Anaesthetic priorities in pre-hospital trauma care

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Abstract

The approach to pre-hospital trauma care has undergone some changes in recent years. Some of the lessons have been learnt from the military as a direct result from experiences in recent conflicts. Personnel involved in pre-hospital care need to be aware of the dangers at the scene and have the ability to work with and liaise with other emergency services. Control of any massive haemorrhage needs to be gained as a priority before moving on to the more familiar *Airway, Breathing and Circulation* approach. The time-critical casualty needs to be recognized and any immediate life- or limb-threatening complications dealt with in the shortest possible time before expedited evacuation to a hospital that can provide definitive care.

In addition human factors and crew resource management must be considered. Furthermore with the introduction of a formal training curriculum the requirement for robust evidence and clinical governance is pressing.

Keywords Massive haemorrhage; pre-hospital; rapid sequence induction; resuscitation; trauma

Royal College of Anaesthetists CPD matrix: 3A10, 2A05, 2A02

Learning objectives

After reading this article, you should be able to:

- describe the new approach in pre-hospital trauma care where any obvious cause of massive haemorrhage should be dealt with as a priority
- describe the indications for a pre-hospital rapid sequence induction and crucially the risks involved
- understand fluid management and hypotensive resuscitation in pre-hospital trauma care
- appreciate the advances in pre-hospital medicine and the current research priorities

The aim of pre-hospital care is to transport the patient to a hospital that can provide definitive care in the shortest possible time whilst treating any time-critical life- or limb-threatening injuries. Treatment interventions should not overly delay transport to the hospital and it is suggested that practitioners spend no longer than 10 minutes at the scene to perform interventions that cannot be performed whilst transporting the patient to definitive care.[1] The exception to this may be in cases of entrapment. The advantage of having a doctor trained in pre-hospital care at the scene is the ability to provide a greater range of life- or limb-saving interventions, the provision of analgesia and sedation and decision-making to direct the patient to the most appropriate hospital for definitive care.

There are many risks involved in the pre-hospital care environment. All personnel entering this environment need to be trained to recognize and avoid these risks. Protective high-visibility reflective clothing needs to be worn that identifies the individual's role. Personal protective equipment should be functional and protect the wearer from the elements as well as from risks at the scene. In a civilian environment all pre-hospital doctors should have access to a helmet as well as heavy-duty gloves and boots with metal toecaps.

The pre-hospital care team will need to work with other emergency services such as the police and fire brigade to ensure their own safety and to coordinate casualty extraction and evacuation.

Approaching the scene

The scene should not be approached until it is safe to do so and this will be directed by the emergency services that have secured the area. Information as to the nature of the incident, the type and number of casualties involved and any specific risks to the rescuers or casualties should be sought. This information can be succinctly given by an **ETHANE** report where the letters of the mnemonic stand for: **E**-exact location, **T**-the time of the incident, **H**-any hazards present, **A**-access and egress to the scene, **N**-number and nature of the casualties and **E**-emergency services present.

The scene itself can provide clues to the nature of the likely injuries. In road traffic collisions reading the wreckage by taking into account speeds, vehicle deformation patterns and where casualties were sitting or standing is an important skill to identify patterns of injury. If there are numerous casualties use of the triage sieve may be required.

The approach to a casualty has changed in recent years directly as a result of military experience in recent conflicts. A CABC approach to a casualty is now recommended where C stands for the initial ***Control*** of ***Catastrophic*** haemorrhage, before moving on to ***Airway, Breathing and Circulation***.[2]

Control of massive haemorrhage

Massive external haemorrhage is a significant cause of pre-hospital mortality and morbidity. Although less common in civilian practice than in military conflicts it still needs to be recognized and dealt with to prevent avoidable deaths. This should be the first step in the primary survey. Once identified, haemorrhage control follows the mnemonic **DDIT** can be used. First ***Direct pressure*** is applied to the bleeding site. If this fails to stem the flow of blood then further ***Direct pressur***e is applied with another dressing applied over the first. If this fails then ***Indirect pressure*** can be applied where an artery can be compressed against a bone such as the femoral artery within the groin, before moving on to the final step of applying a

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Tourniquet if the source of major bleeding is from a limb wound. Recently introduced novel haemostatic agents (such as Celox™ and Hemcon™), developed either in powder form or impregnated into dressings can be packed into wounds to achieve haemostasis.

Airway/C spine/oxygen

After control of massive haemorrhage has been established the airway should be assessed while simultaneously providing manual in-line stabilization of the cervical spine. Cervical spine injury should be assumed to have occurred in patients where any large transfer of energy has occurred or who have sustained specific neck trauma. Manual in-line stabilization can be provided until a collar, spinal board and blocks can be fitted. All patients should be given high-flow oxygen.[3]

In assessing the airway of a pre-hospital trauma patient it is important to confirm it is patent, whether there is a risk of aspiration and whether the patient is breathing adequately. Simple manoeuvres such as jaw thrust and careful suctioning of blood debris and secretions can improve the patency of an airway in unconscious patients. If the patient is obtunded adjuncts such as an oropharyngeal airway or a laryngeal mask airway can be used. In severe maxillofacial trauma manipulation of the facial bones or soft tissue may be needed to improve airway patency. In cases where there is severe trauma to the face or neck then a surgical airway may be the only option.

Patients with severe head injuries with a Glasgow Coma Scale (GCS) score less than 8 or a GCS score that is deteriorating may benefit from intubation and ventilation to optimize oxygenation and maintain a normal CO_2 level to minimize secondary brain injury. Patients with signs of upper airway burns need to be intubated early with an uncut endotracheal tube to prevent airway obstruction from upper airway oedema.

In identifying the most suitable airway manipulation, factors such as evacuation time and mode of transport should be taken into account as well as the skill-set of the pre-hospital care team.

Breathing

When assessing breathing a Look, Listen and Feel approach should be adopted to ascertain whether there is any life-threatening chest injury that requires a specific pre-hospital intervention before evacuation to an environment where more definitive treatment can occur. Any open pneumothorax or sucking chest wound should be covered with either a dressing taped at three sides or an appropriate chest seal if one is available. Flail segments should be splinted and adequate analgesia given if they are interfering with breathing. The exact prevalence of pre-hospital tension pneumothorax is unknown but is thought to be a rare event in blunt thoracic injury.[4] Tension pneumothorax becomes more likely in a positively pressured ventilated patient and this should always be suspected in a ventilated patient who is deteriorating. The treatment is immediate decompression via a needle or open thoracostomy. Open thoracostomy is preferred in ventilated patients. Ventilated patients can be adequately managed for prolonged transfer with an open thoracostomy but chest drain insertion is required in spontaneously breathing patients once an open thoracostomy has been performed. Massive haemothoraces should not be drained in the pre-hospital environment unless they cause severe disruption to breathing; this also applies to simple pneumothoraces.

Circulation

An assessment of the degree of blood loss needs to be made using vital signs such as heart rate, non-invasive blood pressure, respiratory rate and capillary refill time. Also the likely mechanism of injury should be taken into account.

In assessing likely methods of blood loss it is useful to remember the mnemonic '*blood on the floor and four more*'. This reminds us that as well as obvious external bleeding the four main areas of internal blood loss are from long bone fracture, bleeding into the pelvic cavity, bleeding into the abdominal cavity and bleeding into the chest cavity. Management of massive external bleeding has already been covered. Pelvic binders and traction splints can reduce bleeding in the pelvic cavity and from long bone fractures respectively. Evacuation to a place where definitive surgical or radiological control of bleeding is available should occur as soon as possible. Intravenous access should be gained with large-bore cannula if possible but in a shocked patient this should not delay transfer to definitive care.

Intraosseous (IO) access

Since 2010 IO access has been the recommended alternative to intravenous access in the Advanced Life Support guidelines. It is a safe, fast and reliable mode of delivery for drugs, fluids and blood products. The literature has consistently demonstrated success rates of approximately 90% regardless of the background of the practitioner (i.e. nurse, paramedic or physician).[5–9] Complication rates are low at approximately 0.3% but may include a spectrum of conditions from extravasation to osteomyelitis or compartment syndrome. The EZ-IO™ is the most common brand and the most common site of insertion the tibia but in military patients often presenting with lower extremity injuries the humeral head has been used, alternatively sternal intraosseous devices (e.g. FAST™) have been used with good effect. It should be noted however, that anecdotally, insertion and particularly, flushing, of all IO needless has been reported as excruciatingly painful.

Resuscitation

Hypotensive fluid resuscitation is now practised in the pre-hospital environment within the UK.[10] Fluid should only be administered in aliquots of 250 ml at a time and only when a radial pulse is lost which equates to a systolic blood pressure of around 80 mmHg. However there are certain groups of patients in whom it is suggested hypotensive resuscitation should not be practised and these are head-injured patients, children under the age of 12, those with suspected blast injury, pregnant patients and those who were injured more than 1 hour previously.[11]

What fluid should be used remains a controversial issue because of a lack of evidence. There are proponents of crystalloid and colloids as well as hypertonic solutions such as hypertonic saline. In recent British military experience blood and fresh frozen plasma are being transported to the front line and given in the pre-hospital environment during a helicopter evacuation.