Topic Overview: The Bleeding Patient

Module T6

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Learning Outcomes

The learning outcomes for the simulation session target best practice in the management of the bleeding patient including

- Assessment of bleeding
- Stopping the bleeding
- Avoiding the lethal triad
- Massive transfusion
- Surgical correction of bleeding

There are some key points to remember when considering the bleeding trauma patient and these are

- Uncontrolled bleeding is the leading cause of preventable death in trauma
- Early intervention improves outcomes
- Coagulopathy common after severe trauma and occurs very early
- Massive Transfusion Protocols replaces blood and coagulation factors in a coordinated manner
- Haemorrhage is responsible for about 40% of trauma deaths globally. Injuries are sustained from both blunt and penetrating trauma, which demonstrate different injury patterns and sites of bleeding.

Consider the high risk mechanisms of injury

- High speed MVA >100km/hr, ejection, rollover
- Death of other occupant
- Gunshot wound or penetrating wound (esp to torso)
- Fall >1.5m or 5 steps
- MBA with separations
- Bicycle accident of any type

Early rapid intervention has evolved based on the theory of the "Golden hour", which is not a precise 60 minutes, but a reminder that the clinical management is time critical. The pathology has begun when the injury occurred and early intervention may reduce secondary injury from hypotension and the subsequent hypoperfusion that occurs as a result of the trauma. This hypoperfusion of the tissues occurring in trauma will lead to hypoxia of the vital organs, acidaemia, hypothermia and impaired cell functioning, with the result of these physiological changes contributing significantly to coagulopathy, which compounds the haemorrhage of the initial trauma, and multi-organ dysfunction, a late cause of death in trauma.

The early interventions which can occur in the emergency department are limited and should be carried out simultaneously to surgical care being arranged for these patients. When surgical care is available locally it should be arranged expeditiously. If it is not available locally then the retrieval services should be rapidly activated to transfer the patient to a hospital where surgery is available or alternately bring the surgeon to the patient.

There is evidence from numerous retrospective studies that early surgical intervention in major trauma to stop the bleeding improves outcomes and this has led to the use of damage control surgery, prior to the use of

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definitive surgical closure in patients with major trauma. Massive transfusion has been studied, primarily in the military, and has been shown to improve outcomes if both the oxygen carrying capacity of the blood, the haemoglobin, and also the coagulation disorder are corrected. The exact ratio of blood products is controversial, but a high ratio of these products is advised – approximately 1:1:1, packed red blood cells, fresh frozen plasma and platelets. There is recent evidence that tranexamic acid should also be used early in traumatic bleeding (Crash-II Study).

Assessment of Bleeding Trauma

In the assessment of major trauma is it important to use a team approach to trauma and be aware that in these teams assessment and management can occur simultaneously. Any major external haemorrhage should be controlled with direct pressure and elevation at the very commencement of the primary survey. The clinical picture of the whole patient with major trauma is essential in the assessment.

- Appearance - pale, sweaty, agitated?
- Pay close attention to respiratory rate and trends in all physiology
- Heart rate - more sensitive than BP - remember HR low in young fit people; may be tachycardic and shocked with "normal" rate. A higher SBP >100mmHg is needed in a head injured patient. SBP is a late indicator of shock – approximately 30-40% of blood volume lost before SBP↓, MAP of ~65mmHg is likely to allow vital organs to work (supine), Don't forget the diastolic – decreased pulse pressure (i.e. →SBP / ↑DBP means peripheral vasoconstriction and blood loss). Check the pulses – they can give you an idea of systolic pressures - Radial ≥70mmHg, Femoral ≥60mmHg, Carotid ≥50mmHg. Capillary refill – poor indicator of perfusion in traumatic haemorrhage
- Level of consciousness is affected by perfusion – decreased end organ perfusion may be reflected in ABCD or E

During the Primary survey if an immediate threat to life is found it should be treated at that time. These include

  - Threatened airway – Rapid Sequence Intubation
  - Massive Haemothorax – thoracostomy
  - Tension Pneumothorax – thoracostomy
  - Pericardial Tamponade – resuscitative thoracotomy

Imaging including FAST, ultrasound, Xrays and CT scans are often useful in seeking the site of bleeding to direct clinical care.

Investigations including bedside tests (UA, ECG, BSL) and laboratory tests (Group and Hold, FBC, Coags, EUC, LFTS, Amylase, VBG and others) should be promptly arranged in the trauma assessment.

Obviously constant reassessment for response to treatment should take place and if there is a deterioration the AcBCDE of the primary survey should be repeated to seek the cause of the clinical change.

Management of the Bleeding Patient

- Direct pressure and elevation
- Pressure bandage
- Tourniquet application
- Pelvic binder
- Splint limb fractures

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If there is evidence of profuse life-threatening external haemorrhage, it is essential to stem the bleeding prior to the AcBCDE, as this blood loss may rapidly lead to life loss. Simultaneous assessment and management is the norm in trauma team management of the critically bleeding patient.

TABLE I: CLASSIFICATION OF SHOCK (based on a 70 kg patient)

	CLASS I	CLASS II	CLASS III	CLASS IV
Blood Loss (mL)	up to 750	750-1500	1500-2000	2000 or more
Blood Loss (%BV)	up to 15%	15-30%	30-40%	40% or more
Pulse Rate	<100	>100	>120	140 or higher
Blood Pressure	Normal	Normal	Decreased	Decreased
Pulse Pressure	Normal/Increased	Decreased	Decreased	Decreased
Capillary Refill	Normal	Decreased	Decreased	Decreased
Respiratory Rate	14-20	20-30	30-40	>35
Urine Output (mL/hr)	30 or more	20-30	5-15	Negligible
CNS-Mental Status	Slightly anxious	Anxious	Anxious - confused	Confused -lethargic
Fluid Replacement	Crystalloid	Crystalloid	Crystalloid + blood	Crystalloid + blood

(Modified from: Committee on Trauma of the American College of Surgeons. Advanced Trauma Life Support for Doctors.

Figure 1 Classification of shock

Direct pressure and elevation of the bleeding site are simple measures that may slow the blood loss. A large dressing with manual pressure by a member of the team to the area, with elevation above the level of the heart whenever possible, may limit loss and allow some clot formation to occur before more directed or definitive care takes place.

A pressure bandage application where padding is then firmly applied over a bleeding extremity wound is usually effective in controlling the bleeding, this should be combined with direct pressure and elevation for added benefit.

There is evidence that tourniquet application controls haemorrhage, especially in traumatic amputations and penetrating extremity injury. The tourniquet should be applied and left in place until surgical care is available. This time period needs to be as short as possible, and it is important to recognise that this may use significant pain and adequate analgesia should be provided.

Pelvic binders should be placed and left in situ on all patients with possible or confirmed pelvic trauma, without contraindications to binding. The effect of these binders is to tamponade venous bleeding within the pelvic cavity and re-create anatomical placement of the pelvis.

Long bone fractures, especially that of the femur, should be splinted when recognised or suspected. There are numerous manufactured femoral splints including Kendrick, Hare, Donway and Thomas splints. It is important to know the contraindications of the style or make of splint carried in the emergency department, as certain splints cannot be used in patients with pelvic fractures. An alternative is to splint the affected leg to the unaffected leg. Again appropriate analgesia, including consideration of femoral nerve block, is advised for patient comfort.

The Lethal Triad

It is important to avoid the lethal triad, as once it is established it is difficult to reverse. The acidaemia created by hypoperfusion and hypoxia of the tissues contributes significantly to worsening the coagulopathy and multi-organ dysfunction. This is avoided by improving perfusion of the organs – ultimately by stopping the bleeding with corrective surgery but in the emergency department the principles of hypotensive resuscitation will allow enough perfusion to minimise this effect. Avoiding hypothermia will reduce poor perfusion to the tissues and reduce the effect of cold on the coagulation cascade and cellular metabolism. This is done by keeping the patient covered with warm blankets where possible, warming fluid and blood given and using external heating or warmed rooms when exposure is unavoidable. Coagulopathy is both consumptive in nature and a result of the above factors. It is essential to avoid hypothermia and acidaemia and replace the factors which are being consumed – FFP contains most of these factors. Halting the consumption of factors by stopping the bleeding is the ultimate requirement.

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Massive Transfusion

The definition of Massive Transfusion is – "an actual or anticipated requirement for 4 units RBC in <4 hours, and haemodynamically unstable plus or minus anticipated ongoing bleeding". It is seen in severe thoracic, abdominal, pelvic or surgical bleeding as well as major obstetric, gastrointestinal or surgical bleeding.

Replacement of lost blood and coagulation factors with blood and coagulation factors is more physiologic than the use of large volume crystalloid.

In penetrating trauma there is evidence that the use of hypotensive resuscitation improves outcomes and it is thought to be similar in blunt trauma. The target systolic blood pressure is approximately 80mmHg, though the exact number is patient dependent. The target SBP is higher (100mmHg) in those with head injury as there is a increased requirement for maintaining cerebral perfusion in these patients.

Early and aggressive treatment of coagulopathy by transfusion of fresh-frozen plasma (FFP) and packed red blood cells (PRBC) in a 1:1 ratio is requred. The exact ratio of products is unclear with evidence that there is possibly better survival with 1:1 (FFP=blood) than ≤1:1.5 (↓FFP ↑blood). Consider platelets (in 1:1:1 ratio) and tranexamic acid. Tranexamic acid use is promising (CRASH2, 2010) and should be considered (1gIV over 10mins then 1g over 8 hours), as it decreases all cause mortality (3%) associated with trauma if given in within 1 hour of injury, 1-3 hours of injury, but increases risk of bleeding if given beyond 3 hours. There is no apparent increase in vascular occlusive events but also no difference in the transfusion requirements. Of note it performed better in the penetrating injuries and those with SBP <75.

Massive Transfusion guidelines have been published by the National Blood Authority. The important components are that there is early recognition of the need for a Massive Transfusion and that local protocols are activated. The guidelines advise optimising oxygenation, cardiac output, tissue perfusion and metabolic state. Regular monitoring is required, both of clinical observations and laboratory values. This allows guidance of the required products and adjuncts. Remember that Prothombinex is advised for the bleeding patient on warfarin, for those on digabatrin there is no available reversal agent at this time.

Ongoing Care

- Early surgery but not definitive operation
- Control haemorrhage and prevent peritoneal soiling
- Temporary abdominal closure
- Control hypothermia, coagulopathy and acidosis
- Definitive surgery with abdominal closure
- <72 hours after original Damage Control Surgery

Summary

- AcBCDE – structured approach to any trauma emergency
- Continually assess for trends in physiology
- Do not resuscitate to a "normal" blood pressure and give blood + products early – Hypotensive Resuscitation
- Know your hospital's Massive Transfusion Protocol
- Early surgical intervention is a priority

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