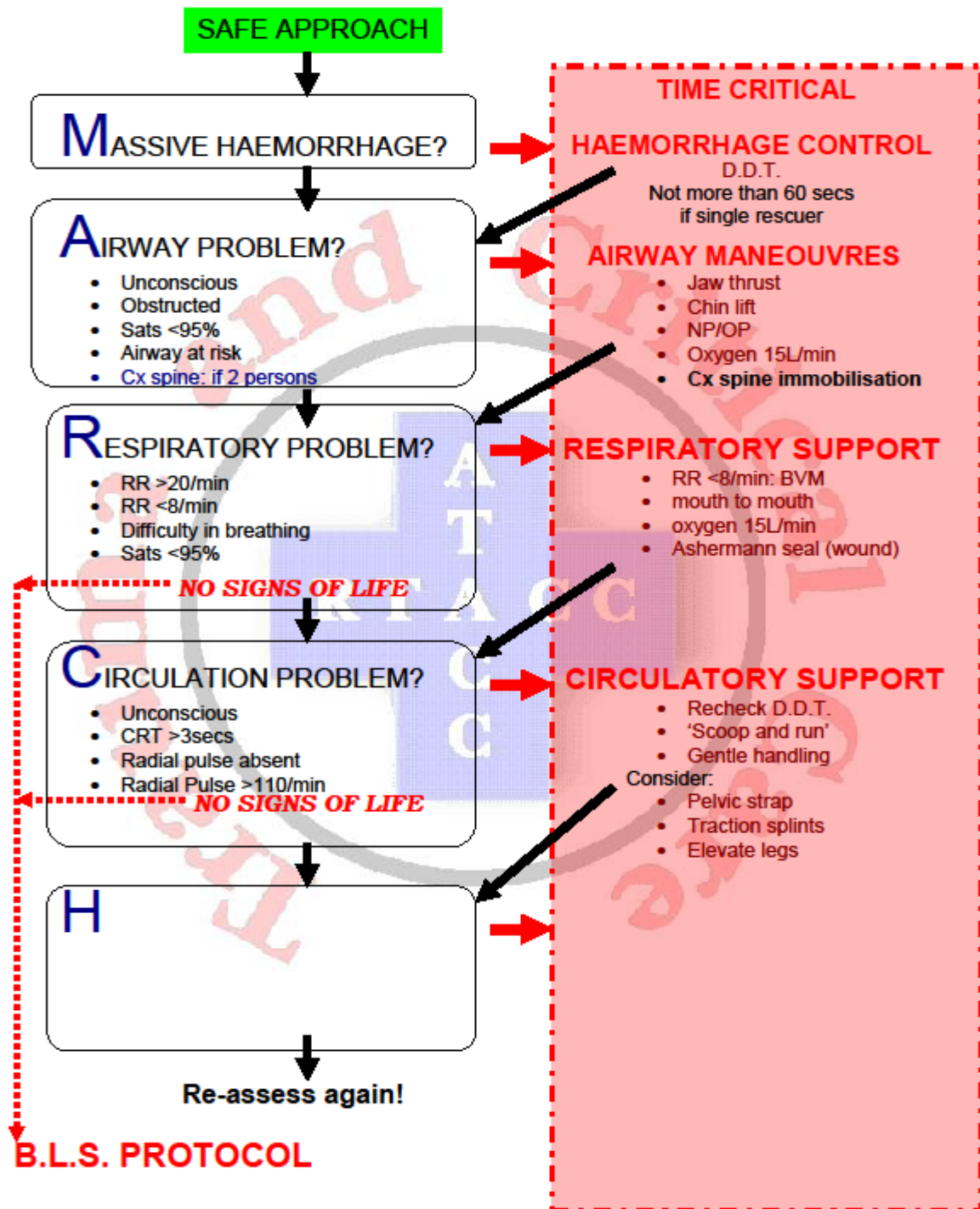
3) d

4) b

5) b

# BTACC Algorithm - CIRCULATION

## BTACC ALGORITHM



## Chapter 6:

### H: Head Trauma and Other Serious Injuries

(Includes head, spinal, fractures, abdominal, burns, pain)



The last step in the MARCH algorithm addresses head trauma and other serious injuries which include spinal injuries, fractures, abdominal injuries, burns, smoke inhalation, and carbon monoxide poisoning. When appropriate, responders should perform a full-body examination of the casualty to determine the presence of any trauma or injuries. Always try to maintain a high level of respect for the casualty's dignity in performing this assessment and take the necessary precautions to prevent heat loss during the examination.

### Head Trauma

Head trauma is a common cause of death or long term disability. Responders aim to prevent or limit further damage after the initial injury as a result of problems such as an obstructed airway, lack of oxygen, dangerously low blood pressure, or falling conscious level.

#### Signs and Symptoms of Head Trauma

Signs and symptoms of head trauma include:

- Reduced level of consciousness
- Wounds or obvious deformity to the head
- Watery fluid coming out of the ears or nose
- Enlarged pupil in one eye (usually a serious sign)
- Combativeness or other abnormal behaviour
- Seizures
- Low respiratory rate (< 8 breaths per minute)

It is essential to detect any changes in a casualty's level of consciousness, as this can indicate the severity of any injury to the brain. By using the **AVPU scale**, a



responder can ascertain the extent of injury and any improvement or deterioration in the casualty's condition.

**'AVPU assessment table:**

Assessment	Response commands	
A	Alert	
V	Responds to verbal	
<b>P</b>	<b>Responds to pain</b>	<b>Time Critical</b>
<b>U</b>	<b>Unresponsive</b>	<b>Time Critical</b>

For casualties who are 'A' or 'V', attempt to keep the casualty talking to continually reassess consciousness.

**All casualties that are 'P' or 'U' should be considered time critical**

For time critical casualties, rescuers should provide effective supportive measures such as providing supplemental oxygen, maintaining an open airway, ensuring adequate respiration, preserving circulation, and arranging for rapid transfer to hospital.

There is little more that rescuers can do to manage traumatic brain injuries, but any delays increase the risk of a poor outcome. Current UK standards aim to have all head trauma casualties in hospital for a CT scan within 1 hour from the time of injury and, if required, in a specialised neurological unit within 4 hours.

**Consider all casualties with head injury to have a neck injury until they can be clinically cleared or assessed and examined in hospital.**

If a casualty is suffering from a concussion, the casualty will be conscious but may be impaired, confused, or dizzy. These mild head injuries typically do not cause any long term damage to the brain but may be unnerving for the casualty or those with him, especially if memory of the incident is lost. Responders should assess the casualty using the AVPU system and, if alert, may permit a responsible adult or relative to monitor the casualty noting that if the casualty develops a headache, nausea, vomiting or blurred vision, he or she should be taken directly to hospital. Any sports players with concussions should cease playing until reviewed by a medical professional. If the conscious level is falling then call an ambulance.

## Spinal Injury

A spinal injuries can have catastrophic consequences including paralysis of limbs or even the inability to breathe effectively. However, if effectively managed then further damage can be avoided

The spinal cord extends from the base of the brain to the lower back and is protected by the vertebral column which is comprised of 33 individual bones called vertebra (see **Figure 6-1**) which extend from the neck through the chest and back to the base of the spine. Injuries to the spine may involve fractures to any of these vertebra or damage to the delicate spinal cord and nerves that they enclose. However, direct blows, penetrating injuries, or excessive bending can damage the spine, causing catastrophic consequences including the inability to breathe or paralysis of limbs.



**Fig: 6-1: 3 views of the human spine. Note that it is not straight but actually has several natural curves. As a result the long-board is not an ideal ‘spine protector’ and should be more as an extrication tool and splint**

To identify spinal injury, consider the kinematics of the incident—ascertain what has happened to the casualty (e.g., ejection from a vehicle) and for any clues at the scene (e.g., cracked windscreen). Injuries to the spine are more common in the following situations:

- Rapid deceleration (e.g., fall from height, road traffic collision)
- Direct blows to the head, neck, or back
- Injuries close to the spine (e.g., penetrating stab wound)
- Extreme twisting or traction injuries to the head, neck, or back
- Injuries resulting in unconsciousness

***Always consider pelvic injury if any spinal injury is suspected.***

All casualties with signs or symptoms of spinal injury should be considered time critical. A spinal injury can have catastrophic consequences including paralysis of limbs or even the inability to breathe effectively.

### **Signs and Symptoms of Spinal Injury**

Signs and symptoms of spinal injury include:

- Sharp, severe neck or back pain
- Limited mobility of the neck
- Feelings of “pins and needles”
- Numbness or weakness of the arms or legs
- Deformity of the back
- Abnormal posturing
- Unconsciousness
- Paralysis or weakness
- Loss of bladder or bowel control
- Persistent penile erection
- Unexplained signs of shock

To manage spinal injuries, rescuers in the field should focus on preventing further injury. This is especially important when the back is broken but the spinal cord still appears undamaged (that is, the casualty has no abnormal sensations or weakness).

Spinal injuries can only be managed effectively with two or more rescuers. A single rescuer can do little alone to manage a spinal injury and should concentrate on haemorrhage control, airway, respiration and circulation. If two or more rescuers are present and spinal injury is suspected, then the cervical spine should be manually immobilised immediately after the airway is secured (see Chapter 2).

**If you suspect or identify a spinal injury at any level then immobilise the entire spine**

The spine should not be immobilised if any of the following conditions are present:

- Immobilisation of the spine would obstruct or prevent airway management.
- The patient forcibly refuses to be immobilised.
- The trauma is only very minor or isolated (e.g. a limb injury).
- A clinician has effectively “cleared” the cervical spine.

**If you are unsure about the presence of a spinal injury, then be cautious and fully immobilise the entire spine.**

To immobilise the spine requires the following equipment:

- Adjustable **cervical collar**
- Bilateral head blocks with chin and forehead tapes
- Longboard

If collars and blocks are not available then SAM splints, fluid bags, sand bags, or folded cardboard may be used as improvised alternatives.

To immobilise the spine, first gently move the spine into a neutral position by straightening the neck, if it is not already in its normal forward-facing position. However, if this adjustment results in pain or numbness or the neck does not move easily to accommodate a cervical collar, then immobilise the spine in its current position without the collar (see **Figure 6-2**).



**Figure 6-2. Manually Immobilising a cervical spine, taking care not to cover the casualties ears**

For motorcyclists wearing helmets, the helmet should be removed in a controlled and deliberate fashion if it inhibits exposure of the patient or hinders the provider’s efforts at airway stabilisation. Only providers who are familiar with the procedure should attempt helmet removal. At least two providers are necessary—one to stabilise the head and perform removal, and the second to maintain manual in-line stabilisation of the patient’s head and neck during the procedure. The helmet should be retained, and any dents or abrasion to its surface should be noted. Until proven otherwise, always assume the presence of a cervical spine injury.

The cervical spine can should manually immobilised until the hard collar and straps and blocks are in place.

**Fig 6-3: Manual immobilisation in a car  
(take care to avoid the eyes or covering the ears wherever possible)**



To apply a hard collar it must be sized according the manufacturers recommendations and then adjusted to fit before application (**Fig 6-4**)



**Fig 6-4 a,b,c: sizing and application of a hard collar in an RTC victim**



**Fig 6-4 d,e: fastening the collar & re-applying oxygen with head still supported manually**



For extrication, longboards can be used to serve as immobilisation devices. Casualties can be moved to a longboard using a log-roll technique or with the assistance of an orthopaedic (scoop) stretcher or similar device.

**Log-rolling** is easy to accomplish, but it usually requires a team of four responders for safety and effectiveness. Because there is often insufficient space for four rescuers to work, it is not always possible to perform this manoeuvre correctly, therefore the principles of movement (rather than specific rules) are stressed here.

The procedure for the four-person log roll includes:

1. **All rescuers get into position to roll the patient.**
2. **One Rescuer (usually holding the head) gives the command and the rescuers roll the patient onto his or her uninjured side.**
3. **The fourth person checks the back for wounds and deformity then slides the longboard toward the patient.**
4. **Once Rescuer gives the command, rescuers roll the patient onto the longboard.**
5. **Centre the patient on the longboard with a 'v' manoeuvre if necessary**
6. **Secure the patient before moving the longboard.**

In any patient-movement technique, and especially if spinal injury is suspected, everyone must understand who is directing the manoeuvre. The rescuer holding the patient's head (Rescuer One) should always give the commands so that all rescuers can better coordinate their actions. The specific wording of the command is not important, as long as every team member understands what the command is. Each member of the team must understand his or her specific position and function.

All patient-movement commands have two parts: a question and the order for movement. Rescuer One says, "The command will be 'Roll!'" When everyone appears ready to roll the patient, Rescuer One asks "Is anyone not ready?" (followed by a short pause to allow for response from any team member). Rescuer One will then command, "Ready, brace, roll!"

Always try to move the casualty as one unit and keep the patient's head in a neutral position at all times. Do not allow the head to rotate, move backward (extend), or move forward (flex). Sometimes this is simply stated as, "Keep the nose in line with the belly button at all times."

**Always fully immobilise the body on the long-board BEFORE strapping the casualty's head into head blocks on the board**

Once the casualty is immobilized, immediate evacuation and transfer should be initiated. En route, the casualty should be continually assessed and monitored, and reassurance given due to the restrictive nature of the longboard immobilisation equipment.

## Fractures

Fractures (broken bones) may be painful, and often unpleasant to look at, but they are rarely fatal. However, they may produce serious consequences such as internal or external bleeding. If the bones break the skin, then this is described as a



compound or open fracture and is likely to produce more external bleeding and a considerably greater risk of infection.

Fractures may damage adjacent blood vessels and nerves, which may create a time critical situation or could lead to a long term disability. Additionally, fractures may indicate severe trauma or injury, especially with rib fractures which may puncture the lungs or with pelvic fractures which may involve massive blood loss. Dislocations and other soft-tissue injuries may be as painful as fractures, but they are less likely to be time critical. These signs and symptoms of fractures can also be seen in dislocation, and the management is effectively the same.

### Signs and Symptoms of Fractures

Signs and symptoms of fractures include:

- Pain at the site of injury
- Deformity
- Bruising
- Swelling
- Inability or unwillingness to move the injured body part
- Loss of pulses in the affected limb
- Crepitus or grating sensation if bone ends move against each other
- Nausea and/or vomiting

Fractures should be immobilised by **splinting**. Splinting limits movement, reduces pain, helps control bleeding, and decreases the risk of damage to the nearby nerves and vessels.

Many different materials can be used as splints. Commercially available splints offer the best support and come in different types and sizes. If a commercial splint is unavailable, improvised splints such as pieces of wood or folded cardboard can be applied with good results.

Simple yet effective, commonly available commercial splints are SAM splints—flexible aluminium sheets covered by foam which can be moulded to fit any shape limb or injury (see **Figure 6-5**). Other rigid splints are made from firm material and applied to the sides and back of a limb, creating a gutter for the injured limb to be secured in. Vacuum splints are very popular with some groups and organisations (see **Figure 6-6**). Once applied and the air drawn out, these splints conform to the injured limb extremely well and provide a high degree of immobilisation. They are very good for spinal injuries but are bulky and can be torn or punctured. Inflatable splints are not as effective or widely used in the UK. Alternatively, a simple bandage and sling may be used for upper arm injuries (see **Figure 6-8**).



**Fig 6-5; multiple use of a malleable SAM splint and a crepe bandage**



**Fig 6-6; Use of a Vac-splint to immobilise a neck that cannot be moved into a neutral position for application of a hard collar**

A large vacuum mattress would allow us to immobilise the whole spine in this manner and is useful if normal alignment is not possible or there is serious deformity of the back

**Avoid turning or rolling casualties with fractures onto the side of the injury if at all possible.**

**Fig 6-7. Simple use of a triangular bandage to form a sling for injured arm immobilisation**



While certain fractures require specialised splinting techniques (outlined below), splinting usually follows the same general principles:

1. Ideally do not move the casualty before splinting, unless there is an immediate danger to the casualty or the responder.
2. Remove clothing from the injured limb to inspect for open wounds, deformity, swelling, bruising, and capillary refill.
3. Note and record the pulse, capillary refill time, and sensation in the injured limb below the site of injury or fracture, both before and after splinting.
4. Cover all open wounds with a non-adhesive, absorbent dressing before applying the splint.
5. Immobilise the joint above and the joint below the injury site.
6. Pad all rigid splints.
7. When applying the splint, use your hands to support the injury site and minimize movement of the limb until splinting is completed.
8. Splint the limb in the position in which it is found, unless it is easy to align or necessary for extrication.
9. When in doubt, splint.
10. Recheck distal circulation below the site of injury.

**Splinting should not delay transfer to hospital by more than a few minutes and can sometimes be done en route**

With a long bone fracture (e.g., thigh or lower leg), ideally immobilise the bone using a traction splint such as a Kendrick traction device, if they are carried by your service. Alternatively, pad between the legs and fasten them together at multiple levels or use a flexible SAM splint bandaged to support and immobilise the fracture.

If major fractures of the lower limbs are present then always consider the need for pelvic strapping and spinal immobilisation as well.

**Fig 6-8 :Applying a Kendrick Traction splint for the lower leg**



a) Attaching the hip strap



b) adjusting the pole to length



b) Inserting pole in hip strap socket



d) Attaching ankle strap (well beyond foot)



e) Attach Traffic light straps (RYG)



f) Traction to foot then pull straps

**After application check for foot pulses, and capillary refill in the toes if they are now absent then consider releasing the traction and see if it improves.**



If a traction splint is not available then a simple box splint can be used to support lower leg fractures or simply fastening the legs together at multiple levels, using the good leg as an effective splint.

Any degree of immobilisation will greatly reduce the pain of the injury and also the amount of bleeding from an unstable fracture.

For rib fractures, responders should be careful to handle the casualty gently and continually reassess for developing respiratory concerns. If the casualty is experiencing difficulty breathing, unless there is a likely spinal injury then responders should move him or her into a sitting position and provide supplemental oxygen. Strapping the chest is not recommended as it may restrict breathing, although some casualties may find relief in holding the ribs themselves, as if hugging themselves.

Pelvic fractures require special treatment, since these injuries often involve severe blood loss because the broken bones can easily lacerate the large blood vessels that run directly adjacent to the pelvic bones.

If pelvic injury is suspected from the kinematics or pain/deformity, then the pelvis should be immobilised. We do not press on or 'spring' the pelvis as has often been described in trauma courses as this may tear vessels or disrupt blood clots and risk a life threatening bleed.

To stabilise the pelvis, apply a broadly folded triangular bandage or pelvic/frac strap around the hips and fasten firmly but not overly tight (see **Figure 6-9**). The strap is passed behind the knees or lower back and then moved into position with a side to side 'sawing action'. Try not to lift or move the pelvis during this process. The correct position is below the waist at the level of the hips (top of the femurs/thigh bones).

Apply an additional strap around the feet and ankles to keep them together (figure of '8' strapping is ideal)

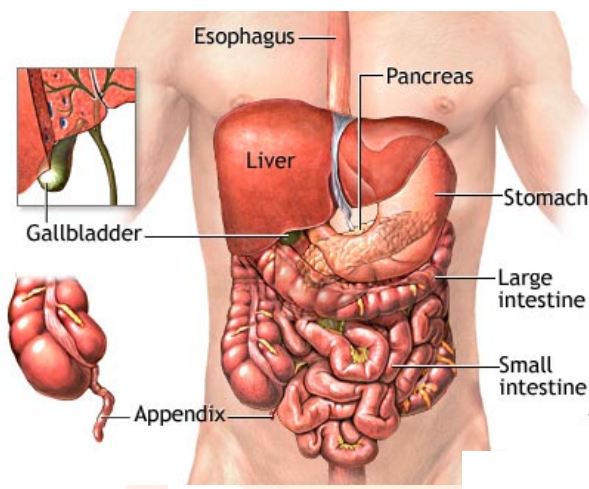


**Fig 6-9; Application of a pelvic or frac-strap for suspected pelvic fracture**

**Do not "spring" or manually assess for pelvic instability or movement, as this can produce life threatening bleeding.**

## Abdominal Injury

The abdomen lies between the chest and the pelvis and contains the intestines, stomach, liver, kidneys, pancreas, and the spleen (see **Figure 6-10**). Injuries to the abdomen can have serious consequences such as major bleeding and perforation of the bowels.



**Fig: 6-10: Organs in the abdomen**

To recognise an abdominal injury, consider the kinematics of the situation (e.g. stabbing or blunt abdominal trauma) and look for any signs such as wounds or external bruising.

Signs of internal bleeding may not be initially obvious eg. abdominal distension is quite a late sign and can be unreliable. Internal bleeding is more likely to be detected by developing signs of shock and blood loss with no obvious signs of external bleeding.

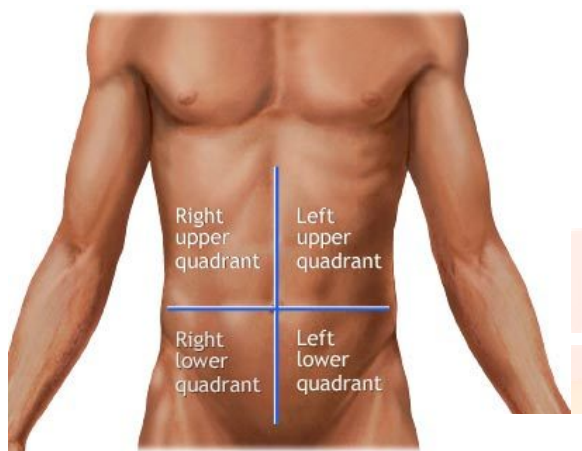
The kinematics of the situation may be the best indicator to alert rescuers as to the possibility of internal bleeding.

To examine a casualty for abdominal injury:

1. Try and lie the casualty flat if possible
2. Explain what you are going to do to the casualty
3. Expose and visually inspect the abdomen.
4. Ask the casualty if they have any pain anywhere
5. Look around the sides of the abdomen.
6. Feel along the back on each side of the abdomen, checking for wounds or bleeding.
7. If the patient is conscious, starting away from any painful area, apply gentle pressure with the flat of your hand in each of the four quadrants of the abdomen (see **Figure 6-11**) asking the casualty if this causes pain or discomfort, looking for any complaint of pain or grimacing on the casualty's face.



If there is no significant discomfort then repeat the examination a second time, pressing a little more firmly, keeping your fingers flat on the abdominal wall.



**Fig 6-11: 4 Quadrants of the abdomen to examine**

### **Signs and Symptoms of Abdominal Injury**

Signs and symptoms of abdominal injury include:

- Abdominal wounds
- Bruising on the abdomen
- Abdominal pain
- Broken lower ribs
- Blood in vomitus
- Bleeding from the anus or urinary tract.
- Distension (bloating of the stomach)

Little can be done to care for abdominal injuries on scene, but recognition is very important, as massive internal haemorrhaging can lead to shock. Rapid transfer to hospital is essential.

Any efforts to treat abdominal injury should not delay transfer. When abdominal wounds are present and time permits, efforts can be made to control external haemorrhaging with simple pressure dressings, chest seals, or—for larger wounds—cling-film.

If any abdominal contents have eviscerated (spilled out of the wounds), they can be gently covered with cling-film or saline-soaked swabs.

**Handle and move any casualty with a possible internal injury or bleeding gently to minimise the bleeding and discomfort. Consider a pelvic strap before any movement if necessary**

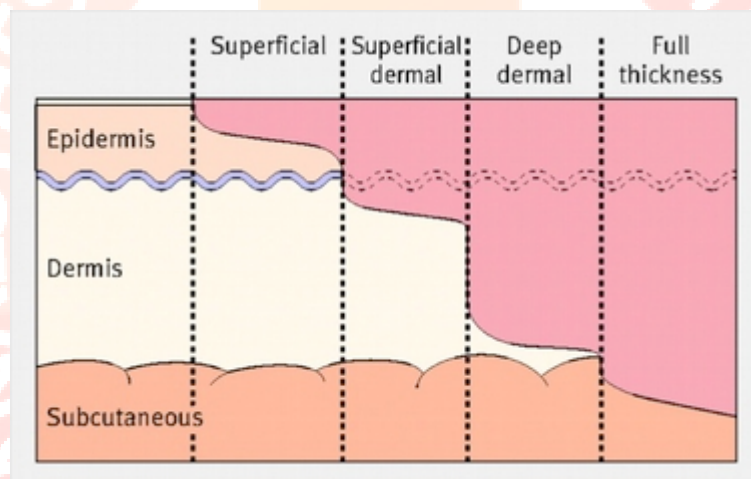
## **Burns**

Burns can vary from minor redness to a life-threatening situation, depending on the depth of the burn (see **Figure 6-13**).

**Superficial burns** (first-degree burns) are the most minor type of burn and are characterised by reddened and painful skin. The injury is confined to the outermost layers of skin, and the casualty experiences minor to moderate pain. An example of superficial burn is sunburn, which usually heals in about a week, with or without treatment.

**Partial-thickness burns, dermal** (second-degree burns) are somewhat deeper but do not damage the deepest layers of the skin. Blistering is present, although blisters may not form for several hours in some cases. There may be some fluid loss and moderate to severe pain because the nerve endings are damaged. Partial-thickness burns require medical treatment and usually heal within 2 to 3 weeks.

**Full-thickness burns** (third-degree burns) damage all layers of the skin. In some cases, the damage is deep enough to injure and destroy underlying muscles and other tissues. Pain is often absent because the nerve endings have been destroyed. Without the protection provided by the skin, patients with extensive full-thickness burns lose large quantities of body fluids and are susceptible to shock and infection.



**Fig 6-13: diagram to describe depth of skin burns**

**All burn patients should receive high flow oxygen to meet the body's increased metabolic demand for oxygen, avoid confusion, agitation, and combat the effects of any carbon monoxide poisoning.**

It is not always possible or necessary to determine the exact degree or depth of a burn. Burns should be always considered time critical if they:

- Cover more than 10% of an adult's body surface area or more than 5% of the body surface area of a child (under 16 years) – **casualty hand = approx 1%**
- Involve a paediatric or elderly casualty
- Involve a casualty with other serious medical or trauma conditions
- Involve the face, hands, feet, genitalia, perineum or major joints
- Are above the shoulders
- Are circumferential ( i.e. go all the way around a limb or body part)
- Are electrical or chemical burns
- Involve fumes or smoke
- Affect the airway

For time critical burn patients, rapid transport is essential.

Burns are also categorised by the source of the injury: thermal, chemical, and electrical. The signs, symptoms, and treatment of each type vary, as outlined in the following sections.

## Thermal Burns

Thermal burns are the result of direct contact with flames or thermal energy (heat) on the skin or tissue. Superficial thermal burns may cause redness and moderate pain. Partial-thickness burns can cause blistering on the skin and severe pain. In full thickness burns, tissues look rubbery, yellow, or brown and do not bleed. They are often less painful than superficial burns as many of the nerve endings have been destroyed.

In all types of thermal burns, treatment should aim to limit the damage caused by the thermal energy. This involves actively cooling the injured area to dissipate the energy which can remain even after the direct heat source has been removed. Place the injured area under clean, cold running water as soon as possible for at least 10 minutes and then dress the burn once it has cooled completely (see **Figure 6-14**). Covering the burns with burn-film (or ordinary cling-film if nothing else is available) keeps the area clean, reduces fluid loss, and reduces pain by covering the exposed nerve endings. Never wrap or wind dressings around a limb, always lay strips lengthways. If the limb starts to swell, the dressing will not constrict the limb.

**Figure 6-14.** Burns are covered with burn-film and plastic bags containing a few millilitres of saline eyewash for the hands and feet.



**Remember cool the burn effectively for 5-10 minutes but avoid significant hypothermia if the burn is extensive**

## Chemical Burns

Chemical burns result from contact with a caustic or corrosive substance or a substance that reacts with moisture on the skin to generate heat. Every effort should be made to identify the chemicals involved to determine the most appropriate form of treatment, as certain chemicals, such as sodium phosphorous may react negatively with water producing more heat.

All chemical powders should be brushed off the patient's clothing or skin, carefully avoiding coming into contact with this substance yourself. After you have removed as much of the dry chemical as possible, irrigate the burned area with clean, cold running water. The water washes off remaining chemical residue and residual thermal energy. Flush the affected area for at least 30 minutes. Once it has been decontaminated effectively, cover the area with a burn-film dressing (if there is

obvious residual chemical on the skin, then avoid dressings) and provide rapid transport to hospital.

## **Electrical Burns**

Electrical burns result from direct contact with a live electric source. Even small electrical burns can cause a large amount of tissue damage and a great deal of pain. With electrical burns, there is added risk of cardiac arrest, which requires immediate basic life support and defibrillation (see Chapter 7).

Before treating an electrical burn, always ensure that the scene is safe and that you are adequately protected from the electrical source. Before you touch or treat a person who has suffered an electrical burn, be certain that the casualty is not still in contact with the electrical power source which caused the burn. If the casualty is still in contact with the power source, anyone who touches him or her may be electrocuted. If the casualty is touching a live power source, your first act must be to unplug, disconnect, or turn off the power. If you are unable to do this alone, call for assistance and stand clear until help arrives.

After the power has been disconnected, examine the casualty carefully, assessing airway, respiration, and circulation before treating visible, external burns. If there is obvious thermal injury (e.g., flames or blistering), then the area may be cooled with water only when there is no risk of contact with electricity. However cooling is less effective in these burns and the wounds should be rapidly dressed with burn-film before immediate transfer to hospital.

**Even small electrical wounds can hide major tissue injury, or result in cardiac injury so all electrical burn casualties should be referred to hospital.**

## **Smoke Inhalation**

Anyone exposed to fire, smoke, or hot gases is at risk of inhalation injury to the lungs and upper airway. In these incidents, the airway can become dangerously swollen and the lungs can become congested with soot and water which is released as a reaction to the damage of the delicate lining of the lungs.

### **Signs and Symptoms of Inhalation Injury**

Signs and symptoms include:

- Airway injury: redness or soot around or inside the nose/mouth
- Coughing: especially with sooty sputum
- Wheezing
- Difficulty breathing
- Presences of fire, smoke, or hot gases at the scene

To treat casualties with inhalation injuries, first move the casualty a safe distance from the scene then assess the casualty in a sitting position, unless he or she shows signs of reduced conscious level, in which case they may be safer lying down in the recovery position until an ambulance arrives.

Administer oxygen through a non-rebreathing mask. Consider inserting a nasal airway if the airway is starting to swell or there are significant burns above the shoulders.

## **Carbon Monoxide Poisoning**

Carbon monoxide binds to the haemoglobin in blood and prevents the normal carriage of oxygen. High levels of carbon monoxide can result in coma and death within minutes. Victims may exhibit flu-like symptoms and reduced levels of consciousness but they still appear 'pink' as the carboxy-haemoglobin is cherry red.

Carbon monoxide poisoning may result from the following scenarios:

- Defective domestic gas appliances such as boilers (most common after the onset of inclement weather when these appliances are first turned on)
- Short exposure to fires or smoke in a closed environment
- Prolonged exposure to fire in any environment
- Fuel-driven engines in a confined space
- Contaminated compressed gas cylinders (e.g. divers)

House fires may also release other toxic gases such as cyanide compounds which can be fatal. Fires in enclosed tunnels, sewers, silos, or hoppers may also involve methane and carbon dioxide which greatly reduce oxygen levels. In any of these situations, responders should be extremely cautious to ensure a safe approach before entering the scene. Even a few breaths in a toxic environment can be dangerous, so responders should always ensure the area is well ventilated or wear appropriate breathing apparatus.

## **Signs and Symptoms of Carbon Monoxide Poisoning**

Signs and symptoms of fractures include:

- Reduced level of consciousness
- Headache
- Dizziness
- Poor coordination and/or balance
- Blurry or double vision
- Abnormal, involuntary eye movement (nystagmus)
- Ringing in the ears
- Shortness of breath
- Chest pain
- Diarrhoea (especially in children)

**Casualties with carbon monoxide poisoning should be given high-flow oxygen (15 L/min). Do not reduce the flow, even if pulse oximeter readings are high, as this condition may cause inaccurate readings.**

To treat casualties with carbon monoxide poisoning, responders should administer supplemental high flow oxygen to displace the carbon monoxide from the haemoglobin. Severe cases (including casualties with a history of reduced conscious level or neurological symptoms and pregnant or paediatric casualties) may later require referral to a medical hyperbaric unit.



**Any casualties brought from a fire or enclosed environment with a reduced conscious level should be given high-flow oxygen, assumed to have CO or Cyanide poisoning and be rapidly transported to hospital.**

### **Summary:**

- The last step in the MARCH algorithm addresses head trauma and other serious injuries which include spinal injuries, bone fractures, abdominal injuries, and burns.
- Treatment of head injuries in the field focuses on preventing further damage.
- The AVPU scale is used to assess casualty responsiveness.
- Head trauma casualties must be transported to hospital rapidly.
- All casualties with signs or symptoms of spinal injury should be considered time critical.
- While there are certain situations in which the spine should not be immobilised, responders should fully immobilise the spine if there is any doubt.
- Longboards can be used for extrication and immobilisation. A casualty should either be placed on the longboard by logrolling or with an orthopaedic (scoop) stretcher.
- Fractures should be immobilised by splinting which limits movement, reduces pain, helps control bleeding, and decreases the risk of damage to the nearby nerves and vessels.
- Many different materials can be used as splints. Splints can be improvised from rigid materials, but commercially available products offer more robust immobilisation.
- Splints should be applied when there is a doubt about their necessity.
- For rib fractures, responders should be careful to handle the casualty gently and continually reassess for developing respiratory concerns.
- Pelvic fractures require immobilisation, since these injuries often involve severe blood loss.
- Examine casualties carefully for signs of abdominal injury and provide rapid transport to hospital if abdominal injury is suspected.
- If treating abdominal injuries will not delay transport, wounds should be dressed appropriately.
- Burns are categorised by depth (superficial, partial-thickness, and full-thickness) and by source (thermal, chemical, electrical).
- Thermal burns are the result of direct contact of flames or thermal energy (heat). They should be cooled under running water, dressed in burn-film wrap, and, if time critical, rapidly transported to hospital.
- Chemical burns result from contact with a caustic or corrosive substance or a substance that reacts with moisture on the skin to generate heat. Chemical burns should be identified, cleaned, washed, and dressed. Casualties should be transported rapidly to hospital.
- Electrical burns result from direct contact with a live electric source. Safe approach is essential when treating electrical burns. Wounds should be dressed with burn-film before rapid transfer to hospital. All electrical burn casualties should receive supplemental oxygen.
- When appropriate, pain management drugs such as Entonox and Fentanyl may be used to help stabilise casualties.

## Vital Vocabulary

**AVPU scale** A scale to measure a casualty's level of consciousness. The letters stand for alert, verbal, pain, and unresponsive.

**cervical collar** A neck support that partially stabilises the neck following injury.

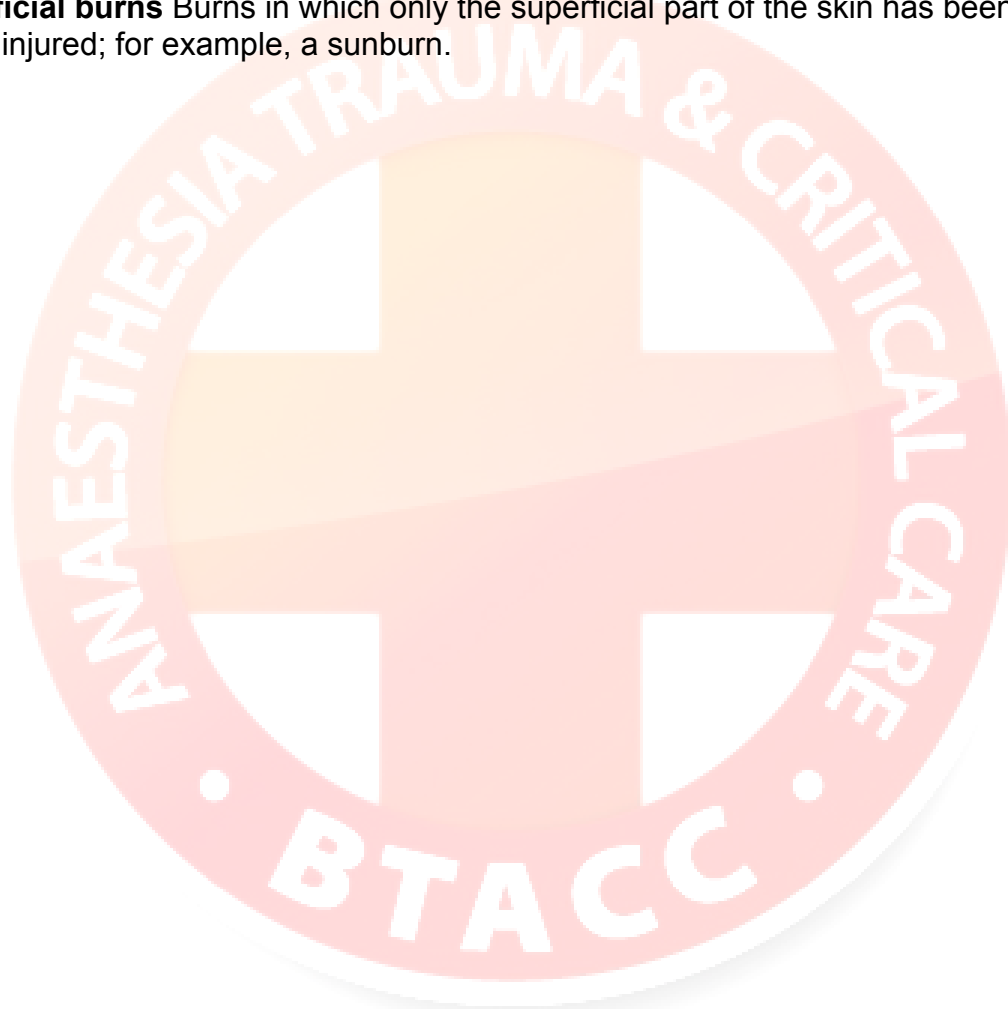
**full-thickness burns** Burns that extend through the skin and into or beyond the underlying tissues; the most serious class of burn.

**logrolling** A technique used to move a patient onto a longboard.

**partial-thickness burns** Burns in which the outer layers of skin are burned; these burns are characterised by blister formation.

**splinting** A means of immobilising an injured part by using a rigid or soft support.

**superficial burns** Burns in which only the superficial part of the skin has been injured; for example, a sunburn.



## Check Your Knowledge

1. Which of the following scales should be used to assess patient response to stimuli?
  - a. ABC
  - b. MARCH
  - c. AVPU
  - d. DiD-iT
  
2. True or False? Any casualty who has suffered a serious head injury and has an oxygen saturation of 90% should NOT be given supplemental oxygen.
  - a. True
  - b. False
  
3. When should a rescuer working alone attempt to immobilise the spine in a casualty with suspected spinal injury?
  - a. Immediately after securing the airway
  - b. When no other Time critical injury needs managing
  - c. Before moving the casualty, under any circumstances
  - d. A single rescuer should never attempt to immobilise the spine.
  
4. In the event of a suspected pelvic fracture, rescuers should:
  - a. Strap the pelvis, legs, and ankles together and then evacuate the casualty on a longboard.
  - b. Use a traction splint.
  - c. Elevate the legs
  - d. "Spring" the pelvis.
  
5. Which of the following criteria relating to burns indicates a time critical situation?
  - a. The burn has caused blistering on the thigh.
  - b. The burn is very painful.
  - c. The casualty has sunburn and cannot wear a shirt.
  - d. The burn is found on the neck.

### Answers:

1) c

2) b

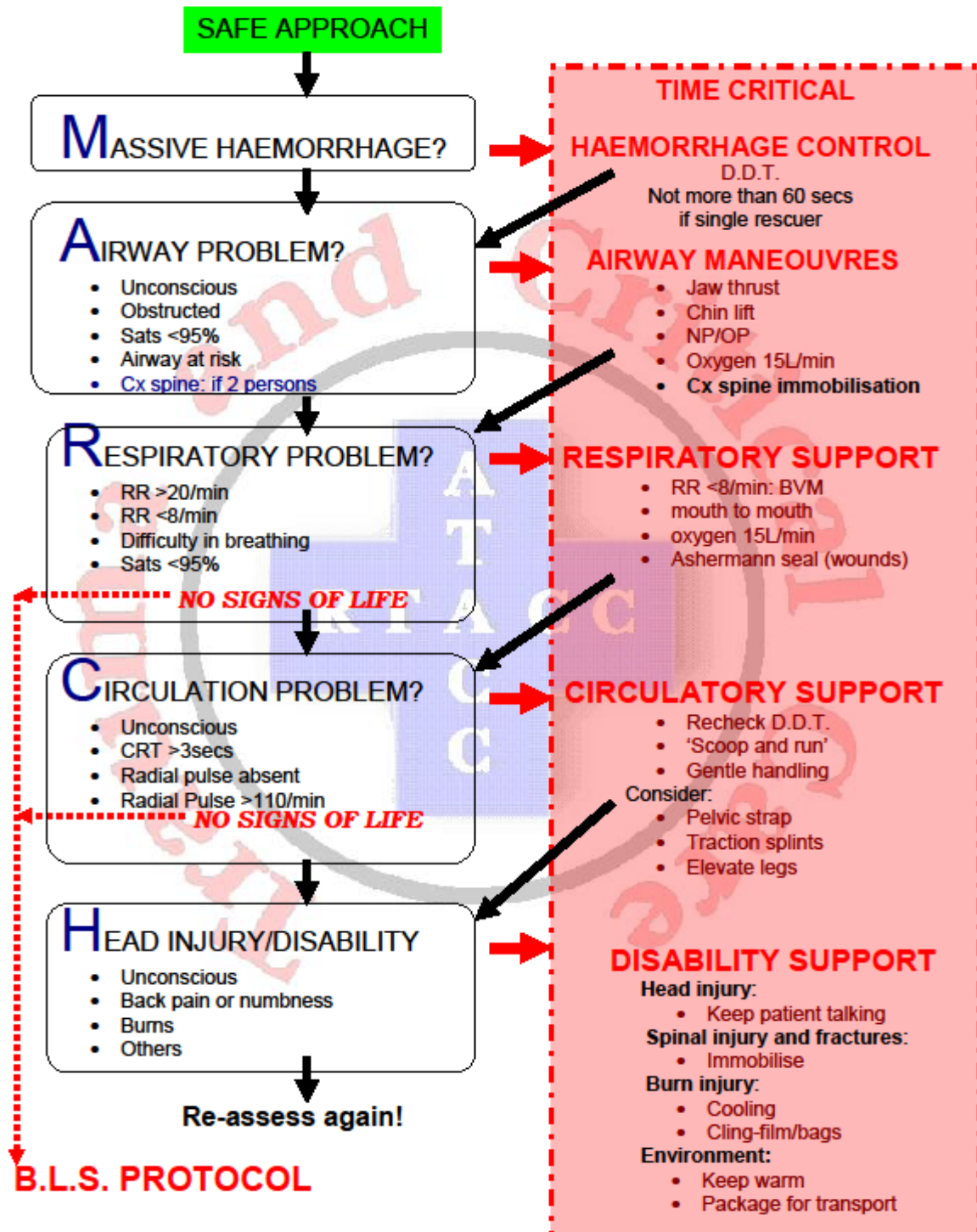
3) b

4) a

5) d

BTACC Algorithm – HEAD INJURY & OTHER SERIOUS INJURIES

# BTACC ALGORITHM



## Chapter 7:

### Resuscitation and Life Support



As BTACC covers trauma as well as cardiac and medical casualties, the BTACC method extends beyond the standard European Resuscitation Council guidelines in several ways, including the addition of pulse checks and respiratory support. In traumatic head injuries, for example, the respiratory rate may be depressed, thus requiring support with a bag-valve mask even though good pulses may still be present. BTACC providers are trained to examine the kinematics of the situation, then check breathing, pulses, capillary refill time, and level of consciousness.

Given this consideration, **life support (LS)** is required in any situation when a casualty shows no signs of life (i.e., movement, breathing, or presence of a pulse) or gasps or grossly abnormal slow breathing. When this occurs, the casualty should be considered time critical and likely to be in cardiac arrest. **Cardiac arrest** occurs when the heart stops contracting and no blood is pumped through the blood vessels. Without a supply of blood, the cells of the body will die due to lack of oxygen, causing organ damage. Brain damage potentially begins within 3-4 minutes of the patient suffering a cardiac arrest. Within 8 to 10 minutes, the damage to the brain may become irreversible.

**If you are in any doubt about the presence of a pulse, commence life support.**

Even without a trauma injury, any patient who has suffered cardiac arrest will be unconscious and not breathing normally. You will be unable to feel a pulse and the patient will appear dead. Responders should immediately shout for help (which may mean additional medical support or an ambulance) and attempt to open the airway. If the casualty is not breathing normally, responders should call 999 or 112 and begin cardiopulmonary resuscitation (CPR) to preserve cardiac output and get oxygen to essential organs (see **Figure 7-1**).



## Signs and Symptoms of Cardiac Arrest

Signs and symptoms of cardiac arrest include:

- Unconsciousness
- Abnormal or absent respirations
- No signs of life

## Cardiopulmonary Resuscitation (CPR)

If a person is in cardiac arrest, responders should attempt to maintain or restore circulation through **cardiopulmonary resuscitation (CPR)**. CPR is comprised of two components: chest compressions and ventilations.

### Chest Compressions

**Early Chest compressions** should be started as soon as possible to give the patient the best chance for survival and keep the patient alive until more advanced medical care can be administered. CPR commences with 30 compressions before any breaths. To perform chest compressions, kneel beside the patient's chest facing the patient (Fig 7-1). Place the heel of one hand in the centre of the patient's chest. Place the heel of the other hand on top of the hand on the chest, interlocking your fingers.

**Place hands over the mid-lower part of the sternum (breast-bone). Do not delay the chest compressions trying to be too exact, but ensure that you are not compressing the soft abdomen**

After you have both hands in the proper position, compress the chest of an adult 4 to 5 cm straight down. For compressions to be effective, stay close to the casualty's side and lean forward so that your arms are directly over the casualty. Keep your back straight and your elbows locked so you can apply the force of your whole body to each compression, not just your arm muscles. Between compressions, keep the heel of your hand on the patient's chest but allow the chest to completely recoil. Compressions must be rhythmic and continuous. Each compression cycle consists of one downward push followed by a rest so that the heart can refill with blood. Compressions should be at the rate of 100 compressions per minute.



**Fig 7-1: Performing Chest Compressions**

1. Kneel beside the casualty's chest
2. Place the heel of one hand in the centre of the casualty's chest.
3. Place the heel of the other hand on top interlocking your fingers.
4. Compress the chest of an adult 4 to 5 cm straight down.

Between compressions, keep the heel of hand on the casualty's chest but allow chest to completely recoil

## Ventilations or 'Rescue breathing'

**Ventilations** allow the rescuer to breathe for the casualty. To perform ventilation, use a pocket mask or a bag-valve mask (see **Figure 7-2**). For the pocket mask, ensure that the airway is clear and open (jaw thrust, chin lift) then seal the mask onto the face.



**Fig 7-2a: use of the pocket mask for ventilation**

Keep the casualty's airway open by using the head tilt–chin lift manoeuvre (or the jaw-thrust manoeuvre for patients with suspected head or neck injuries) then take a deep breath and blow steadily into the mask for about half a second. Use rapid but gentle, sustained breathing and just enough to make the casualty's chest rise.

Remove your mouth from the mask and allow the lungs to deflate and the chest to fall.

If using a Bag valve mask (BVM) then squeeze the bag ONLY ENOUGH TO SEE THE CHEST RISE NORMALLY. This allows you to use a large adult bag on small adults or even children.

**Fig 7-2b: use of a pocket mask with oxygen attached**

The rate of breaths should be 10 to 12 breaths per minute for an adult. If a pocket mask or bag-valve mask is not available, and you are unwilling or unable to perform mouth-to-mouth ventilation, then continue with chest compressions only at a rate of 100 per minute.



**Fig 7- 2c: person Bag-valve-mask (BVM)**

If the ventilations do not make the casualty's chest rise and fall, as seen with normal breathing, then make sure that the airway opening technique you are using (e.g., head-tilt–chin-lift or jaw-thrust manoeuvre) is being appropriately applied.



Check for and remove any visible obstruction in the casualty's mouth. Provide only two ventilations before returning rapidly to chest compressions, and keep repeating these checks until normal chest rise is seen with ventilation.

**One or Two-Rescuer CPR is now the same in adults**  
(no difference in compression:ventilation ratio)

To perform rescuer CPR, providing 30 chest compressions for every 2 ventilations. Continue this process without stopping unless the casualty starts to breathe properly or more advanced health care professionals arrive.

**Rescuer CPR.**

1. Establish they are unresponsive.
2. Open the airway.
3. Look, listen, and feel for breathing.
5. Check for circulation.
6. Provide 30 chest compressions at 100-120/min
7. Provide 2 ventilations
8. Continue the 30:2 ratio.

Although one-rescuer CPR can keep the casualty alive, two-rescuer CPR is preferable because it is less exhausting for the rescuers. Using two rescuers is more effective than one because one person can deliver chest compressions while the other performs ventilation. In two-rescuer CPR, the first rescuer should provide 30 chest compressions and then pause just long enough for the second rescuer to provide two ventilations. To avoid rescuer fatigue—which may result in less effective chest compressions—the two rescuers should switch roles after every five cycles of CPR (about every 2 minutes). Two rescuers should be able to switch roles quickly, interrupting CPR for the minimum amount of time.

**The aim is that under no circumstances, should CPR be interrupted especially for longer than 10 seconds.**

Regardless of the number of rescuers involved, CPR should only be discontinued when one of the following conditions occurs:

1. The casualty starts breathing normally.
2. More-qualified help arrives and takes over.
3. You become exhausted and unable to continue.

**Automatic External Defibrillator (AED)**

In Europe, nearly 700,000 individuals die of cardiac arrest each year. About 70% of adult patients who suffer a non-traumatic cardiac arrest are in a state of **ventricular fibrillation (VF)**—a condition in which the heart muscle is 'quivering' or 'fibrillating' and not effectively pumping blood.

In **Traumatic cardiac arrests**, VF is rare and CPR and defibrillation are unlikely to be successful. The mortality from blunt traumatic cardiac arrest is as good as 100% but most providers will still wish to try some aspect of resuscitation although they should be aware that this is likely to be futile.

However, penetrating cardiac arrests may be amenable to aggressive surgical control, but this is far beyond the scope of all but the most advanced trauma-medical teams and most will die of hypovolaemic or other effects such as bleeding around the heart.

This irregular heart electrical rhythm can be defibrillated and reorganized into effective heartbeats with the use of an automated external defibrillator (AED) (see **Figure 7-3**). **Automated external defibrillators (AEDs)** are machines which can accurately identify ventricular fibrillation and advise responders to deliver a shock to defibrillate the heart rhythm.



**Figure 7-3: An Automated or Advisory External Defibrillator (AED)**

Once the AED is brought to the scene, quickly attach the adhesive electrode pads to the casualty. Nearly all AEDs provide accurate and simple voice and screen commands. Follow these and ensure that no one is touching the casualty whilst the AED is analyzing the rhythm.

**When applying the AED, always minimize any interruptions in performing CPR.**

When placing the pads on the chest, ensure that the chest is dry and not too hairy (safe hair-removal devices can be kept with the AED). Do not delay defibrillation awaiting a razor. Place one pad just to the right of the sternum, below the collar bone and the other pad on the left side of the chest, just below the nipple (for males) or underneath the breast tissue (for females). If the pads are slightly misplaced, avoid removing and reapplying them, as they may not adhere as well.

**Rescuers may refer to the AED pad packaging for correct placement.**

The AED will assess the casualty's status every two minutes and advise when to deliver a shock. When a shock is advised, use the following steps (**Fig 7-4**):

1. Stop CPR.
2. Disconnect any supplementary oxygen and move bag-valve mask at least 1.5 m away from the casualty.
3. Ensure that no one is touching the casualty.
4. Shout "Stand clear!"
5. Press the "shock" button on the AED. (Fully-automatic AEDs will deliver the shock automatically.)
6. Stand back while the AED delivers a shock.
7. Immediately recommence CPR for 2 minutes until the AED reassesses the casualty's need for further shocks.

Repeat this sequence until the casualty starts to breathe normally.

If no further shocks are indicated, continue CPR until the patient regains spontaneous breathing, or more qualified help arrives. If spontaneous breathing is present, then check for a pulse (carotid or femoral).



**Fig 7-4 Analysing a rhythm using an AED**



**AEDs vary in their operation so learn how to use your specific AED.  
Practice until you can perform the procedure quickly and safely.  
Ensure you always follow the most recent Resuscitation Council guidelines.**

Care should always be taken when using AEDs in certain environments, particularly those that are wet or near water sources. Additionally, responders should check for the **8 P's** which require special attention before administering shocks:

- Piercings
- Pacemakers
- Pendants
- Playtex (bras)
- Patches (GTN/ nitrate patches)
- Perspiration
- Paediatric casualty (requiring special pads)
- Personnel in contact with patient

Foreign objects listed above should be avoided or removed, without delaying the shock or ongoing CPR. Special paediatric pads may be required for children (see Chapter 9). No one should be contacting the casualty when a shock is administered.

**Many AEDs are only equipped with adult sized pads which are suitable to down to 8 years of age.**

**For smaller children, if no paediatric pads are available then the adult ones can be used over 1 year of age, placed on the front and back if necessary.**



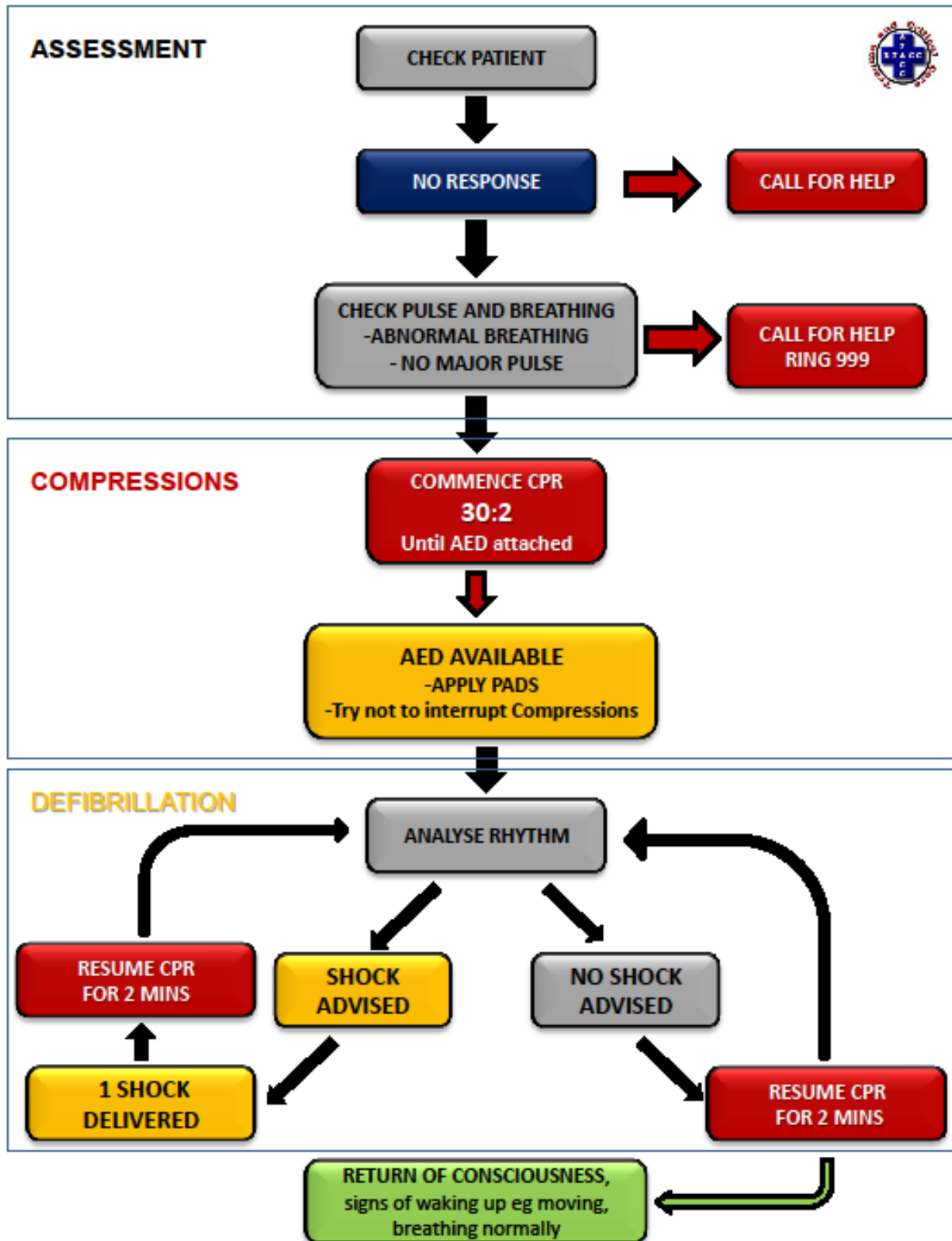


FIG 7-5: BTACC AED - Life Support Protocol (Based on UK/ERC Guidelines 2010)

## Summary:

- When a casualty shows no signs of life then he or she is likely to be in cardiac arrest and should be considered time critical.
- In cardiac arrest, the heart stops contracting which can lead to organ and brain damage.
- Chest compressions should be performed on all casualties suffering a cardiac arrest.
- Chest compressions are delivered by placing one hand in the centre of the casualty's chest, and placing the other hand on top of the fist, interlocking the fingers. Push down 4-5 cm and allow full recoil.
- Chest compressions should be given at a rate of 100 compressions per minute.
- 30 chest compressions should be given followed by 2 ventilations. This should continue until the casualty starts breathing normally, more qualified help arrives, or you become exhausted.
- An AED will deliver a shock that stops the heart quivering or fibrillating, allowing it to start again in a suitable rhythm.
- If an AED is available, it should be applied to the casualty using adhesive pads and the voice prompts followed
- Traumatic cardiac arrests rarely survive their injuries

## Vital Vocabulary

**automated external defibrillator (AED)** Portable battery-powered device that recognises ventricular fibrillation and advises when a shock is indicated. The AED delivers an electric shock to a casualty in ventricular fibrillation.

**basic life support (BLS)** CPR to treat a casualty who has no signs of life until a defibrillator is available

**cardiac arrest** Ceasing of breathing and a heartbeat.

**cardiopulmonary resuscitation (CPR)** The artificial circulation of the blood and movement of air into and out of the lungs.

**chest compressions** Manual chest-pressing method that mimics the squeezing and relaxation cycles a normal heart goes through; administered to a person in cardiac arrest.

**ventilations** Artificial means of breathing for a casualty.

**ventricular fibrillation (V-fib or VF)** An uncoordinated muscular quivering of the heart; the most common abnormal rhythm causing no-traumatic cardiac arrest.

## Check Your Knowledge

1. Which of the following would indicate that CPR is needed?
  - a. Rapid pulse
  - b. Dilated pupils
  - c. Absent breathing
  - d. Shortness of breath
  
2. Which of the following is NOT a key component of basic life support?
  - a. Leg elevation
  - b. Chest compressions
  - c. Ventilations
  - d. Automatic external defibrillation
  
3. What is the appropriate depth of chest compressions for an adult casualty?
  - a. 1 to 2 cm
  - b. 2 to 4 cm
  - c. 4 to 5 cm
  - d. 5 to 7 cm
  
4. When performing adult CPR, what is the ratio of chest compressions to ventilations?
  - a. 5 to 1
  - b. 15 to 2
  - c. 30 to 2
  - d. 50 to 2
  
5. When should rescuers deliver a shock using an AED?
  - a. When the device tells you a shock is advised
  - b. When the device indicates that the pulse rate is below 30 beats per minute.
  - c. Only when the cardiac arrest was witnessed.
  - d. Only after 2 cycles of CPR, if no signs of life are present.

## Answers:

1) C

2) A

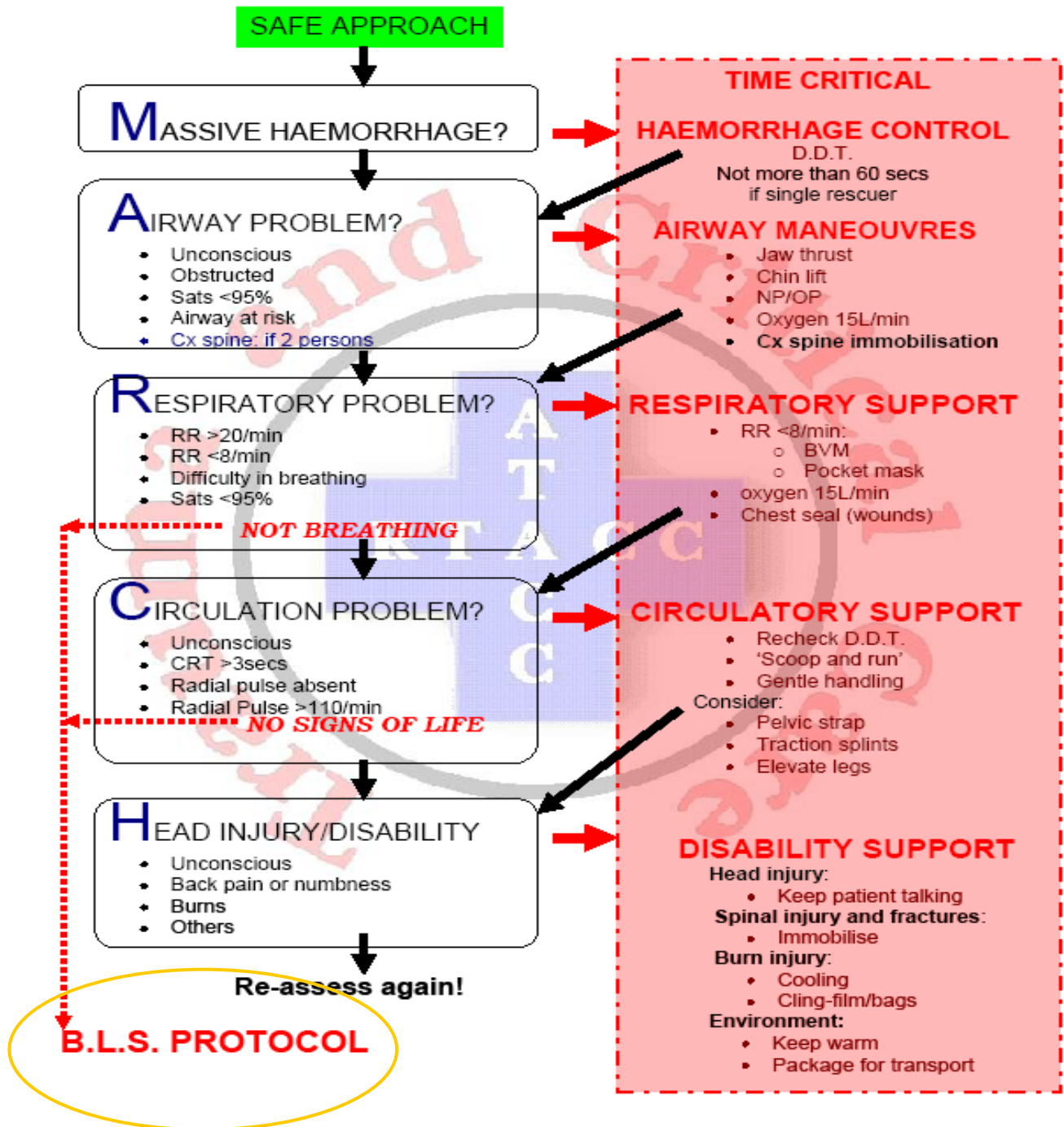
3) C

4) C

5) A

BTACC Algorithm: 'no signs of life' – Life support

# BTACC ALGORITHM



# ***BTACC special Modules:***

These chapters are additional material that can be included in any Specialist BTACC course that requires a particular element or they can all be completed as part of the RTACC core modules.

The sections include:

## ***Chapter 8: Special Situations***

- Crush injury
- Suspension Trauma
- Entrapment, extrication and extraction
- Drowning and near drowning
- Diving accidents and pressurised tunnel accidents
- Major Incident and Triage
- Pain management

## ***Chapter 9: Special patients***

- Pregnancy
- Children

## ***Chapter 10: Medical Emergencies***

- Difficulty in breathing
- Asthma attack
- Panic Attack
- Heart attack and chest pain
- Stroke
- Seizures
- Diabetic emergency
- Allergic reaction and anaphylaxis





## Chapter 8:

### Special Situations



For most basic trauma situations, the BTACC methods presented in previous chapters will be sufficient to make an adequate assessment and provide appropriate treatment. However, in certain special situations such as crush injuries, suspension trauma, entrapment, drowning, and diving accidents, additional knowledge is required to respond appropriately.

#### Crush Injury

A **crush injury** is a form of blunt trauma involving compression of the body to an extent and duration that causes damage to the body's tissues. The longer the period of crush, the greater the damage, and the greater the likelihood that complications or death will result. Crush injuries of the trunk are often immediately fatal as a result of internal organ injury. Crush injuries may also include time critical injuries such as pelvic or long bone fractures (see Chapter 6).

To diagnose a crush injury, consider the kinematics of the situation. Crush injuries are common in road traffic collision entrapments (where the dashboard encroaches on the legs) and in building or trench collapses (see **Figure 8-1**).



**Figure 8-1: crush injury to lower legs**

If a limb has been crushed for more than 30 minutes, blood supply may be limited to the limb, resulting in tissue damage. Limbs, especially the legs, contain large muscle groups and can sustain a considerable amount of tissue damage. However, once the limb is released from the crush, toxic chemicals wash out of the muscles as blood flow is restored. The sudden release of toxins can result in cardiac arrest and death. Therefore, responders

should aim to prevent or delay this washout by applying an arterial tourniquet to the affected limb. The tourniquet should be applied as if being applied for massive haemorrhage control, and sited on the most accessible part of the limb before the casualty is released (see **Figure 8-2**). It is essential to record the site and time of application of the tourniquets in an obvious place on the casualty or the record sheet. Once in hospital, the tourniquets can be released in a controlled fashion.



**Figure 8-2 bilateral arterial tourniquets applied before release of legs**

**Anyone trapped for more than 30 minutes with a crushed limb is considered time critical and may deteriorate rapidly on release without a tourniquet in place beforehand**

## **Suspension Trauma**

**Suspension trauma**, or harness induced pathology, occurs when a casualty is suspended in a harness for long periods (more than 20 minutes) motionless, not using his or her legs. This is very rare unless the casualty is actually unconscious.

The 2009 guidelines from the UK Health and Safety Executive (HSE) recommend treating a casualty by:

- 1. Encouraging the casualty to 'push-off' to keep his leg muscles working**
- 2. Rescuing the casualty as rapidly as possible (especially if unconscious)**
- 3. Treating the casualty as any other trauma victim, once rescued.**

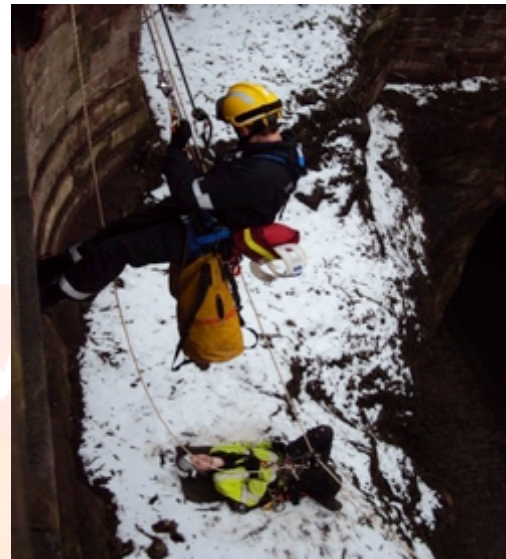
(Previous HSE guidelines recommended keeping casualties sitting up after rescue, but this has been dismissed as ineffective.)

These new guidelines do not address the issue of prolonged unconscious suspension for periods greater than 30 minutes, so following research conducted in Cork University in consideration with the pathological process involved, BTACC advises treating such severe cases of suspension trauma by using the steps outlined below:

- 1. Suspended for less than 30 minutes or conscious and pushing off – simply get them down**
- 2. Suspended for more than 30 minutes unconscious then:**
  - a. Lower the casualty to just above ground level as quickly as possible.**
  - b. Apply tourniquets to the lower limbs as high on the leg as possible.**
  - c. Document the time and placement of the tourniquets.**
  - d. Lower and move the casualty to a safe surface.**
  - e. Lay the casualty onto the ground.**
  - f. Assess and treat according to the MARCH algorithm.**
  - g. Rapid transfer to hospital**

Release of the tourniquets should be performed under medically controlled conditions, ideally in hospital.

**Fig: 8-3: A technical rescue requiring decisions about speed of extrication**



## Entrapment

Any casualty that cannot be immediately released or evacuated from the scene of injury should be considered in a state of **entrapment**. Entrapment may be the result of a physical barrier (e.g., a car dashboard crushing the casualty's legs) or an environmental barrier (e.g., a tactical firearms situation). As such, the speed of extrication is governed by the state of the casualty and the nature of the environment. In some situations, the state of the casualty or the environment is so unstable that certain compromises must be made to preserve life. When responding to a case of entrapment, the responder must determine the necessary speed of extrication (see **Fig 8-4**) based on the kinematics of the situation and patient assessment.

**Fig 8-4: Speed of Extrication**

Speed of Extrication	Casualty situation	Recommended time for casualty extrication
<b>Urgent</b>	<b>Normal extrication</b>	<b>20 minutes</b>
<b>Rapid</b>	<b>Stable but 'time critical'</b>	<b>10 minutes</b>
<b>Immediate</b>	<b>Unstable 'time critical' problem which is immediately life threatening</b>	<b>1 minute</b>

This can also be considered as a simple decision flow chart based on the patient's stability (**Fig 8-5**). Some 'time critical' conditions do not necessitate or allow immediate extrication. It may be necessary to spend time making the situation safe BEFORE extricating the casualty eg taking gunfire in open ground or a building on fire. Use the chart in **Figure 8-6** as a guide to determine the level of extrication required.





Fig 8-5 Speed of extrication – Casualty eg Road traffic collision

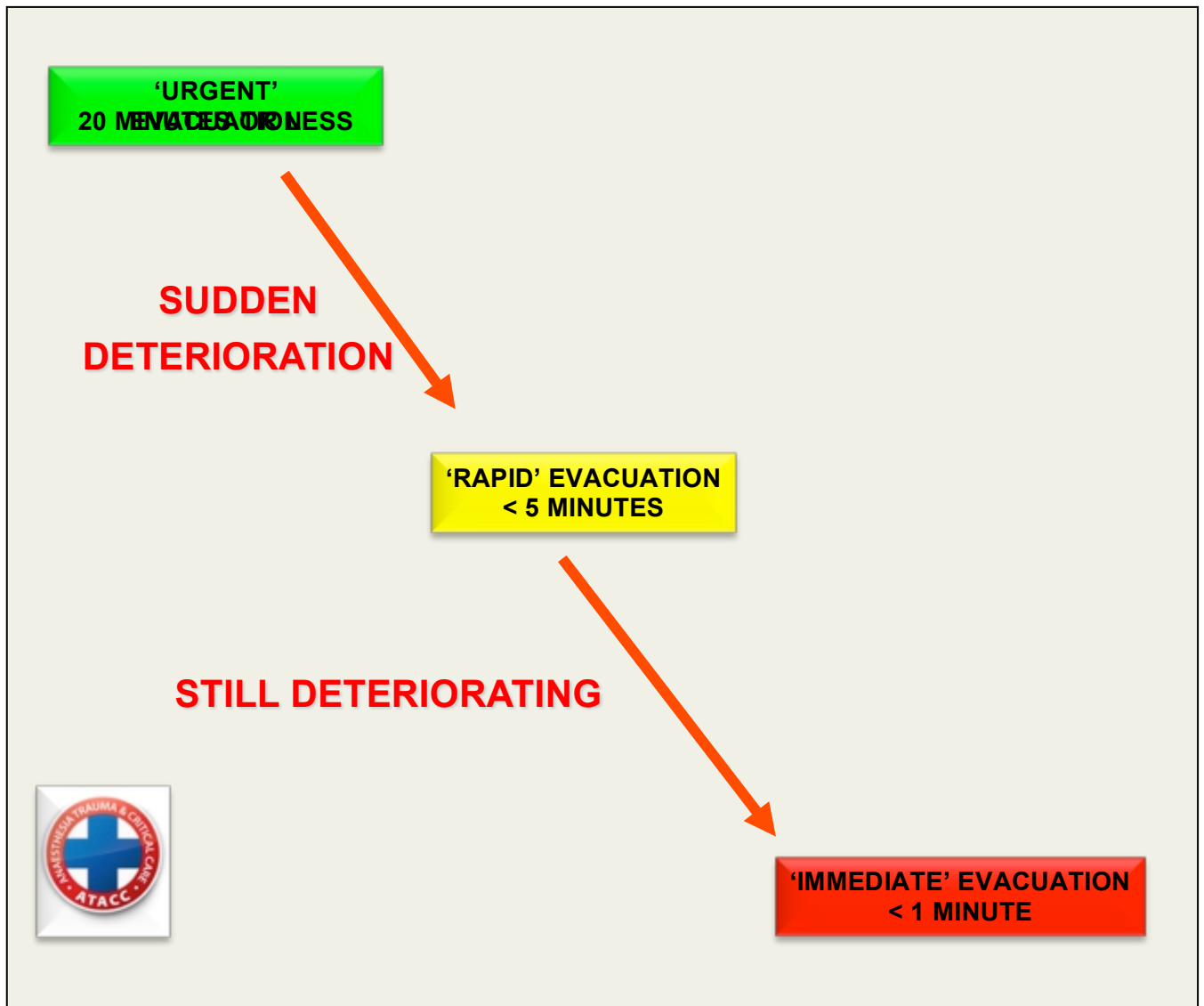
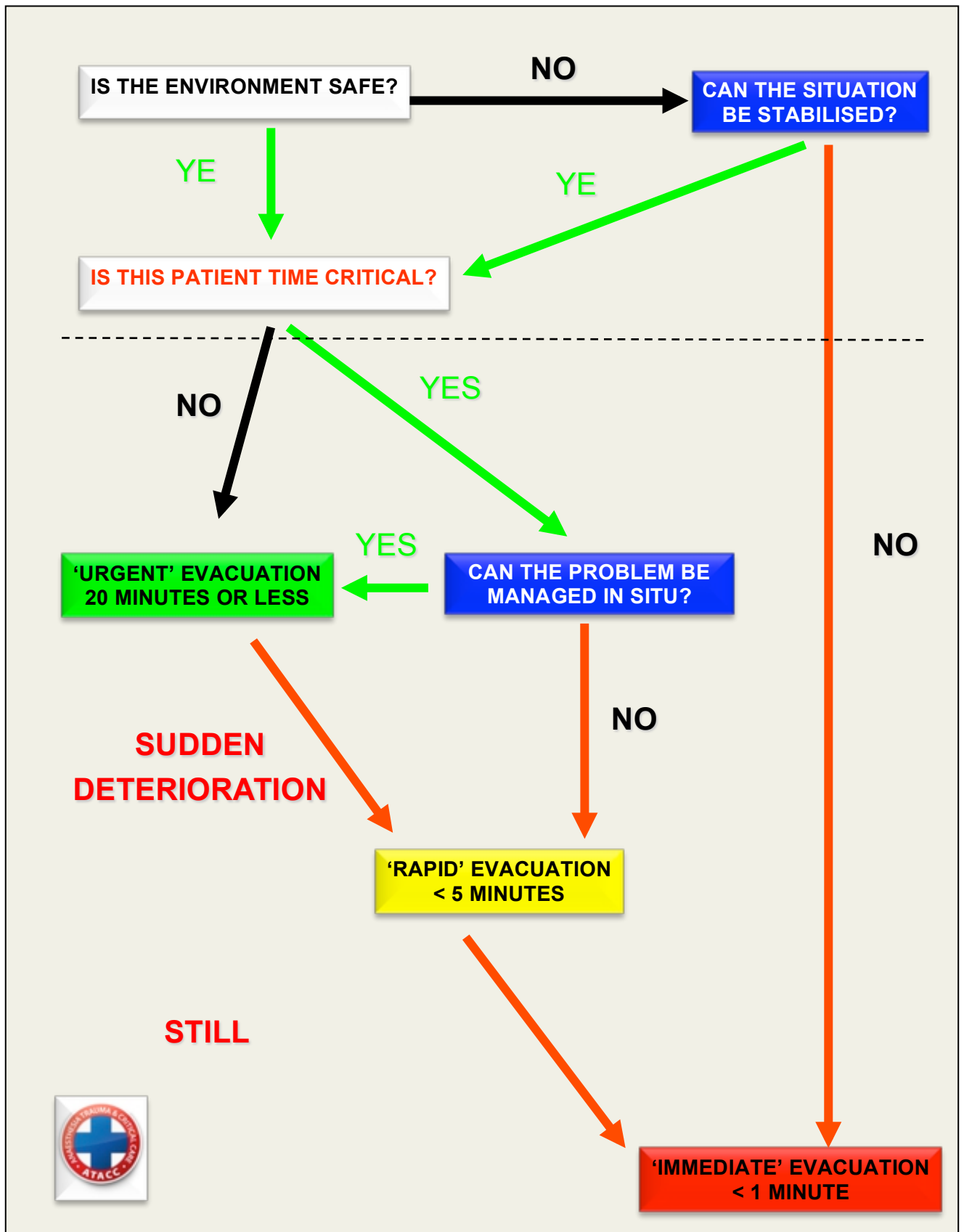


Figure 8-6: Caption: Speed of Extrication Algorithm – casualty and environment



**All Road Traffic Casualties should be classed as an 'urgent' and ideally extricated within 20 minutes.**

## **Drowning and Near Drowning**

In treating casualties of **drowning** or near drowning, BTACC focuses on managing cardiac arrest and hypothermia.

In cases of drowning, the casualty will show no signs of life following rescue; providers should assume that they are in cardiac arrest and require immediate life support. In cases of near drowning, casualties may still have signs of life (e.g., breathing and pulses present), but they are likely to be very cold and suffering from hypothermia. Casualties should be kept warm and given 100% oxygen (especially if they are shivering). All near-drowning casualties require rapid transfer to hospital, as their condition may deteriorate later.

**It is important to suction to clear the airway, but rescuers should not attempt to push fluid out of the lungs in the resuscitation of victims of drowning.**

Resuscitation of all victims of drowning or near drowning should continue until medical help arrives or the casualty reaches hospital. Casualties from drowning or near drowning incidents are likely to have a degree of hypothermia, which may offer some protection of essential organs such as the brain. This is especially true in children and cases of drowning in icy cold water.

**Any victim who has been submerged for more than 90 minutes should be presumed dead.**

## **Diving Accidents and Tunnel Workers**

Divers are at risk from a number of problems including drowning, gas embolism (gas bubbles in the blood), and decompression illness. The risks of accidents increase with greater dive duration, dive depth, and speed of ascent.

**All diving accidents should be treated as Time Critical**

If a diver ascends too quickly, large air bubbles may block the blood supply to major organs and produce stroke-like symptoms (e.g., weakness, paralysis, unconsciousness, severe difficulty in breathing). Small gas bubbles may also develop in the tissues and joints, resulting in pain and inflammation known as decompression illness or "the bends".

The presence of any of the following signs and symptoms following a dive may indicate decompression illness:

- Red/purple skin rash (commonly on the trunk)
- Pains in the muscles or joints (commonly in the shoulders, neck, knees)
- Paralysis or weakness of limbs
- Areas of altered sensation on the body
- Loss of bladder and bowel function
- Impaired coordination
- Any other unexpected symptoms in the nervous system

Casualties exhibiting any of these symptoms require urgent rescue, supplemental oxygen, resuscitation, and emergency recompression in a hyperbaric chamber. Divers should be removed from the water and should not be permitted to return until they have been examined by a medical professional. Never attempt to return a diver to the water to help recompression. The ambulance service and Coastguard should be informed, as the casualty may require immediate transfer to an appropriate medical facility. This will often require a helicopter transfer, so consider identifying a possible landing site nearby.

If the casualty is conscious, he or she should be encouraged to drink fluids (as dehydration will worsen the condition (and may take simple pain killers such as Ibuprofen or paracetamol to provide some relief until they can undergo recompression in a chamber. Entonox must NEVER be given for pain related to diving accidents.

**Casualties of diving accidents should be given high-flow oxygen (15 L/min). Do not reduce the flow, even if pulse oximeter indicates 100% saturation**

## **Major Incident or Major Civilian Disaster (MCD)**

Despite the common misconception a Major Incident does not have to involve hundreds of casualties. What it actually means is that the number of casualties 'overwhelms' the available resources for example, if you are a solo medic then attending 3 seriously injured colleagues may totally overwhelm your capabilities and is in effect a Major incident. Alternatively, a hospital emergency department may suddenly receive 50 casualties simultaneously from a serious incident such as a bomb blast and the department is immediately totally overwhelmed.

Whilst both represent a Major Incident, the second would more commonly also be described as a Major Civilian Disaster as the numbers are so large and the impact on the community and healthcare provision is so much greater. In such situations we must provide effective care to as many casualties as we possibly can and this requires some form of prioritisation to avoid wasting time concentrating on a small number of individuals, whilst others are left unaided.

**When dealing with an overwhelming number of casualties we must adopt an affective system that does "the most for the most".**

This system of prioritisation of the injured is called 'Triage' and there are many different ways of doing this from a simple sieve through to some of the complex sort processes which consider a large number of parameters in reaching a final conclusion.

For BTACC we adopt the simplest of Sieves which is a highly effective tool when used properly but there are certain basic rules:

- The individual performing the triage does not treat and casualty until all of the process is completed
- The individual must keep moving and work through all of the casualties.
- A typical triage assessment should take less than a minute.
- Triage is just a 'snapshot' of the current position and must be repeated

The casualties are classified according to their injuries into a number of groups described below:

**Fig 8-7**

Injuries	Assessment	Evacuation
Uninjured		
Walking wounded	Likely to be stable injuries	Delayed evacuation
Injured	Not Time Critical: may deteriorate	Urgent evacuation
Seriously injured	Time critical: will die if left	Will die if not treated now
No signs of life	Dead	Do not move unless to reach others

A number of triage systems and categorisations exist based upon a colour coding, Priority 1-3 or delayed, urgent or immediate. The simple coding defines the priority for evacuation:

**Green – Priority 3 (P3) – Delayed**

**Amber/yellow – Priority 2 (P2) – Urgent**

**Red – Priority 1 (P1) – Immediate**

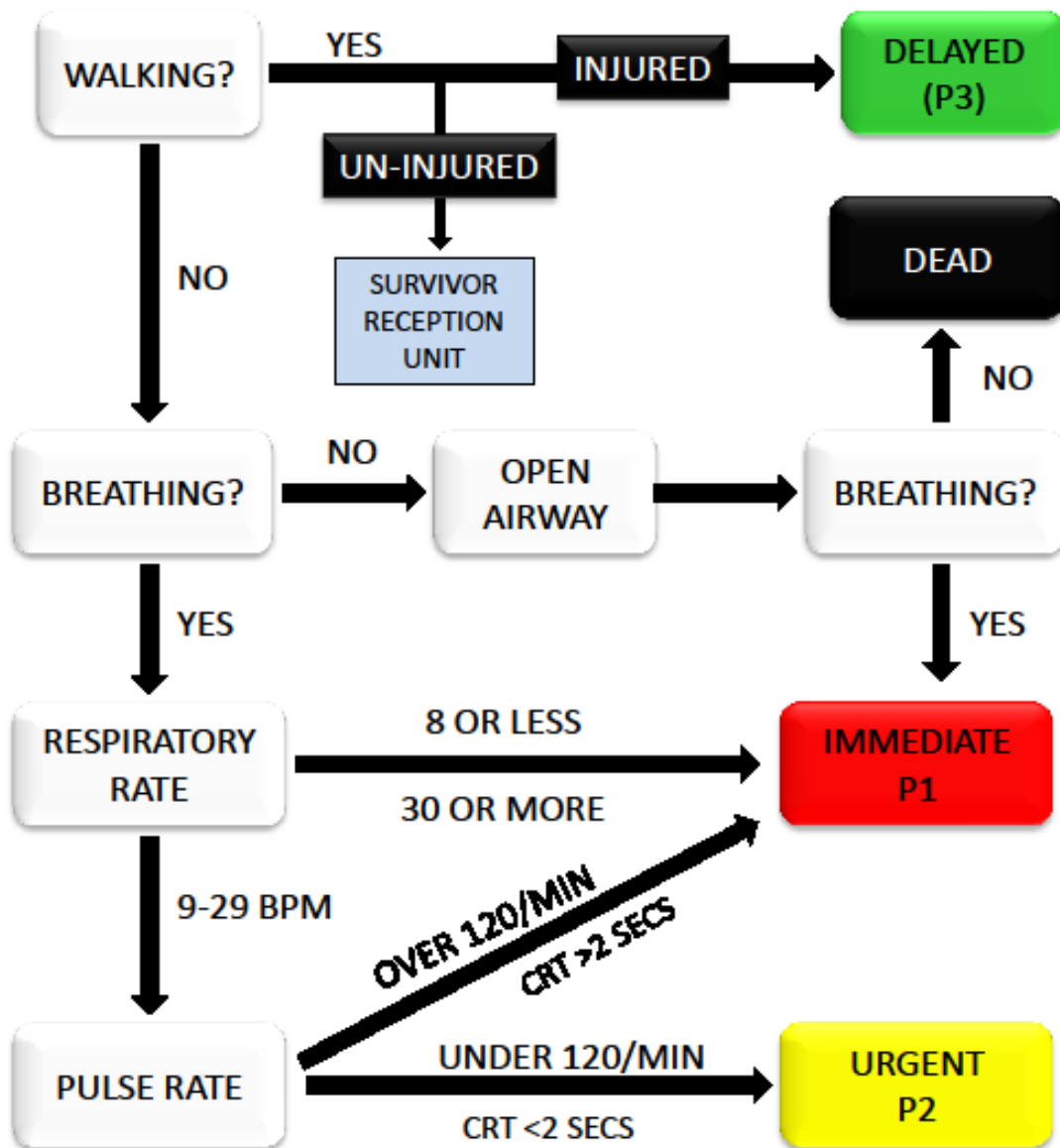
The triage process is repeated to ensure that the casualty carers remain up to date with the status of the injured. Obviously some casualties will get worse but others may actually get better and be less dependent upon medical care. In addition, as more resources arrive we can provide trauma care for more people and with lesser injuries.

The actual categorisation or 'sieving' of the casualties is based upon a number of key parameters that are easy and quick to assess eg ability to walk, breathing, pulses or capillary refill time. A simple stepwise approach is used for the assessment and it should take less than a minute per casualty (**Fig 8-8**)

Once a casualty has been assessed they must be marked and recorded. Many methods have been used including a simple marker pen to write on the forehead, Triage cards and even coloured pegs or bands.



Fig 8-8: The BTACC Triage Sieve:



*If pulses are difficult to locate or feel then Capillary refill (CRT) can be used instead*

## Pain Management for Trauma Casualties (RTACC)

An injured person may have increased breathing and pulse rates as he or she struggles to deal with pain. Especially for casualties suffering from fractures, effective pain management will most certainly help stabilise the casualty.

There are many ways of providing pain relief, though they may have serious side effects or be difficult to administer. Typically oral pain relief medicines (e.g., paracetamol or aspirin) take too long to be absorbed into the casualty's body and are therefore not effective in the emergency setting. Medications injected under the skin or into a muscle or vein are absorbed more quickly, but this form of administration requires a higher level of medical training and is therefore not suitable for all responders. Injections under the skin or into muscle can also be very unpredictable in terms of onset and effect, especially in shocked casualties.

BTACC does not focus on the use of pain management drugs, instead emphasising stabilisation, immobilisation, and rapid transfer to hospital. However, in some areas local arrangements may allow responders to use pain relief agents such as Entonox gas (nitrous oxide and oxygen mixture) or Fentanyl. Different agents are compared in the **table 8-9**

Entonox is easy to administer and has a rapid onset. The gas has been used very effectively in the UK for many years and if the casualty cooperates and breathes in several large breaths of the gas, the analgesic quickly takes effect. When the casualty becomes drowsy or stops inhaling the gas, the effects quickly cease. Entonox is usually delivered through a demand valve, which requires the casualty to take hold the mask and to take a breath, rather than a continuous flow of gas as used in anaesthesia. This further improves the safety when using this agent as if they casualty cannot self-administer or hold the device then they will not get any entonox.. Casualties may experience drowsiness, dizziness, or light-headedness with Entonox gas, and they should be warned about these possible side effects before the drug is administered.

**Entonox should never be used in patients with suspected major chest trauma, diving or compressed gas breathing accidents or casualties with a reduced conscious level**

A new promising alternative is Fentanyl—a strong opioid drug similar to morphine which may be administered in the form of a lozenge or lollipop, avoiding the need for intravenous access. With Fentanyl, the pain relief is felt within minutes and lasts for around 30 minutes. A small loop is provided for the casualty's thumb so that should the casualty become drowsy and drop his or her arm, the lozenge will be pulled out (see **Figure 8-10**). Fentanyl should never be used unsupervised.

Fentanyl lozenges take about 5 minutes to reach full effect and must not be chewed or sucked as the drug is absorbed much better from the lining of the mouth rather than the stomach. If removed from the mouth, the effects wear off in less than a minute or two. As a Controlled drug, the use of Fentanyl is limited for many potential users, but has been adopted by organisations such as Mountain Rescue teams.

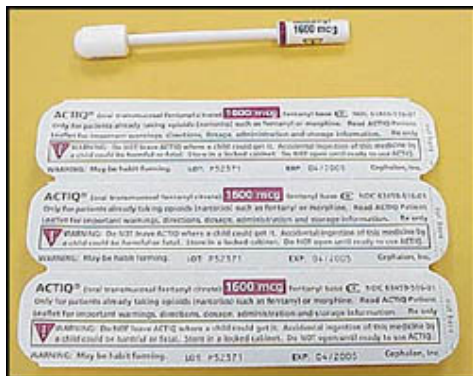
**Table 8-9: comparing different common pain-killers and their uses:**

<b>Pain and indication</b>	<b>Pain-killer</b>	<b>Comment</b>
<b>Mild Pain</b> Minor injuries, headaches	Paracetamol	Check if taken any in last 6 hours
	Ibuprofen	Not if any history of gastro-intestinal bleeding or asthma
<b>Moderate pain</b> eg sprains, scalds and minor burns	Codeine	Not if conscious level reduced
	Codeine – paracetamol combinations	As for individual drugs
	Voltarol (diclofenac)	Not if any history of ulcers, bleeding disorders or kidney disease
<b>Severe pain</b> Eg. Major trauma, fractures, burns, cardiac pain	Codeine (higher doses)	Not if conscious level reduced May cause sickness May cause respiratory depression
	Tramadol	Not in head injuries May cause sickness May cause respiratory depression
	Entonox	Inhaled drug: needs specialist equipment and training
	Fentanyl lozenges	Controlled drug
	Oral Morphine	Controlled drug
	Intravenous Morphine/fentanyl	Intravenous Controlled drug
	Ketamine	Specialist Intravenous Drug

**THIS IS NOT A PRESCRIPTIVE DOSAGE CHART BUT MERELY A GUIDE TO DRUG SELECTION**

**All drugs to be administered according to manufacturers guidelines**

**Figure 8-10. Fentanyl lozenges. These can rapidly and effectively deliver excellent pain relief to help stabilise casualties.**



### Summary:

- Certain situations such as crush injuries, suspension trauma, and entrapment require specialized knowledge.
- Crush injuries can be diagnosed based on the kinematics of the situation.
- The longer that a limb is crushed, the more likelihood that damage and complications will occur.
- Suspension trauma occurs when a casualty is suspended motionless in a harness for more than 20 minutes.
- To treat an unconscious victim of suspension trauma, lower the victim close to the ground, apply tourniquets, then lay the casualty on the ground and treat using the standard BTACC algorithm.
- Entrapment occurs when a physical or environmental barrier makes it difficult to evacuate a casualty.
- Rescuers must determine the appropriate speed of extrication for cases of entrapment, based on the casualty's condition and the kinematics of the situation.
- For victims of drowning or near drowning, rescuers should focus on resuscitation following cardiac arrest and managing possible hypothermia.
- When faced with large numbers of casualties we aim to do the most for the most. The best way to achieve this is Triage (assess) every casualty before you start treating individuals.
- The Triage Sieve is a reliable assessment tool for prioritising who needs to be evacuated or treated first.

### Vital Vocabulary

**crush injury** A form of blunt trauma in which the body is compressed to an extent and duration that causes damage to the body's tissues.

**drowning** Submersion in water that results in suffocation or respiratory impairment.

**suspension trauma** An injury in which a casualty is suspended in a harness motionless for long period of time.

**entrapment** A situation in which a casualty cannot be immediately released or evacuated from the scene of injury.

## Check Your Knowledge

1. If a limb has been crushed for more than 30 minutes, following release:
  - a. Blood flow will start after another 30 minutes
  - b. Blood flow will never be restored
  - c. Toxic chemicals will wash out of the muscles
  - d. The limb should be immediately amputated.
  
2. For a casualty to be more at risk from suspension trauma, he or she would likely:
  - a. Be unconscious.
  - b. Be suffering thrashing around on the rope.
  - c. Have been lowered to the ground too quickly.
  - d. Have been elevated too high.
  
3. Which of the following situations would be considered entrapment?
  - a. A casualty with a gunshot wound in an exposed area receiving incoming fire
  - b. A casualty suffering burns from a live electrical source.
  - c. A casualty with a traumatic amputation of his arm after a train crash
  - d. An agitated casualty suffering from head trauma after a road traffic collision.
  
4. For an 'Immediate' extrication, the casualty must ideally be evacuated within:
  - a. 1 minute.
  - b. 10 minutes.
  - c. 5 minutes.
  - d. 3 minutes.
  
5. If a casualty is considered time critical, this always necessitates immediate extrication.
  - a. Immediate extrication
  - b. If the injury can be stabilised then immediate extrication is not essential
  - c. The injuries must not influence the speed of the extrication
  - d. Await medical support before extrication

## Answers:

1) c

2) a

3) a

4) a

5) b





## Chapter 9:

### Special Casualties



Responding to emergencies involving pregnant women or children requires some variations of the BTACC method. While carrying for these casualties can be a traumatic experience for responders, the situation demands the same basic process and methods of resuscitation as for normal adult casualties, with a few notable differences as outlined below.

#### Caring for Pregnant Women

For pregnant casualties, rescuers should strive to manage the mothers' injuries first, as managing her will best protect the unborn child. Rescuers should enquire how far along the pregnancy is (in weeks) and if there have been any problems. In pregnant casualties, any of the following conditions should be treated as time critical:

- Complaints of abdominal or pelvic pain
- Sensations of tightening (contractions)
- Bleeding or fluid loss from the vagina

**All pregnant trauma patients should be given high flow oxygen. Entonox may be provided if the casualty is in pain if there is no chest trauma or reduced conscious level.**

Some pregnant women may feel uncomfortable, lightheaded, or dizzy lying on their backs, as the weight of the baby may restrict blood flow in this position. These casualties may prefer to lie on one side and should be permitted to do so during transport. When immobilised on a longboard, the longboard should be tilted between 15 and 30 degrees, usually to the left, to address this concern.

**Pregnant casualties may be more comfortable if they are transported with a lateral tilt to avoid restricting blood flow back to the heart.**

## Caring for Children

There is a huge debate over the issue of caring for children with adult protocols, but basically, whilst the 'normal' values for some paediatric observations vary with age, the essential management principles are exactly the same. Maintain an airway, stop bleeding, keep them warm and get them to hospital quickly. As such, for children above the age of 2 years, they are effectively 'small adults'.

The BTACC algorithm can therefore be used for children but if the modified BTACC Paediatric Algorithm is available (see end of chapter) then it will be useful as it includes parameter ranges relevant to various age groups of children.

**Children get many of their behavioural cues from their parents. Be sure to be calm and communicate with the child's parents about the treatment you are providing.**

### M: Massive Haemorrhage Control

Children's bodies have a smaller volume of blood than adults (see **Table 9-1**), so even a small amount of blood loss can be very serious.

**TABLE 9-1 Average Blood Volume for Children**

Age (in years)	Average Blood Volume
1	800 ml
5	1500 ml
10	2400 ml

The DiD-iT method (application of direct pressure, more direct pressure, and tourniquet) can be used to control haemorrhaging in children, but thumb or finger pressure will often be all that is required.

### A: Airway Management

Though the principles of airway management are the same, children have some anatomical differences from adults which make their airway slightly more difficult to manage.

- First, a child's airway is smaller in relation to the rest of the body. Therefore, secretions or swelling from illnesses or trauma can more easily block the child's airway.
- Second, because a child's tongue is proportionally larger than an adults (relative to overall body size), the tongue can more easily block the airway in unresponsive children.
- Third, because a child's upper airway anatomy is more flexible than that of an adult, you must remember to avoid overextending the neck of an infant or child when attempting to open the airway. Keep the child's neck in a neutral or slight sniffing position to avoid overextending.

Children can compensate as the demands on their respiratory system change, but they may quickly progress into respiratory distress or failure. Therefore, it is important to perform a complete and thorough patient assessment and to monitor the

child's vital signs, reassessing at least every 5 minutes when caring for seriously ill or injured paediatric patients.

Children go 'blue' from lack of oxygen very quickly as they have a relatively higher rate of oxygen consumption compared to adults. All children with significant traumatic injuries should therefore receive oxygen. This will do no harm even to young babies if administered pre-hospital.

**Infants and young children normally cry in response to fear or pain; a child who is not crying or is unusually quiet should raise concerns. They may have a decreased level of consciousness, an upper airway infection, or be very unwell.**

When delivering supplemental oxygen to children, use a **paediatric non-rebreathing mask (the one with the reservoir bag) or the paediatric face mask on the bag valve mask**. If a child will not tolerate the mask, then gently waft the oxygen across his or her face.

The pulse oximeter will still work very effectively in on very small fingers and the results will be accurate if it works.

## R: Respiratory Management

Breathing rates in children are faster than in adults. **Table 9-1** presents the normal breathing rates for children. Excessively fast or slow rates for a specific age group indicate a time critical situation and require immediate intervention and transfer.

**Fig 9-1: Normal Respiratory Rates in Children**

Age	Respiratory Rate (breaths/min)	Time Critical
Baby (infant)	25–40	>40
Toddler to Pre-school	20–30	>30
School-age	15–20	>20
Teenager	12–15	>20

The technique of ventilation (described in Chapter 4) is slightly different for children. The steps for determining responsiveness, checking / maintaining the airway, and checking supporting a child's breathing are essentially the same as for an adult casualty, but you should keep the following differences in mind:

1. The optimal airway position depends on the child's age— neutral position for infants, with a gradual introduction of a slight sniffing position for older children.
2. The rate of ventilation is slightly faster for children. Give 1 ventilation every 3 to 5 seconds (about 12 to 20 ventilations per minute) instead of the adult rate of 1 ventilation every 5 to 6 seconds (10 to 12 ventilations per minute).

When resuscitating a child using a bag-valve mask, use a paediatric mask. The bag can be a larger volume or adult type, as long as the two persons performing the technique both monitor the chest movement carefully to ensure that chest is adequate and not overinflated or over-expanded.

### C: Circulatory Management

The easiest pulse to feel in young children is the brachial on the inside of the arm just above the elbow. Pulse rates in children are generally faster than those in adults. **Table 9-2** presents the normal pulse rates for children. Excessively fast or slow rates for a specific age group indicate a time critical situation and require immediate intervention and transfer.

**Fig 9-2: Normal Pulse Rates in Children**

Age	Pulse Rate (beats/min)	Time Critical
Baby (Infant)	100–150	>150
Toddler to pre-school	90–140	>140
School-age	70–110	>120
Teenager	60–100	>120

### H: Head Trauma and Other Serious Injuries

Head injuries may be difficult to assess in children as they may not cooperate with responders' assessment attempts. The AVPU scale may still be used, but it is not as reliable since younger children may not respond in the same manner that adults do. Drowsiness, lack of activity, interest, or responsiveness in children can signal serious illness or injury.

Bone fractures in children are usually obvious because of bruising, deformity, and pain. However, due to a higher degree of tissue and bone flexibility, children may have serious underlying or internal injuries, despite not having any fractures. Treat child casualties from incidents which suggest possible bone fractures with close monitoring and immobilisation around the possible injury site to reduce pain.

All children with burns (other than small superficial burns and sunburn) should be considered time critical. Small burns are those less than 1% of the child's body surface area. A good way to estimate this is to consider the child's outstretched palm with fingers closed as roughly 1%. If ever there is any doubt, the child should be taken to hospital.

When cooling burns, be careful not to cool the child casualty excessively. Because children have a greater surface area relative to the mass of their body, they lose relatively more heat than adults do and have limited abilities to compensate for changes in temperature. If burns are cooled for too long, the child may become hypothermic. However, it is still important to cool the burn properly to prevent further damage.



Great care should be taken in cooling burns that extend over 10% of the child's body surface area. Once a burn has been cooled, the application of burn-film in strips, creates a good dressing that allows the area to be kept clean, continually seen and also can be cooled again if required without having to be removed. Blankets should be offered to the child to avoid excessive cooling and hypothermia once the cling-film has been applied

**While it is important to cool the burn, no unnecessary delay should occur in transferring the child to hospital and avoid causing hypothermia.**

### Choking in children

**The same algorithm can be used in children down to the age of 1 year of age, below this age (Infants) the abdominal thrusts are replaced with chest thrusts/compressions.**

Small children can be placed across the lap for back blows and infants can be cradled in the arms.

One other difference for children is that if the child is unconscious then commence Paediatric life support which starts with 5 rescue breaths before chest compression starts.

**In cases of choking abdominal thrusts should not be used in infants (children under 1 year of age) – chest compressions are used instead**

### Basic Life Support

**Children require basic life support if there are no signs of life or if the heart rate is less than 60 beats per minute**

Because children are smaller and more likely to have a respiratory cause for their arrest than adults, they require modifications for CPR:

**When only one rescuer is present then provide 1 minute of BLS BEFORE going for help.**

**The only exception is in witnessed arrest or collapse, when a shockable rhythm is likely requiring defibrillation. In this case call for help immediately**

**When more than one rescuer is present then immediately start life support whilst sending the other individual for appropriate help.**

Note that the ideal ratio of compressions to ventilations in children currently recommended is 15:2 (However, if responders cannot remember then 30:2 can be used)

1. Provide five initial ventilations before starting chest compressions at a rate of 100 – 120 compressions per minute. (Push hard and fast!)
2. Provide a ratio of 15 chest compressions to two ventilations. (15:2)
3. When working alone (as a sole responder), provide one minute of CPR before seeking help.
4. Use the heel of one hand or two hands on the lower 1/3 of the chest to perform compressions, depending on the size of the child.
5. In infants encircle the chest with your hands as if about to pick them up. Adjust your thumbs over the lower third of the chest for compressions.
6. Compress the sternum one third the depth of the chest.

**Rescuers may fear harming children and be hesitant to attempt resuscitation, through lack of training but it is far better to use the adult BLS sequence for resuscitation of a child than to do nothing.**

**Standard AEDs are suitable for use in children older than 8 years.**

**They are also safe to use for children between 1 and 8 years of age.**

If available then paediatric pads or a paediatric mode should be used. Alternatively, in small children, place one adult pad on the front of the child and one on the back, then use the AED in adult mode.

### **Summary:**

- In general, the principles of BTACC apply equally to pregnant women and children, with some modifications.
- When caring for a pregnant casualty, complaints of abdominal or pelvic pain, tightening sensations, or blood or fluid coming from the vagina are all time critical concerns.
- The BTACC method does not apply to infants (children under one year of age).
- The overall volume of blood in children is lower than that of adults, so even a small amount of blood loss should be a cause of concern for responders.
- When applying direct pressure to control massive haemorrhaging, thumb or finger pressure may be sufficient.
- A child's airway differs from that of an adult. These differences can complicate airway care.
- A paediatric face mask should be used whenever it is necessary to provide supplemental oxygen to a child.

- It may be difficult to assess head trauma in children, as they often do not understand or comply with responder's assessment attempts.
- Bone fractures in children are usually obvious because of bruising, deformity, and pain.
- There are a few notable differences regarding the performance of CPR on children such as hand placement and compression pressure.
- AEDs can be used on children, but paediatric pads should be used when available.



## Check Your Knowledge

1. The BTACC methods:
  - a. Can be used on adults, children
  - b. Children over 25kg
  - c. Can be used on all age groups
  - d. Must not be use for children under 4 years
  
2. Because children have less overall blood volume than adults, which of the following is true?
  - a. Children suffering from trauma require CPR more often than adults.
  - b. Blood pressure in children is higher than in adults
  - c. A small amount of blood loss in children can be significant.
  - d. Blood transfusions are always necessary to treat massive haemorrhaging.
  
3. To use the DiD-iT technique for controlling massive haemorrhaging in children, which of the following changes should be made?
  - a. Instead of applying pressure with the entire palm or hand, only a finger or thumb may be required.
  - b. If the first attempt at direct pressure is unsuccessful, a tourniquet should be applied immediately.
  - c. Tourniquets should never be applied to children.
  - d. DiD-iT cannot be used in children.
  
4. If a child has been scalded on their arm, a responder should:
  - a. Immediately cool the scald with cold water.
  - b. Immediately apply cling film.
  - c. Never use cold water to cool the burn.
  - d. Apply burn jelly dressings, only.
  
5. The normal respiratory rate in children is \_\_\_\_\_ that of adults.
  - a. Higher than
  - b. Lower than
  - c. Not a useful sign compared to
  - d. More variable than

## Answers:

1) a

2) c

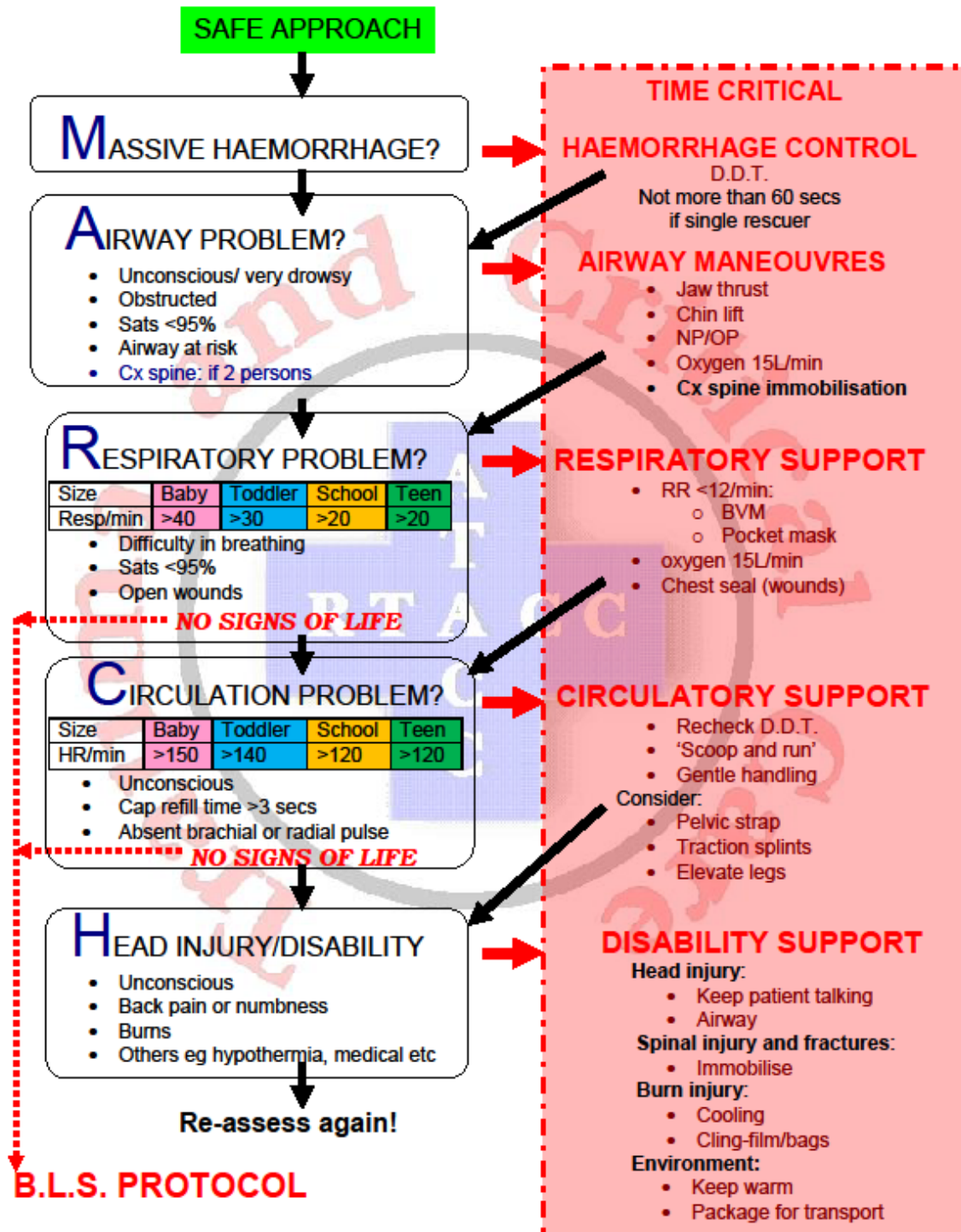
3) a

4) a

5) a

BTACC Algorithm for Children:

## BTACC PAEDIATRIC ALGORITHM (UPTO AGE 15)







## Chapter 10:

### Medical Emergencies (Optional Component)



Whilst the main focus of BTACC is trauma care, providers are occasionally faced with certain medical emergencies. This section outlines common medical conditions that may be encountered and how responders can recognise and manage these conditions until further help arrives.

#### General Approaches to a Medical Patient

Your approach to a patient who has a general medical complaint should follow the systematic BTACC approach. Carefully check the scene to assess your safety and that of the patient. As you perform the initial patient assessment, first try to get an impression of the patient's problem.

Usually, it is best to collect a medical history on the patient experiencing a medical problem before you perform a physical examination. The medical history should be complete and include all factors that may relate to the patient's current illness. The SAMPLE history format will help you secure the information you need:

- S**     **Signs/symptoms**
- A**     **Allergies**
- M**     **Medications**
- P**     **Pertinent past history**
- L**     **Last oral intake**
- E**     **Events associated with or leading to the illness or injury**

Although the physical examination should focus on the areas related to the patient's current illness, you should also realise that the patient may not always be aware of all facets of his or her problem. It is better to perform a complete physical examination and find all the problems than to perform a partial examination and miss

an underlying problem. Determine the patient's vital signs and do not forget to perform ongoing assessment if additional EMS personnel are delayed.

As you perform the patient assessment, remember to reassure the patient. Any call for emergency medical care is a frightening experience for the patient. Many medical conditions are aggravated by stress. If you can reduce the patient's stress, you will go a long way toward making the patient more comfortable.

General medical conditions may have different causes, but they result in similar signs and symptoms. By learning to recognise the signs and symptoms of these conditions as well as general treatment guidelines, you will be able to provide immediate care for patients even if you cannot determine the exact cause of the problems. This initial treatment can stabilise the patient and allow other EMS and hospital personnel to diagnose and further treat the problem.

## Shortness of Breath

Shortness of breath can affect people of all ages. The casualty or family should be asked about any pre-existing chest conditions such as asthma or chronic bronchitis. Providers should also seek to gain additional information from the presence of inhalers, home oxygen, or emergency bracelets.

Take a short patient history about how the condition developed. Typical questions include:

- Have you ever had this condition before?
- Do you take any medication for a chest condition?
- Have you ever been in hospital with chest-related complications?
- How quickly did this condition come on?
- Do you have any pain in your chest?
- Do you have any other medical problems?
- Do you smoke?
- Do you have any allergies?

Use the BTACC method to assess any breathing or respiratory concerns using the look, listen, and feel approach:

- **Look**
  - Is breathing in a normal pattern?
  - How fast is the casualty breathing? (>20 or <8 breaths/min is considered time critical)
  - Are both sides of the chest moving equally?
- **Listen**
  - Is the casualty coughing or wheezing?
  - Is the casualty producing sputum?
- **Feel**
  - Are there any regions where the casualty experiences chest pain?
  - Are there any wounds or crisp, crunchy sensations in the chest?

**Anyone who is experiencing extreme shortness of breath (e.g., cannot speak in full sentences or is unable to speak at all) should be considered time critical.**

To treat persons suffering from shortness of breath, first call for an ambulance, then reassure the casualty and encourage him or her to breathe slowly. Most casualties with shortness of breath prefer to sit up rather than lie down. Administer supplemental oxygen and apply a pulse oximeter (any saturations <95% on oxygen should be considered time critical). Support breathing with a bag-valve mask if respirations are less than 8 breaths per minute. If the casualty is unconscious with abnormal breathing, commence basic life support. Continually reassess the casualty until help arrives.

**Some patients may have severe 'COPD' or been told to avoid oxygen by the hospital, in such patients a saturation of 88-90% on the pulse oximeter is considered adequate.**

If oxygen is given then monitor the patient and if their respiratory rate falls to less than 10-12/min, then support their breathing and if the oxygen saturation is >95% then reduce the flow from 15L/min to 8L/min and reassess

## **Asthma Attack**

**Asthma** is one of the most common causes of shortness of breath and remains a major cause of death in all age groups. Asthma is an acute clamping down or spasm of the smaller air passages. It is associated with excess mucus production and swelling of the small airways and is caused by a type of allergic reaction. The lungs of an asthmatic are very sensitive to various trigger agents which may cause the airway to spasm, known as an asthma attack. Typical triggers include allergies (e.g. pollen or house dust), drugs, exercise, irritants (e.g. smoke, perfume), cold air, and infection.

Patients experiencing an asthma attack have great difficulty exhaling through partially obstructed air passages. A wheezing sound will be heard during exhalation. If there is a limited amount of air moving through the small air passages, wheezing may be absent. Fatigued patients may be so short of breath that they are unable to talk. Many asthmatic patients will have taken medications before your arrival.

A short history is an essential part of the assessment, and most asthmatics are well aware of their condition and how they are compared to normal. Enquire about any previous hospital admissions and any recent coughs or colds.

Casualties with the following signs or symptoms should be considered time critical:

- Inability to speak normally
- High respiratory rate (>20 breaths per minute)
- Exhaustion or drowsiness or
- Unconsciousness
- Lack of response to inhaler
- Inability to use inhaler

To treat persons suffering from asthma attacks, first call for an ambulance, then reassure the casualty and encourage long, slow breaths. During an attack asthmatics are often very scared, and this fear may inhibit the casualty's ability to breathe. Therefore, attempts to reassure and calm the casualty are essential. Keep casualties in a sitting position. Administer supplemental oxygen and apply a pulse oximeter (any saturations <95% on oxygen should be considered time critical). Encourage the casualty to use his or her ventolin inhaler (which is usually blue, see Figure 10-2). If no improvement is seen, the inhaler may be used again after 5-10 minutes. If the casualty is unconscious with abnormal breathing, commence basic life support. Continually reassess the casualty until help arrives.

**Figure 10-2. A Ventolin inhaler for Asthma attacks**



## **Panic Attack**

A person may have a panic attack after exposure to some kind of stimulus such as an emotional shock, fear, or a phobia which results in **hyperventilation**. The symptoms tend to be mild at first but can rapidly escalate in a vicious circle as the symptoms increase the feeling of panic.

### **Signs and Symptoms of Panic Attack**

Signs and symptoms of panic attack include:

- Shortness of breath and a feeling of not being able to breath
- Chest tightness
- Choking
- Light-headedness, drowsiness, or unconsciousness
- "Pins and needles" sensations
- Spasm of the hands, feet, and lower arms
- Rapid breathing and pulse rates

To treat persons suffering from panic attacks, reassurance with a calm voice is often all that is needed; complex medical or hospital treatment is rarely required. Oxygen may seem to provide some relief, but with some casualties the face mask may increase the feeling of panic and risks further hyperventilation and is often better avoided.

Casualties should be encouraged to take long, slow breaths, rather than 'big breaths'. If symptoms worsen, encourage the casualty to breath in and out of a paper bag for 3-4 minutes. The pulse oximeter can be used to ensure that the oxygen level in the bag is kept at a safe level for the casualty to breath. The bag should be large enough to only partially collapse with each breath. After this time, reassess the casualty and repeat for a further 3-4 minutes if required.



## Heart Attack or Angina

A common medical emergency is a patient complaining of chest pain. There are many potential causes, some more serious than others, but providers should assume the possibility of a **heart attack** until proven otherwise. A heart attack occurs when a part of the heart actually dying from lack of blood supply. If the blood supply is still present, but insufficient for the heart muscle, this results in **angina**. Angina suggests that the muscle is at risk but not dead.

To diagnose a heart attack or angina, take a short patient history; typical questions include:

- What is the pain like? (Cardiac pain is described as crushing, vice-like, like a heavy weight or pressure on the chest.)
- Where is the pain? (Cardiac pain is usually centrally in the chest but can also go down the arms, up the neck or jaw.)
- Have you had similar symptoms before?
- Do you have a history of heart problems or other related medical conditions?
- Has you fallen recently or otherwise injured your chest?

Other possible causes for symptoms of chest pain include indigestion, an ulcer in the gut, muscular or bony pain or an abnormal aorta (aneurysm). Excluding any of these without investigations is very difficult, although a history of trauma or tenderness to touch may indicate a muscle or bony problem.

### Signs and Symptoms of Heart Attack or Angina

Signs and symptoms of a heart attack or angina include:

- Severe chest pain (often after exercise but may occur at rest)
- Shortness of breath
- Sweaty, clammy skin
- Blue lips or skin
- Nausea or vomiting
- Fear or feeling that they are dying

To treat persons suffering from chest pain, first call for an ambulance, then reassure the casualty. Administer supplemental oxygen and apply a pulse oximeter. The casualty may prefer to sit up unless he or she feels faint. If the casualty is unconscious with abnormal breathing, commence basic life support. Continually reassess the casualty until help arrives.

Depending upon local policies, a nitrate spray may be administered to provide some pain relief. Aspirin may also be given to reduce the damage to the heart, if the patient can take it safely.

## Stroke

Strokes are a leading cause of brain injury and disability in adults. A **stroke** occurs following an interruption in the blood supply to the brain or when there is a bleed into the brain from a leaking blood vessel. The area of the brain affected is at risk unless the blood supply is rapidly restored. Without treatment, that part of the brain will be damaged or die. Think of a stroke as a “brain attack,” similar to a heart attack. People with high blood pressure have an increased risk of having a stroke.

The signs and symptoms of stroke vary depending on which portion of the brain is affected. A stroke patient may be alert, confused, or unresponsive. Responsive patients may not be aware that they have signs of a stroke. Some stroke patients are unable to speak; others are unable to move one side of their body. The patient may have a headache and may describe it as “the worst headache of my life.” Some stroke patients suffer seizures.

### **Signs and Symptoms of Stroke**

Signs and symptoms of stroke include:

- Previous strokes
- Weakness or altered sensation (usually down one side of the face or body)
- Slurred speech or inability to speak
- Confusion or reduced conscious level
- Seizures

To treat persons suffering from stroke, **rapid transfer to hospital is essential.** There is little more that can be done pre-hospital other than simple supportive measures. First call for an ambulance, then reassure the casualty. Administer supplemental oxygen and apply a pulse oximeter. Maintain the airway if the casualty’s conscious level is reduced. If the casualty is unconscious with abnormal breathing, commence basic life support. Continually reassess the casualty until help arrives.

### **Seizures or Convulsions**

**Seizures** are caused by sudden episodes of uncontrolled electrical impulses in the brain. Seizures that produce shaking movements and involve the entire body are called generalized seizures or grand mal seizures. These seizures usually last less than 5 minutes, although prolonged seizures may continue for more than 5 minutes. Patients are usually unconscious during generalized seizures and do not remember them afterwards.

Some seizures result in only a brief lapse of consciousness. These seizures are called absence seizures or ‘petit mal’ seizures. Patients experiencing absence seizures may blink their eyes, stare vacantly, or jerk one part of their body.

Although seizures are rarely life threatening, they are a serious medical emergency and may be the sign of a life-threatening condition. Usually, the seizure will be over by the time you arrive at the scene. If it has not ended, your treatment should focus on protecting the patient from injury. Do not restrain the patient’s movements. If you attempt to restrain the patient, you may cause further injury.

During a seizure, the patient generally does not breathe and may turn blue. You cannot do anything about the patient’s airway during the seizure, but once the seizure has stopped, it is essential that you ensure an open airway. Observe the seizure activity and report your observations and assessment findings to other EMS providers. They may be important in determining the cause of the seizure. Regardless of the cause of the condition, the responder’s priority is to keep the casualty safe, maintaining their airway and avoiding further injury.

After a seizure, the patient may be sleepy, confused, upset, hostile, or out of touch with reality for up to an hour. You should open the airway, place the patient in the

recovery position, and arrange for rapid transport to hospital. Most patients start to breathe soon after the seizure ends. If the patient does not resume breathing after a seizure or if the seizure is prolonged, begin CPR

Many times you will not be able to determine the cause of the patient's seizure. To treat persons suffering from seizures or convulsions, first call for an ambulance, then make efforts to protect the casualty from hitting objects or injuring him or herself. Do not attempt to restrain the casualty during the seizure, but move any objects out of the way. Apply a pulse oximeter and then administer supplemental oxygen to keep saturation >95%. Consider using a nasal airway if the airway is obstructed. Even if seizures cease before the ambulance arrives, do not cancel the ambulance. Maintain the airway and continue to monitor and reassess the casualty regularly until help arrives.

## Diabetic Emergency

**Diabetes** is caused by the body's inability to process and use the type of sugar that is carried by the bloodstream to the body's cells. Sugar is an essential nutrient. The body's cells need both oxygen and sugar to survive. The body produces a hormone (chemical) called insulin that enables sugar carried by the blood to move into individual cells, where it is used as fuel.

If the body does not produce enough insulin, the cells become "starved" for sugar. This condition is called diabetes. Many diabetics (people with diabetes) must take supplemental insulin injections to bring their insulin levels up to normal. Mild diabetes can sometimes be treated by oral medicine rather than insulin.

Diabetes is a serious medical condition. Therefore, all diabetic patients who are sick must be evaluated and treated in an appropriate medical facility. Changes to diet, medication, or insulin may reduce the blood sugar level. Illness and infection can increase instability of blood sugars.

If medication is taken without food, the blood sugar levels can become dangerously low, a condition known as **hypoglycaemia**. Most diabetics will be aware if their blood sugar levels are low and will take some sugar or call for help; however, some have little warning and collapse. It can be very difficult to determine that a patient is hypoglycaemic without a blood sugar test.

### Signs and Symptoms of Hypoglycaemia

Signs and symptoms of hypoglycaemia include:

- Weakness
- Fainting
- Hunger
- Abnormal behaviour
- Sweating
- Cold, clammy skin
- Drowsiness

Take a short patient history; typical questions include:

- Have you ever had this condition before?
- What is your normal blood sugar level?

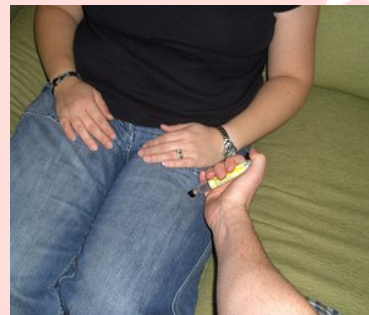
- Have you taken any medication or insulin?
- Have you been unwell or not eating recently?
- Have you taken any sugar or glucose tablets?
- Do you have a diabetic card or Med-alert bracelet?

To treat persons suffering from diabetic emergencies, first call for an ambulance, then reassure the casualty. If the casualty is experiencing hypoglycaemia, sit or lie the casualty down and provide a sugary (non-diet) drink, glucose sweets, or chocolate. If the casualty's level of consciousness is reduced, do not give drinks but consider applying a glucose gel or using jam, both of which can be applied to the gums. Administer supplemental oxygen. If the casualty becomes unconscious, provide basic life support. Reassess the casualty and consider repeating treatment if there is no improvement.

## Allergic Reaction

Allergic reactions can have variable effects from a minor irritation to a severe life threatening collapse. The trigger for the reaction can be anything such as food stuffs, drugs, insect bites, or materials such as latex. Casualties may or may not be aware of their allergy. The most at-risk individuals may carry an adrenaline pen to self-administer (Epi-pen) (see Figure 10-5). Check for any allergy cards or Med-Alert bracelets.

**Figure 10-5 An Epi-pen may be used to treat an allergic reaction**



## Signs and Symptoms of Allergic Reaction

Signs and symptoms of an allergic reaction include:

- Presence of an obvious trigger agent
- Irritation or itching of the skin
- Redness and swelling of the skin, face, or tongue
- Wheezing or difficulty breathing
- Faintness or collapse
- Cardiac arrest

To treat persons suffering from allergic reactions, first remove the potential trigger or cause of the reaction. Call an ambulance and reassure the casualty. Administer supplemental oxygen and apply a pulse oximeter. Consider inserting a mechanical airway if the mouth is swelling. If the casualty is unconscious with abnormal breathing, commence basic life support. Continually reassess the casualty until help arrives.

## Summary:

- Your approach to a patient who has a general medical complaint should follow the BTACC sequence. Usually, it is best to collect a medical history on the patient experiencing a medical problem before you perform a physical examination. The SAMPLE history format will help you secure the information you need.
- General medical conditions may have different causes, but they result in similar signs and symptoms. By learning to recognise the signs and symptoms of these conditions as well as general treatment guidelines, you will be able to provide immediate care for patients even if you cannot determine the exact cause of the problems.
- Use the look, listen, and feel approach to determine the cause of shortness of breath. Encourage casualties to breathe slowly and provide high-flow oxygen.
- Victims of asthma attacks should use a ventolin inhaler and should be kept in a sitting position.
- Panic attacks may result in hyperventilation; it is important to calm and reassure the casualty. It may be useful to have the casualty breathe into a paper bag.
- Anyone suffering from chest pain should be considered to be having a heart attack, until proven otherwise.
- Signs and symptoms of stroke vary, but rapid transfer to hospital is always essential.
- Seizures are caused by sudden episodes of uncontrolled electrical impulses in the brain. Usually, the seizure will be over by the time you arrive at the scene. If it has not ended, your treatment should focus on protecting the patient from injury. Do not restrain the patient's movements. You cannot do anything about the patient's airway during the seizure, but once the seizure has stopped, it is essential that you ensure an open airway. After you have opened the airway, place the patient in the recovery position and arrange for transport to an appropriate medical facility.
- In diabetic patients, blood sugar levels can become dangerously low (hypoglycaemia). Patients should be given a sugary drink, glucose sweets, or chocolate or, if unconscious, glucose gel or jam. Administer supplemental oxygen.
- For casualties with allergic reactions, first remove the potential trigger or cause of the reaction. Consider inserting a mechanical airway if the mouth is swelling.

## Vital Vocabulary

**angina** Chest pain resulting from decreased blood supply to the heart.

**asthma** An acute clamping down or spasm of the smaller air passages.

**diabetes** A disease in which the body is unable to use sugar normally because of a deficiency or total lack of insulin.

**heart attack** Interruption in the blood supply to the heart.

**hypoglycaemia** Low blood sugar level

**seizures** Episodes of uncontrolled electrical impulses in the brain that produce shaking movements

**stroke** Interruption in the blood supply to the brain



## Check Your Knowledge

1. True or False? To treat a medical emergency, it is critical to understand the underlying cause of the condition.
  - a. True
  - b. False
  
2. An diabetic patient
  - a. Will never know if their blood sugars are getting low
  - b. Frequently has pain
  - c. May behave strangely if their sugar is low
  - d. Never needs a rapid speed of evacuation
  
3. A casualty with who is experiencing shortness of breath and is having difficulty speaking in full sentences should be:
  - a. Considered time critical.
  - b. Given their nitrate spray and aspirin, if conscious.
  - c. Likely to be suffering from angina.
  - d. All of the above.
  
4. When responding to someone experiencing seizures, you should:
  - a. Examine the scene for the presence of a trigger
  - b. Never move the casualty
  - c. Administer supplemental oxygen and apply a pulse oximeter.
  - d. Hold them to avoid injury
  
5. Which of the following is not a sign of a possible severe allergic reaction?
  - a. Wheezing
  - b. Swelling of the lips
  - c. Tingling around the mouth
  - d. Uncontrollable voiding of the bladder
  - e. Redness of the skin

## Answers:

1) a

2) c

3) a

4) c

5) d

## GLOSSARY

<b>angina</b>	Chest pain resulting from decreased blood supply to the heart
<b>apnoea</b>	Condition where the casualty is not breathing.
<b>asthma</b>	An acute clamping down or spasm of the smaller air passages.
<b>automated external defibrillator (AED)</b>	Portable battery-powered device that recognises ventricular fibrillation and advises when a shock is indicated. The AED delivers an electric shock to a casualty in ventricular fibrillation
<b>AVPU scale</b>	A scale to measure a casualty's level of consciousness. The letters stand for alert, verbal, pain, and unresponsive.
<b>bag-valve mask</b>	A device used to deliver supplemental oxygen to a casualty who is not breathing. Oxygen is squeezed from the bag, through a one way valve and into the mask applied to a casualty's face.
<b>basic life support (BLS)</b>	Combination of CPR and AED to treat a casualty who has no signs of life (i.e. breathing, movement, or pulse).
<b>BTACC algorithm</b>	A flowchart which guides providers through the BTACC system of assessment and trauma care.
<b>capillary refill time</b>	The ability of the circulatory system to restore blood to the capillary blood vessels after it has been squeezed out by the rescuer
<b>cardiac arrest</b>	Ceasing of breathing and a heartbeat.
<b>cardiopulmonary resuscitation (CPR)</b>	The artificial circulation of the blood and movement of air into and out of the lungs.
<b>cervical collar</b>	A neck support that partially stabilises the neck following injury.
<b>chest compressions</b>	Manual chest-pressing method that mimics the squeezing and relaxation cycles a normal heart goes through; administered to a person in cardiac arrest.
<b>chest seal</b>	Specialised circular, adhesive dressing used to cover open or sucking chest wounds
<b>circulation preservation</b>	Principle of care focusing on minimizing blood loss rather than fluid replacement
<b>crush injury</b>	A form of blunt trauma in which the body is compressed to an extent and duration that causes damage to the body's tissues.
<b>diabetes</b>	A disease in which the body is unable to use sugar normally because of a deficiency or total lack of insulin.



<b>DiD-iT</b>	A technique used to control external bleeding; the mnemonic DiD-iT outlines the three steps of this technique: application of direct pressure, more direct pressure, and a tourniquet.
<b>drowning</b>	The process of experiencing respiratory impairment from submersion or immersion in a liquid.
<b>energy transfer</b>	The process through which kinetic or potential energy is distributed to an object or person during an impact.
<b>entrapment</b>	A situation in which a casualty cannot be immediately released or evacuated from the scene of injury.
<b>full-thickness burns</b>	Burns that extend through the skin and into or beyond the underlying tissues; the most serious class of burn.
<b>head tilt-chin lift manoeuvre</b>	Opening the airway by tilting the head backward and lifting the chin forward, bringing the entire lower jaw with it.
<b>heart attack</b>	Interruption in the blood supply to the heart.
<b>hypoglycaemia</b>	Low blood sugar level
<b>hypoxaemia</b>	Low levels of oxygen in the blood.
<b>jaw-thrust manoeuvre</b>	Opening the airway by bringing the jaw forward without extending the neck.
<b>kinematics</b>	The science of how matter moves and interacts in collisions.
<b>logrolling</b>	A technique used to move a patient onto a longboard.
<b>MARCH</b>	The BTACC acronym for casualty assessment and care, which stands for massive external haemorrhage control, airway management, respiratory management, circulatory management, and head trauma and other serious injuries.
<b>massive external haemorrhage</b>	A major life-threatening bleed on the outside of the body.
<b>nasal airway</b>	An airway adjunct that is inserted into the nostril of a casualty who is not able to maintain a natural airway; also called a nasopharyngeal airway.
<b>oral airway</b>	An airway adjunct that is inserted into the mouth to keep the tongue from blocking the upper airway; also called an oropharyngeal airway.
<b>paediatric face mask</b>	A mask fitted over the child's nose and mouth to assist in delivering supplemental oxygen.
<b>partial-thickness burns</b>	Burns in which the outer layers of skin are burned; these burns are characterised by blister formation
<b>personal protective equipment (PPE)</b>	Specialised equipment worn or used to protect rescuers from injury and infection.

<b>pulse oximeter</b>	A machine that consists of a monitor and a sensor probe that measure the oxygen saturation in the capillary beds.
<b>pulse</b>	The wave of pressure created by the heart as it contracts and forces blood into the major arteries and around the body.
<b>recovery position</b>	A side-lying position that helps an unconscious patient maintain an open airway.
<b>scoop-and-run</b>	Term for rapid evacuation to hospital, performed as quickly as possible
<b>seizures</b>	Episodes of uncontrolled electrical impulses in the brain that produce shaking movements
<b>shock</b>	Failure of the cardiovascular system in which body is not getting the essential oxygen and substrates it needs to survive
<b>splinting</b>	A means of immobilising an injured part by using a rigid or soft support.
<b>stridor</b>	Harsh, high pitched noise that indicates airway obstruction.
<b>stroke</b>	Interruption in the blood supply to the brain
<b>superficial burns</b>	Burns in which only the superficial part of the skin has been injured; for example, a sunburn.
<b>suspension trauma</b>	An injury in which a casualty is suspended in a harness motionless for long period of time.
<b>three-sided dressing</b>	Type of square dressing used to cover open or sucking chest wounds that is taped to the casualty on only three-sides, with the fourth side left open to serve as a one-way air valve
<b>time critical</b>	Serious and potentially life-threatening situation.
<b>tourniquet</b>	Device used to occlude blood supply to a limb by compressing the artery against a bone.
<b>ventilations</b>	Artificial means of breathing for a casualty.
<b>ventricular fibrillation (VF)</b>	An uncoordinated muscular quivering of the heart; the most common abnormal rhythm causing cardiac arrest.





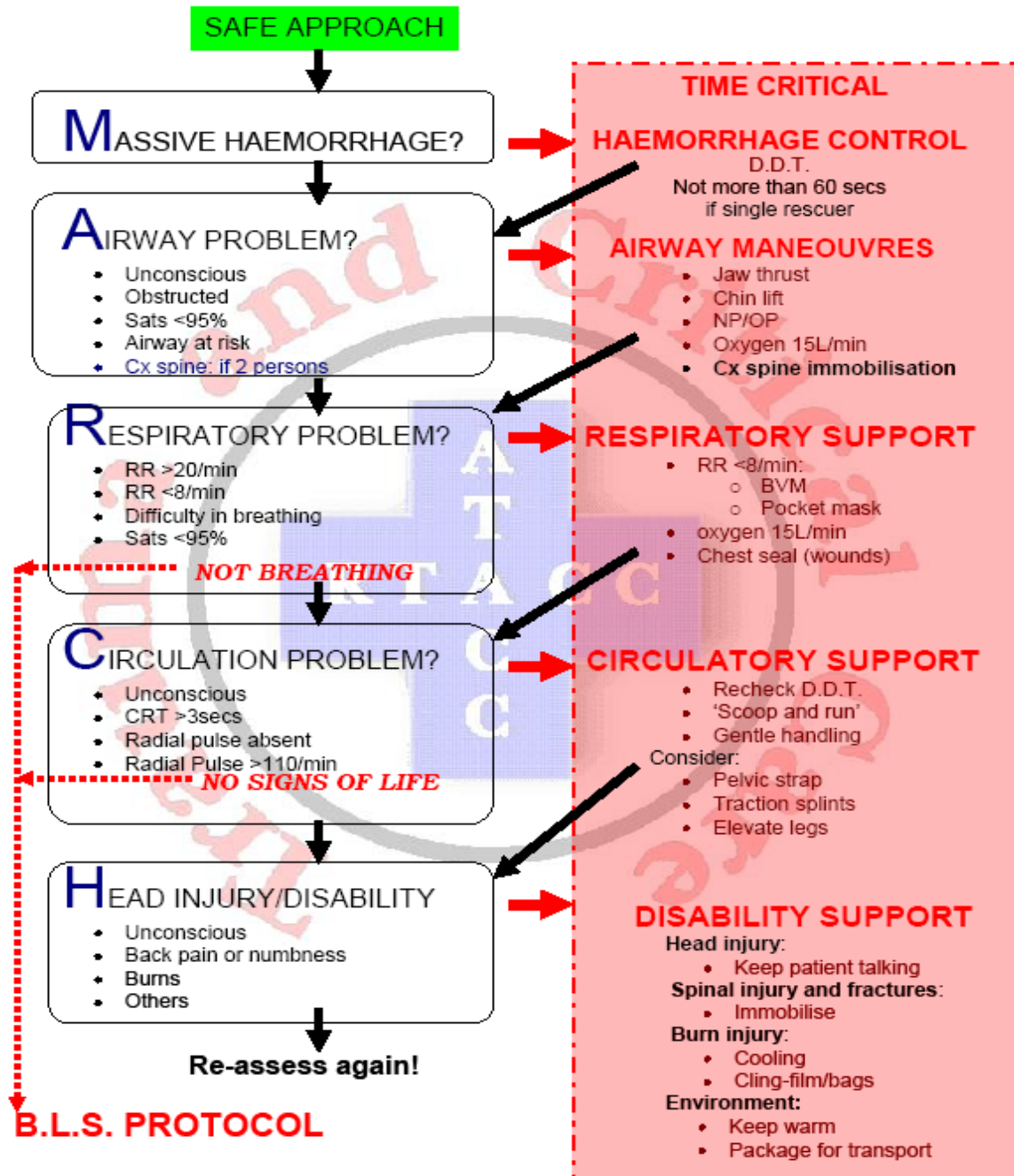
# Appendix A: Patient Report Form – example from Cheshire Fire & Rescue Service

		Casualty Carer						
		<b>PATIENT REPORT FORM</b>						
		Risks assessed <input type="checkbox"/>						
Name			Age	Sex	M / F			
Address			Incident number					
Location								
Kinematics								
Potential injuries	All Head Airway Chest Abdomen Pelvis Limbs							
<b>Massive Haemorrhage?</b> Yes <input type="checkbox"/> Site: _____  <b>Airway (+ Cervical spine)</b> Unconscious <input type="checkbox"/> Obstructed <input type="checkbox"/> At risk <input type="checkbox"/> Sats <93% on air <input type="checkbox"/>  Possible cx spine injury <input type="checkbox"/>			Existing medical problems  Allergies					
						<b>TIME CRITICAL</b>		
<b>Respiration</b> Rate >20/min <input type="checkbox"/> Rate <8/min <input type="checkbox"/> Difficulty in breathing <input type="checkbox"/> Sats <95% on oxygen <input type="checkbox"/>			D <input type="checkbox"/> D <input type="checkbox"/> I <input type="checkbox"/> T Time applied ..... <input type="checkbox"/> Haemostatic <input type="checkbox"/> Oxygen <input type="checkbox"/> Jaw Thrust <input type="checkbox"/> Chin lift <input type="checkbox"/> NP <input type="checkbox"/> OP <input type="checkbox"/> IGEL/LMA <input type="checkbox"/> Suction <input type="checkbox"/> Hard collar <input type="checkbox"/> Blocks <input type="checkbox"/> Manually immobilised <input type="checkbox"/>					
<b>Circulation</b> Conscious level reduced <input type="checkbox"/> CRT >3secs <input type="checkbox"/> No radial pulse <input type="checkbox"/> Pulse >110/min <input type="checkbox"/>			Pocket mask <input type="checkbox"/> BVM (2 person) <input type="checkbox"/> Chest seals 1 <input type="checkbox"/> 2 <input type="checkbox"/>					
<b>Head Injury/Disability</b> AV <input type="checkbox"/> Back pain/numbness <input type="checkbox"/> Burns <input type="checkbox"/> Paralysis <input type="checkbox"/> Fatality in vehicle <input type="checkbox"/>			DDT check <input type="checkbox"/> Scoop and run <input type="checkbox"/> Gentle handling <input type="checkbox"/> Pelvic strap <input type="checkbox"/> Splints <input type="checkbox"/>			C# Closed Fracture O# Open Fracture B Burn (shade area) F Foreign Body L Laceration A Abrasion S Splint T Tourniquet P Penetrating wound W Bruising O Amputation ⊙ Chest seal		
<b>No signs of life</b>			Spinal immobilisation <input type="checkbox"/> Splints <input type="checkbox"/> Burns cooling >5 mins <input type="checkbox"/> Burns dressing <input type="checkbox"/> Keep warm <input type="checkbox"/> Prepare for transfer <input type="checkbox"/>			Time (mins)		
<b>BLS</b> Time of collapse Bystander CPR Y / N Time started ROSC time No. of shocks delivered Time of 1 <sup>st</sup> shock			Sats			Oximeter heart rate (bpm)		
			Respiratory Rate (bpm)			Radial pulse present (tick)		
			Carotid pulse present (tick)			AVPU		
			Observations at least every 5 minutes					
Ambulance number			Other Information					
Hospital								
Others attending								
Time								

\*MARCH\* casualty handover

Appendix B: BTACC ALGORITHM

# BTACC ALGORITHM



## Appendix C: BTACC Trauma kit

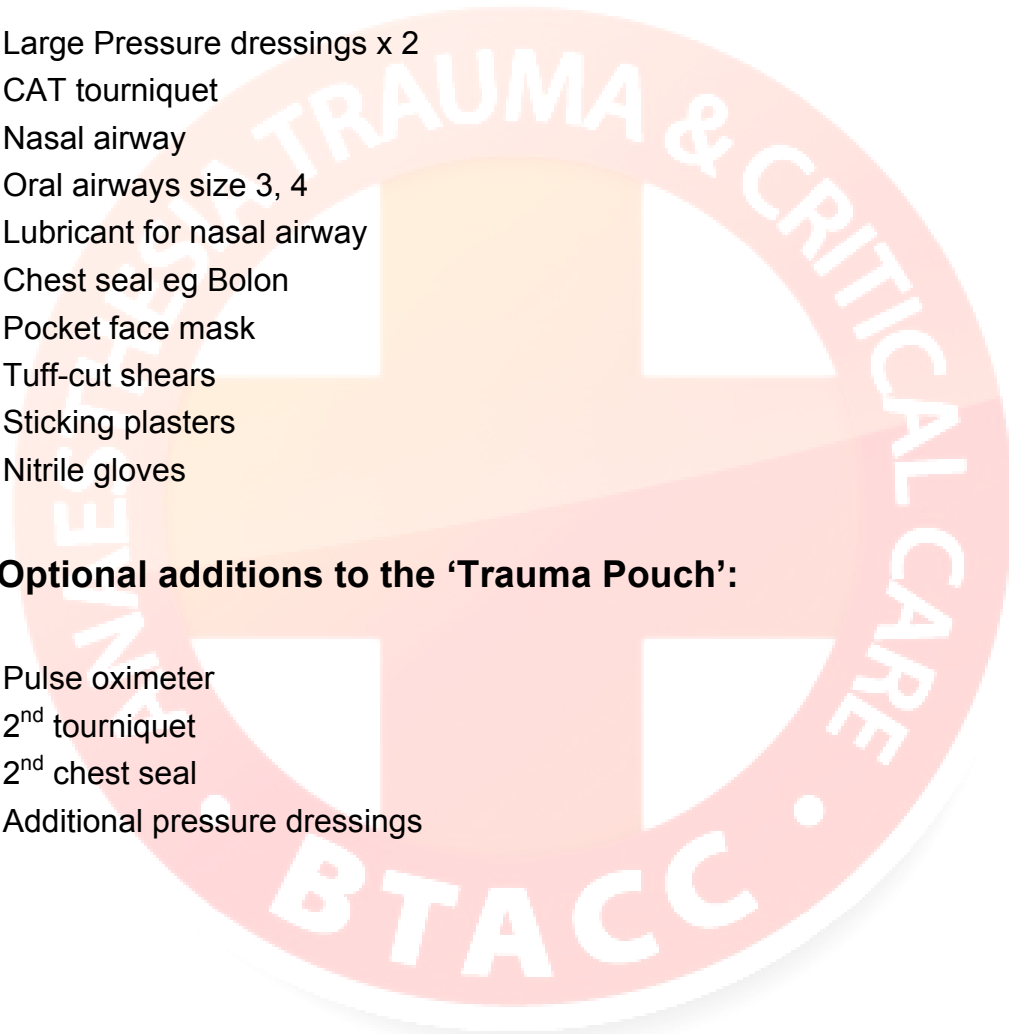
1. Basic 'BTACC Trauma Pouch'
2. Optional additions to the 'Trauma Pouch'
3. Additional equipment in 'BTACC Trauma BAG'

### 1. Basic 'BTACC Trauma Pouch' kit eg leg pouch or bum-bag:

2. Large Pressure dressings x 2
3. CAT tourniquet
4. Nasal airway
5. Oral airways size 3, 4
6. Lubricant for nasal airway
7. Chest seal eg Bolon
8. Pocket face mask
9. Tuff-cut shears
10. Sticking plasters
11. Nitrile gloves

### 2. Optional additions to the 'Trauma Pouch':

1. Pulse oximeter
2. 2<sup>nd</sup> tourniquet
3. 2<sup>nd</sup> chest seal
4. Additional pressure dressings



### 3. Additional contents in BTACC Trauma Bag:

1. Oxygen cylinder
2. Non-rebreathing oxygen mask – adult
3. Non-rebreathing mask – child
4. Bag-valve mask with adult face mask
5. Paediatric mask to use on Bag-valve mask
6. Hand operated suction with disposable container and tubes
7. Adjustable hard collar – adult
8. Adjustable hard collar – child
9. Pocket face mask
10. Triangular bandage
11. Pelvic strap
12. Sam Splint
13. Crepe bandage for use with Sam splint
14. Burn-film – cling film
15. Polythene hand/foot bags (freezer bags)
16. Surgical tape
17. Pack of gauze swabs
18. Eye wash – saline
19. Yellow clinical waste bag
20. Snap-light sticks
21. Medi-wrap thermal blanket

