Queensland Trauma Education

HAEMOSTATIC RESUSCITATION

Trauma vascular access

Procedural skill

Facilitator resource kit

Clinical Excellence Queensland
JAMIESON TRAUMA INSTITUTE
CSDS Clinical Skills Development Service
Queensland Government

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The resources developed for Queensland Trauma Education are designed for use in any Queensland Health facility that cares for patients who have been injured as a result of trauma. Each resource can be modified by the facilitator and scaled to the learners needs as well as the environment in which the education is being delivered, from tertiary to rural and remote facilities.

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Queensland Trauma Education
Haemostatic Resuscitation – Trauma vascular access: Procedural Skill – Facilitator resource kit
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About this training resource kit

This resource kit provides an opportunity for the learner to gain insight into escalation procedures and options for the management of difficult vascular access for trauma patients.

National Safety and Quality Health Service (NSQHS) Standards

Target audience

Emergency department medical and nursing clinicians.

Duration

30 minutes.

Group size

Suited to small group participation.

Learning objectives

By the end of this session the participant will be able to:

- Discuss why trauma patients may have difficult venous access
- Describe an escalation process to gain vascular access
- Practice performing various vascular access options.

Facilitation guide

1. Use suggested questions and answer template to lead discussion with case scenarios
2. Hands on procedural session with equipment as required for site

Supporting documents (in Printable Resources)

The following supporting documents are provided for this case discussion:

1. IO access information booklet [Page 9]: EZ-IO Pocket Guide
2. Infusion flow rate guide [Page 10]: ETM: Large Bore Access Showdown
3. RIC (rapid infusion catheter) insertion guide [Page 11, 12]: St Mungo's RIC Insertion

Procedural skill

Resources required

Equipment	• Case scenario cards • Vascular access equipment (IO needles and drill, RIC catheters, US long cannulas, CVL kits) • Blue phantom / available vascular access trainer • IO mannequin/models • US machine (if incorporating USGPIVC)
Delivery tool	Facilitator led discussion and procedural workshop

Case 1

Tom is a 42-year-old man who has a history of intravenous drug use. He has been involved in a high speed RTC and requires vascular access to deliver analgesia.

Case 2

John is a 36-year-old man who has fallen from the second story roof where he was cleaning the gutters. He has a suspected pelvic injury and has an open fracture of his L elbow. The initial attempt at IV access in his R UL was unsuccessful.

Case 3

Mary is an 18-year-old girl who has been involved in a high-speed MBC. She is peripherally shut down, with a weak central pulse and is requiring a massive haemorrhage transfusion protocol to be enacted. She currently has one 22g PIVC in her L hand.

Case 4

An unknown male is brought to the Emergency Department after being struck by a vehicle whilst he was crossing the road. He was initially confused to questioning and complaining of severe chest and abdominal pain. On transfer from the ambulance stretcher to the ED trolley his PIVC is pulled out and he rapidly loses output and progresses to traumatic cardiac arrest.

Question and answer guide

1. Why is vascular access important in trauma care?

Adequate vascular access is required for the management of trauma patients to allow the provision of medications, resuscitation fluid and to facilitate advanced investigations using IV contrast for CT scans.

2. What size vascular access is needed?

Any vascular access is better than none! However, larger cannulas will allow faster flow rates and improve time to resuscitation fluid administration.

Poiseuille's law states that the flow rate through a cylinder is proportion to the radius to the power of 4 and inversely proportional to its length. Therefore, a wide and short cannula will allow the fastest delivery of fluid.

An 18g vs 20g cannula will allow 1L crystalloid to be administered 2min and 2sec faster![1]

3. Which patients are likely to have difficult intravenous access (DiVA)?

DiVA patients are characterised when clinicians are required to have more than one attempt at vascular access. DiVA scenarios are defined when there are non-visible and non-palpable veins and an alternate technology is required to insert the vascular device. In normal clinical scenarios, up to 1/3rd of all adult patients are thought to be DiVA due to intravascular volume status, historical reasons including the use of intravenous drugs and chemotherapy or due to anatomical factors such as obesity and malnourishment.[2]

4. Who should perform vascular access in trauma patients?

The clinician most likely to succeed! Within trauma teams this may be a senior medical, nursing or specialty service- with the aim to early, appropriate and secure venous access. Often this task is allocated to the most junior and least experienced member of the clinical team, however, recognising the importance of this role many trauma teams now allocate this to a senior medical officer before they move on to other tasks.

5. If an attempt at standard PIVC fails, what are other options?

1. Ultrasound guided vascular access- this may be peripheral or central
2. Intraosseous- humeral, tibial or sternal
3. Alternate vessel- subclavian, femoral or internal jugular

6. What training is needed for ultrasound guided peripheral IV access (USGPIVC)?

Many hospitals and health services have standardised training and credentialling packages relevant to the local site. Local educators can provide information regarding these training options. After initial training, a credentialling process is also undertaken for each clinical site.

CSDS runs online and face-to-face training courses: CSDS Ultrasound Guided Peripheral Intravenous Cannulation (USGPIVC)

7. Where can intraosseous (IO) lines be placed?

An IO device refers to the placement of a hollow bore needle into the medullary space of the bone to allow the administration of medical therapies.

IO access can be achieved in 20 seconds, and success rates are more than 2x that of standard PIVC access in the hypotensive trauma patient.[3]

Locations:

1. Sternal: 1cm below the sternal notch
2. Humerus: The humerus should be internally rotated and the hand placed on the abdomen with the elbow flexed to 90 degrees, ensuring that the bicep tendon is medially located and not penetrated. The surgical neck is palpated, and the needle is placed 2 cm above the surgical neck into the greater tubercle at about 45 degrees to the anterior plane.
3. Distal femur: With the leg straightened and centered in the anterior plane, 1 cm proximal to the patella, and 1 to 2 cm medially.
4. Proximal tibia: 1 cm to 2 cm inferior and medial to the tibial tuberosity in the flat portion of the tibia
5. Distal tibia: 2 cm proximal to the medial malleolus in the flat portion of the tibia.

8. Are there contraindications to intraosseous (IO) lines placement sites?

Fracture at the bony site or concern for fracture/vascular disruption above the level of the planned IO site (ie: should not be placed in the femur or tibia with suspected pelvic trauma).[4]

Relative: cellulitis or burn at the site, osteoporosis, previous IO at the same site <48 hours prior, recent orthopaedic surgery.

9. What other lines can be inserted in trauma patients?

Central line (CVL) and MAC (multi lumen access catheters) lines are inserted using a seldinger technique with/without US guidance.

A 3 or 4 lumen CVL is ideal to administer infusions including sedation, but the flow rates are less than an 18G cannula and so should not be the primary resuscitation access device in large volume resuscitation.
MAC lines are infrequently found in Australian EDs, but if available, result in rapid flow rates for large volume resuscitation.

Other notes

- Clinical vignettes are used to illustrate the need for vascular access plan during team preparation.
- Varied equipment can be used for practical session as required at clinical site.

Scenario objectives

- perform the assessment of a haemodynamically unstable trauma patient to identify multiple sources of bleeding
- apply tourniquet and external pelvic compressive device to aid haemorrhage management
- implement haemostatic resuscitation strategy demonstrate early targeted management.

Example questions

Exploring diagnosis

- Explain your thought process for the rapid assessment of the haemodynamically unstable trauma patient for identification of life-threatening injuries.
- What clinical findings aided in the identification of bleeding source? Do the radiological investigations and EFAST help you identify the type of bleeding (arterial or venous)?
- What clinical features aided the classification of shock state for this patient into mild/moderate/severe?
- Were there concerns for other injury/was spinal precautions considered- what challenges are faced when patients self-present vs ambulance transfer?
- What are the signs of associated urethral injury with an open book pelvic fracture?

Discussing management

- What was your priority to manage the haemodynamic instability? How did the team prioritise the management of external and internal sites of haemorrhage?
- What is a system for classification of pelvic fractures and how does this affect your management?
- Is interventional radiology available at your hospital? What processes need to occur to activate this service?
- How do you activate a massive transfusion/VHA guided resuscitation protocol?
- Are there challenges in placing an indwelling catheter in this patient?

Discussing teamwork / crisis resource management

- Calling for help early - did you have enough team members to simultaneously manage the patient?
- How do you prioritise the management to improve his haemodynamic state?

Key moments

- Rapid recognition of haemodynamic instability and assessment focused on identification of source of bleeding.
- Use of escalating management to control external haemorrhage.
- Early application of pelvic binder with internal rotation of feet to aid haemorrhage control.
- Institution of haemostatic resuscitation.
- Decision making for disposition - CTA and IR vs OT.

Acronyms and abbreviations

Term	Definition
CTA	Computed tomography arterial
IR	Interventional radiology
OT	Operating theatre
VHA	Viscoelastic haemostatic assays
EFAST	Extended focused assessment with sonography in trauma
UA	Urinalysis
ECG	Electrocardiogram
NAD	No abnormality detected
USGPIVC	Ultrasound guided peripheral intravenous catheter
RIC	Rapid infuser catheter

References

1. Barcelona, S.L., Vilich, F. & Coté, C.J. (2003). A comparison of flow rates and warming capabilities of the Level 1 and rapid infusion system with various-size intravenous catheters. *Anesth Analg*, *97*(2), 358–63.
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