12. Peripheral vascular injuries including use of tourniquets

Background

Within UK trauma systems, most vascular injury will be the result of blunt rather than penetrating mechanisms. However, delayed diagnosis of vascular compromise is more common following blunt injury. Amputation rates are lower after penetrating than blunt arterial injury. Rapid assessment and treatment is required to maximize limb salvage.

Network referrals

Time critical transfers to the Leeds Major Trauma Centre should follow your standard pathway. Stabilize, arrange immediate transfer ("Priority 1") and inform ED consultant at LGI (0113 392 8927 or 392 8908) or LGI ED red phone (0113 245 9405).

When time permits contact the on call vascular surgeon via LGI switch board to warn them the patient is coming and provide ATMIST hand over (see under telephone advice below for contact details).

ALL ISCHAEMIC LIMBS SHOULD BE CONSIDERED TIME CRITICAL

Telephone advice

It is expected that non time critical emergency transfers will be unusual with most cases justifying use of the time critical pathway here. Telephone advice is available by contacting the appropriate vascular surgeon directly:

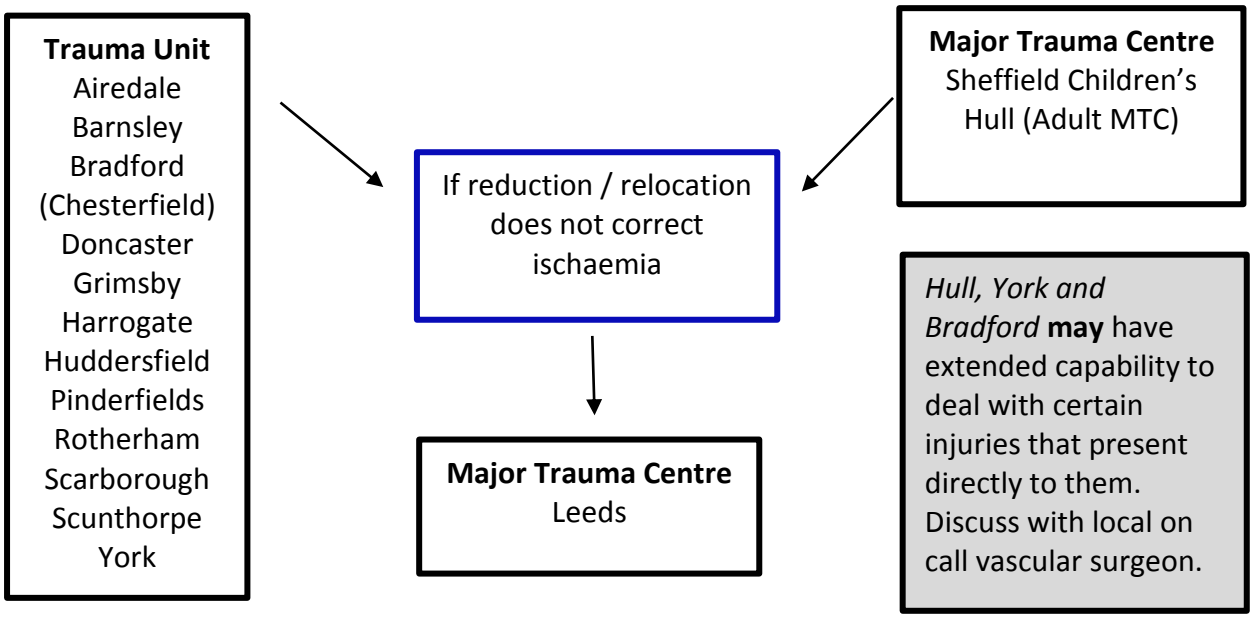
Week days: Between 08.00 - 18.00 the case should be discussed with the on-call Consultant Vascular Trauma Surgeon (switch board 0113 243 2799).

Week days: From 18.00 - 08.00 the case should be discussed with the on-call resident Vascular Registrar or Vascular Consultant (switch board 0113 243 2799).

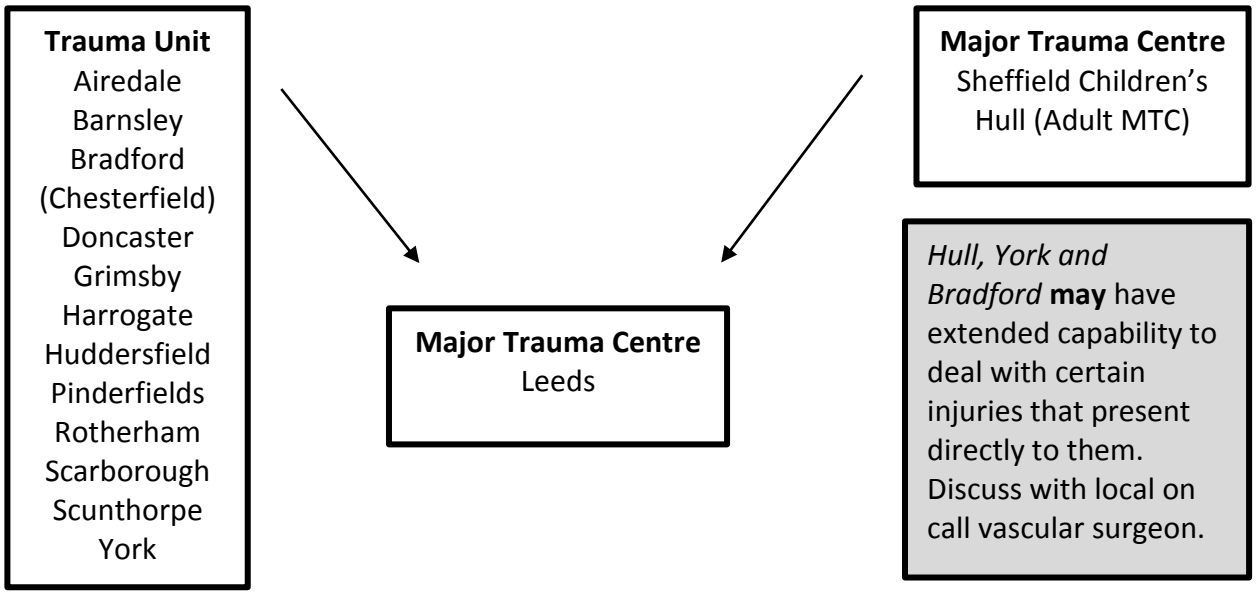
Weekends: The case should be discussed with the on-call resident Vascular Registrar or first on Vascular Consultant (switch board 0113 243 2799).

Patient Flows

(a) After diagnosis of ischaemic limb secondary to blunt trauma



(b) After diagnosis of ischaemic limb secondary to penetrating trauma



General principles of care

Initial assessment & management

The hospital teams should receive an ATMIST handover from the prehospital team. The patient should be assessed by the trauma team as per APLS / ATLS guidelines.

In the absence of associated blunt trauma a cervical collar is not indicated for a patient with penetrating injury and if fitted may obscure wounds. Only when there are neurological signs attributable to penetrating injury to the neck is C-spine protection indicated.

Patients with penetrating injury must be log rolled to identify all sites of injury. Beware of missing wounds within skin creases especially axilla and perineum.

Active bleeding from wounds should be controlled with direct pressure (bandage or fingers). Rarely and only when this fails and it is felt that the limb may need to be sacrificed to save life should a tourniquet be applied to a limb on the direction of the team leader. It should be applied as distally as possible.

Vascular and neurological examination of the limb should be undertaken. If there is concern regarding a vascular injury, pressure measurements can be taken: an ankle brachial pressure index (ABPI, lower limb only) or an arterial pressure index (API, upper or lower limbs). An API is defined as the Doppler systolic arterial pressure distal to the site of injury divided by the Doppler systolic arterial pressure measured at the same point in the uninjured extremity. An ABPI or API >0.9 indicates a very low risk of a significant arterial injury.

If you feel the patient requires time critical transfer do not image as this delays transfer. Imaging is only appropriate if you plan to manage the patient locally. Plain radiographs (with markers on skin wound) of the injured part should be undertaken for gunshot injury. Trajectory determination is helpful to injury identification and to detect bone fractures. Radiographs for stab wounds may reveal retained foreign material. Paper clips taped to skin make useful skin markers with intact clips used for anterior wounds and o*p*ened clips for *p*osterior wounds.

Management

Patients with limb ischaemia secondary to displaced, angulated long bone fractures and / or joint dislocations e.g. knee or ankle dislocation, mid shaft femoral or supracondylar humeral fracture, should have the injury realigned or relocated as quickly as possible. This will require appropriate analgesia with neurological and vascular examination documented both before and after any manipulation.

In general, patients with hard signs of vascular injury (List 1) require urgent operative intervention. Those with exsanguinating active bleeding and / or rapidly expanding haematoma require immediate operative intervention for haemorrhage control.

List 1: Hard signs of vascular injury

External pulsatile bleeding

Large, expanding, pulsatile haematoma

Palpable thrill or audible bruit

Absent distal pulse

Signs of distal ischaemia (pain, pallor, paralysis, paraesthesia, perishingly cold)

Even in the presence of hard signs, preoperative imaging may help guide surgical decision making and may be performed if the patient's haemodynamic condition allows. Such situations include:

- When difficult to determine precise site of injury e.g. skeletal injury especially the mangled limb, long wound tracts parallel to course of vessel or multiple pellets from shot gun wounds.
- Patients with preexisting arterial disease / abnormalities.
- Clinical concern that hard signs may be due to extensive bone & soft tissue injury without actual vascular injury.

Metallic foreign bodies (retained knife blade, pellets & bullets) will produce artefact on CT angiography but usually result in images of sufficient quality for decision making. Digital subtraction intra-arterial angiography or on table angiography may be required in selected cases. If preoperative imaging is indicated it must be undertaken rapidly to reduce ischaemic time to a minimum.

List 2: Soft signs of vascular injury

History of arterial bleeding at the scene (no ongoing bleeding)

Small, non expanding, non pulsatile haematoma

Shock with no other injury (suggesting large volume blood loss)

Weak pulse

Injury to anatomically related nerve

Proximity of wound to vessel

Ankle brachial pressure index <0.9 or arterial pressure index <0.9 or dampened flow on Doppler examination

Patients with soft signs of vascular injury (List 2) require further assessment with a low threshold for imaging. Those with penetrating injury have 3-25% chance of significant injury. A CT angiogram is likely to be first line investigation but artifact from retained foreign bodies may occasionally necessitate intra-arterial angiography.

Patients with a normal vascular and neurological examination with an ABPI or API >0.9 are extremely unlikely to have a significant arterial injury and do not usually require further vascular investigation. In particular, patients following knee dislocation with normal ankle pulses and ABPI or API >0.9 do not usually need further imaging. However, the requirement for imaging following knee dislocation is debated and the case for imaging should be considered on a case by case basis.

See Appendix 7 – management of significant bleeding from a limb and use of tourniquets

Appendix 7

Management of significant bleeding from a limb and use of tourniquets

APPLY DIRECT PRESSURE WITH DRESSING AND ELEVATE THE LIMB

SUCCESSFUL?
Apply pressure dressing and continue assessment of patient
Observe wound closely for recurrence of bleeding

UNSUCCESSFUL?
Call orthopaedic and (if available) vascular surgeon
Apply indirect pressure to proximal artery

UNSUCCESSFUL?
Apply tourniquet using pneumatic cuff in preference to Combat Application Tourniquet (CAT)
Apply to **single long bones, or on the lower leg or forearm**

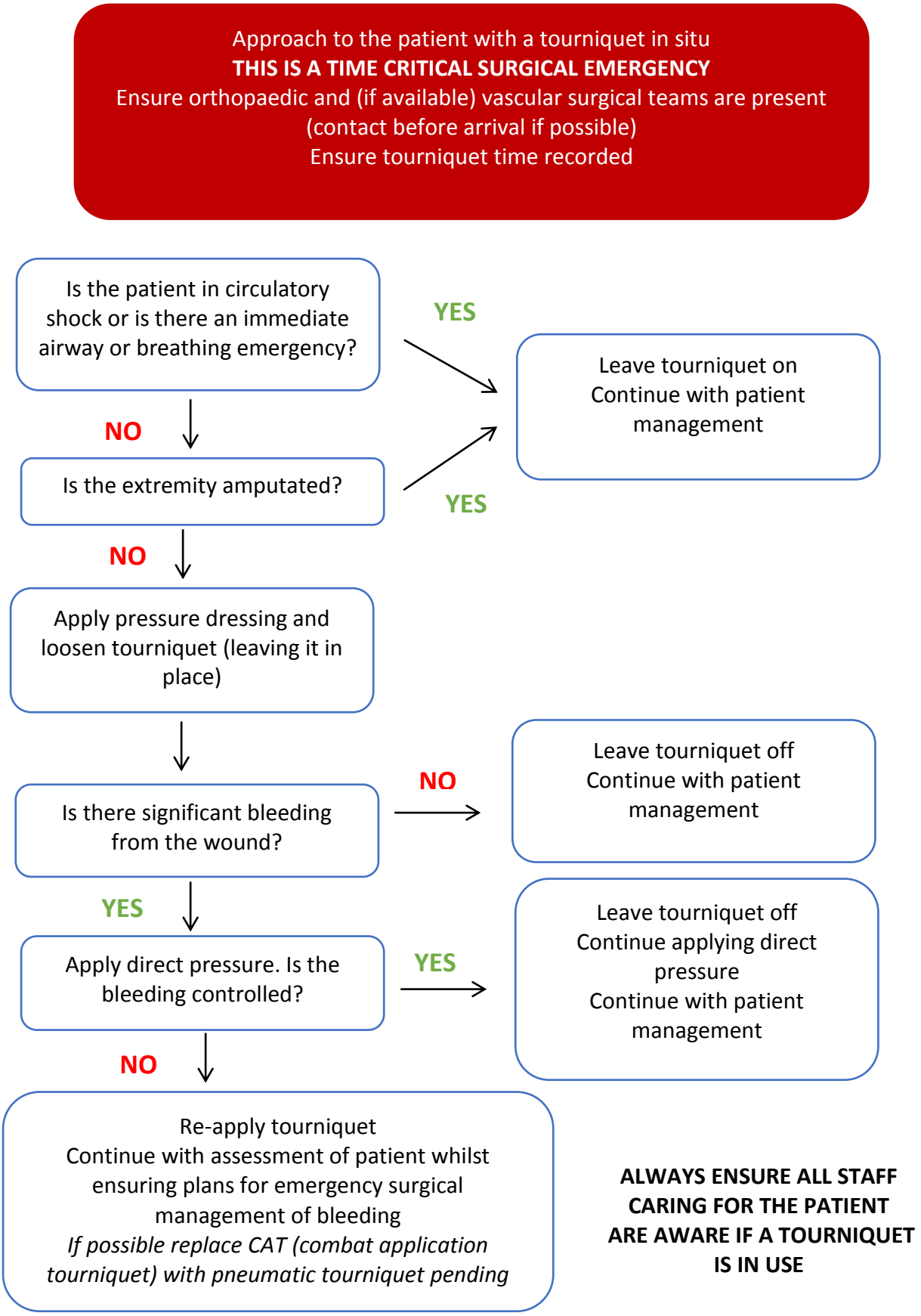
- For the femur, one hand width above the patella or at least 5cm proximal to the wound
- For the humerus, one hand width above the elbow joints or at least 5cm proximal to the wound
- For the lower leg or forearm, 5cm proximal to the wound

THIS IS NOW A TIME CRITICAL EMERGENCY

Record tourniquet time
Ensure presence of suitably senior surgical teams (transferring to MTC if necessary)

ALWAYS ENSURE ALL STAFF CARING FOR THE PATIENT

ARE AWARE IF A TOURNIQUET IS IN USE


Approach to the patient with a tourniquet in situ
THIS IS A TIME CRITICAL SURGICAL EMERGENCY
Ensure orthopaedic and (if available) vascular surgical teams are present (contact before arrival if possible)
Ensure tourniquet time recorded
Is the patient in circulatory shock or is there an immediate airway or breathing emergency?
YES
Leave tourniquet on
Continue with patient management
NO
Is the extremity amputated?
YES
NO
Apply pressure dressing and loosen tourniquet (leaving it in place)
Is there significant bleeding from the wound?
NO
Leave tourniquet off
Continue with patient management
YES
Apply direct pressure. Is the bleeding controlled?
YES
Leave tourniquet off
Continue applying direct pressure
Continue with patient management
NO
Re-apply tourniquet
Continue with assessment of patient whilst ensuring plans for emergency surgical management of bleeding
If possible replace CAT (combat application tourniquet) with pneumatic tourniquet pending
ALWAYS ENSURE ALL STAFF CARING FOR THE PATIENT ARE AWARE IF A TOURNIQUET IS IN USE