State Major Trauma Unit Tourniquet Management Clinical Guideline

Scope

Site	Department, Division or Operational Area	Applicable to
Royal Perth Hospital (RPH) only	State Major Trauma Unit (SMTU), Emergency Department (ED), Operating Theatre (OT)	Medical, Nursing

Definitions

Tourniquet	A device for stopping the flow of blood through a vein or artery, typically by compressing a limb with a cord or tight bandage

Links within document

Appendix I: Combat Application Tourniquet (CAT) Manufacturer's Instructions

General information/preamble

Pressure bandages are normally adequate for most cases of bleeding from open wounds in extremity injuries. However, on occasion, uncontrolled arterial bleeding may require the assistance of a tourniquet to arrest all blood flow to and from the limb. These situations typically involve a traumatic amputation, blast injuries, or a mangled limb injury.

Primary data supporting the use of tourniquet comes mainly from the military setting. Tourniquets were reintroduced in the military setting during the early 2000s, due to increased clinical evidence discounting previous concerns with nerve and muscle injury from their use. Less than 2% major complication rates associated with tourniquet use are reported, and tourniquet induced pain did not appear to be a major issue for these patients.

Several clinical series supported improved mortality outcomes with the assistance of tourniquet use[1,2,3]; before reintroduction, exsanguination from extremity trauma accounted for around 10% of preventable deaths. This was almost completely prevented by their use.

Guidelines concur in their direction on the initial application of the tourniquet. The European guideline for the management of bleeding following major trauma, updated in 2010, states: "We recommend adjunct tourniquet use to stop life-threatening bleeding from open extremity injuries in the pre-surgical setting.

Regarding the precise timing of tourniquet application, the literature offers little more than stating that the tourniquet should be applied before the onset of shock. This intuitive statement implies careful clinical evaluation of injured limbs for signs of ongoing haemorrhage, and perhaps a degree of necessary over-triage, to avoid otherwise preventable haemorrhagic deaths.

Indications

Life threatening extremity haemorrhage, unable to be controlled by elevation, direct pressure, and pressure dressing.

Management

Generally, in the trauma setting, patients will arrive to the Emergency Department (ED) with the tourniquet already in situ – applied by the St John Ambulance (SJA) paramedics. Trauma management, therefore, will be in the order of the following situations:

Tourniquet not controlling haemorrhage

Consider applying an additional tourniquet, a few centimetres upstream (broadening the area of compression).

Note: an inappropriately loosely applied tourniquet may cause venous engorgement and worsen haemorrhage.

Removal of the tourniquet

Effective tourniquets should only be removed after definitive haemorrhage control[4,1]. This should occur as expeditiously as possible. Publications have suggested a maximum application time of 2 hours[5], though case reports of longer times with good functional outcomes are described. If a tourniquet is unable to be removed, an amputation at the level of the tourniquet will likely be necessary.

In delayed transfer settings (i.e., greater than 1 hour transit time), some authors have suggested “a trial of tourniquet conversion”. After a period of reduced arterial flow from the tourniquet, sufficient clotting may have been effective to stop the haemorrhage, facilitating the success of direct wound pressure dressings. Such a trial is only feasible in a haemodynamically stable patient, with physiological reserve, in who direct wound packing has been secured, and in whom the tourniquet can be immediately reapplied should haemorrhage recur. This is a risky manoeuver, attempting to maximise tissue viability, and careful clinical judgment is required.

Historically, protocols of care including periodic loosening of tourniquets have been used. These policies attempted to reduce limb ischaemia, but often led to the incremental exsanguination and death of the patient instead. Such practice is not recommended[6].

For patients arriving with tourniquets in situ, the default mode remains transfer to the controlled environment of the operating theatre, and the release of the tourniquet after definitive haemorrhage control has been achieved. However, the aforementioned over triage and “trial of tourniquet conversion” raises the feasibility of an attempt at tourniquet removal, particularly if the treating team is uncertain regarding the necessity of the device. Several safeguards are prudent before embarking on an attempted release:

1. A Consultant Surgeon should be present and actively involved in this decision
2. Local wound pressure bandaging should have been optimized
3. Immediate resuscitation should be available to be instituted (i.e. patient has appropriate monitoring, with large bore intravenous (IV) access, and a major transfusion pack or similar is immediately available)
4. The ability to immediately reapply the tourniquet should be preserved.

Management – cont'd

Special considerations for tourniquets applied in remote areas

Prehospital providers (St John Ambulance, WA), and Royal Flying Doctors Service (RFDS) are aware to call the trauma registrar or consultant at the earliest possible time when a torniquet has been applied.

The trauma registrar and fellow are to escalate immediately to the trauma surgeon these clinical situations (where a tourniquet has been applied in the field).

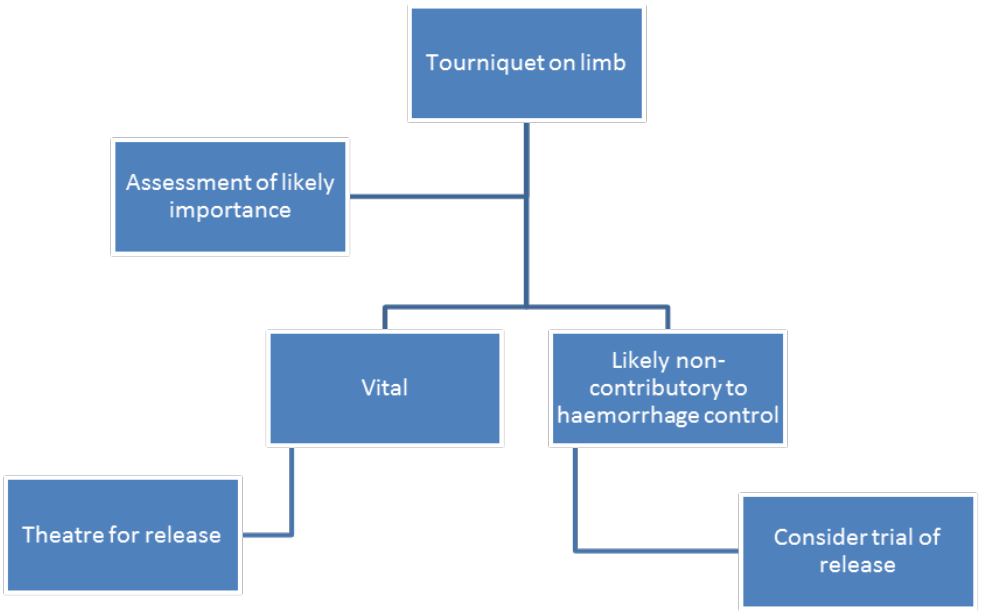
The trauma surgeon will guide the ongoing management of the tourniquet. This may include a trial removal in a regional hospital or external health care facility if deemed safe.

Special considerations at the time of removal

Special attention to the resuscitation at the time of removal is required. The reperfusion of the limb is likely to elevate the potassium and lactate. Most authorities recommend aggressive resuscitation with bicarbonate rich fluid at the time of release.

The torniquet should be able to be reapplied at any stage.

Algorithm



Technique

Principles of tourniquet application include:

- Placement of the tourniquet as distal as possible, but at least 5cm proximal to injury; sparing joints as much as possible; and ideally applied directly onto exposed skin to avoid slipping[1.]
- Effectiveness of tourniquet use will be determined by cessation of external haemorrhage and not by the presence or absence of a distal pulse. If it is ineffective the tourniquet should be tightened or repositioned. If the tourniquet is still ineffective (unlikely) the health care provider may consider a second tourniquet placed just proximal to the first. Slight oozing may still occur in a limb amputation despite effective application if there is medullary bone blood flow.[12]
- The tourniquet(s) should never be covered with bandages or clothing or blankets so that it is always visible to the clinician.

The time of application should be recorded on the tourniquet and in clinical documentation and handed over to the receiving emergency department staff.

Commercially available devices are stored in the ED. Combat Application Tourniquet (CAT), as used by SJA, is available for use, and two are stored in the 4th drawer of the Rapid Intervention Trolley (RIT) in ED Resus. There are also two in the ED Resus Trolley in the Theatre Holding Bay and, in the Helipad, Rapid Intervention Trolley.

The manufacturer's instructions are attached, refer to Appendix I.

Alternatively, where a commercial device is unavailable, a triangular bandage or similar improvised cloth can be used. Any strong object such as a pen or torch can be used as the windlass.

Accurate records of the time of application and release should be kept in the patient's clinical notes.

The limb should be kept under active examination and/or visualisation to ensure haemostasis is maintained.

Facilitator

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Review authors

RPH Trauma Service
RPH Trauma Committee

References

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Legislative requirements, the evidence and the standard

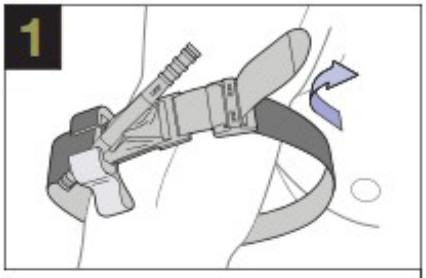
For information relating to the legislative requirements and standards that RPBG policy documents must adhere to, and regarding the logos and levels of evidence used within RPBG policy documents, refer to Legislative Requirements, the Evidence and the Standard (live link) on the Policy HUB.

ACSQHC NSQHS Standards 2nd Edition (2021):
Standard 1: Clinical Governance
Standard 5: Comprehensive Care

Appendix I: Combat Application Tourniquet (CAT) manufacturer's instructions

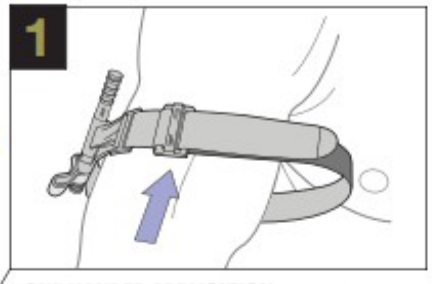
C-A-T COMBAT APPLICATION TOURNIQUET

INSTRUCTIONS FOR USE

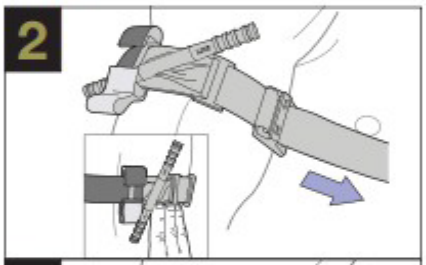


TWO-HANDED APPLICATION
Route the band around the limb, pass the tip through the slit of the buckle, and position the CAT 2-3" above the bleeding site directly to the skin.*

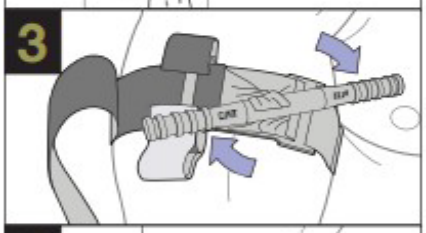
OR



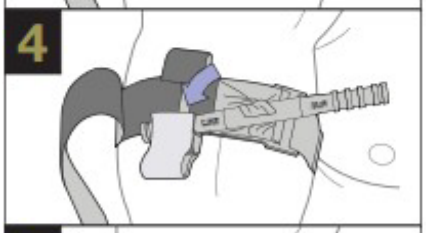
ONE-HANDED APPLICATION
Insert the injured limb through the loop in the band and position the CAT 2-3" above the bleeding site directly to the skin.*



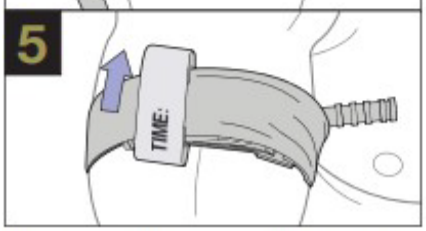
Pull band tightly and fasten it back on itself all the way around the limb, but not over the rod clips. Band should be tight enough that tips of three (3) fingers cannot be slid between the band and the limb. If the tips of three (3) fingers slide under band, retighten and re-secure.



Twist the rod until bleeding has stopped.



Secure the rod inside a clip to lock it in place. Check for bleeding and distal pulse. If bleeding is not controlled, or distal pulse is present, consider additional tightening or applying a second CAT above and side-by-side to the first. Reassess.



Route the band between the clips and over the rod. Secure rod and band with TIME strap. Record time of application.

*If you cannot be sure or cannot take the additional time to examine where the bleeding is coming from based on the situation, the CAT can be effectively applied over clothing as high on the arm or leg as possible. The CAT must NOT be applied over solid objects within the clothing. As soon as the situation permits, the injured limb should be evaluated and the CAT re-positioned 2"-3" above the injury directly to the skin.