Arterial Tourniquet De-Escalation

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THE TOURNIQUET IN FIRST AID

There is no place for the tourniquet as a first-aid measure for acute haemorrhage. Watson-Jones (1952) pointed out that more limbs have been lost by the use of the tourniquet than have been saved. It is a pity that the public have not been educated to know that severe haemorrhage from a limb injury can be effectively controlled by lying the patient down, elevating the limb and obtaining firm pressure over the wound with a well padded bandage.

Application of Hemostatic Tourniquet on Wounded Extremities in Modern "Trench" Warfare: The View of a Vascular Surgeon

MILITARY MEDICINE, 00, 0/0:1, 2024

ABSTRACT
Introduction:
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Materials and Metho
The article analyzes th
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The analysis included

Results and Discussio
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Misuse of Tourniquets in Ukraine may be Costing More Lives and Limbs than they Save

Rom A. Stevens, MD; Michael S. Baker, MD, FACS†,‡; Ostap B. Zubach, MD, Lt. UKR§; Michael Samotowka, MD, FACS‖*

ABSTRACT Hands-on training and social media sites have heavily emphasized the use of tourniquets to treat limb injuries during the Ukraine war. Tourniquet overuse or misuse can lead to significant tragedy—limb loss, physiologic complications, and even death. Casualty evacuation in Ukraine often exceeds 6 hours, and the liberal use of limb tourniquets may have unintentionally increased morbidity. Tourniquet application was appropriate in 24.6% of the wounded with tourniquets in one recent publication by a Ukrainian vascular surgeon. The longer a limb tourniquet is in place raises the risk of compartment syndrome, vascular thrombosis, rhabdomyolysis, and irreversible myonecrosis resulting in major tissue loss and often necessitating limb amputation. If bleeding is controlled with a tourniquet, attempts to remove the tourniquet as early as possible to avoid the negative consequences are essential. Training in tourniquet use without explaining possible limb loss and other complications resulting from tourniquets left *in situ* more than 2 hours makes use risky. Tourniquets should be loosened at one hour if the tactical situation allows, and the injury assessed to determine if major bleeding persists or to determine if other methods of hemostasis would be effective. Ukraine must improve the training so that everyone becomes aware of the risks of prolonged or improper tourniquet use. This tourniquet training information must be transmitted to military medical leaders, Ukrainian military medics, civilian volunteers, volunteers in Ukraine, and NATO trainers in allied countries conducting medical training for Ukrainian soldiers. A trauma registry and tracking through echelons of care can enhance performance improvement through timely feedback.

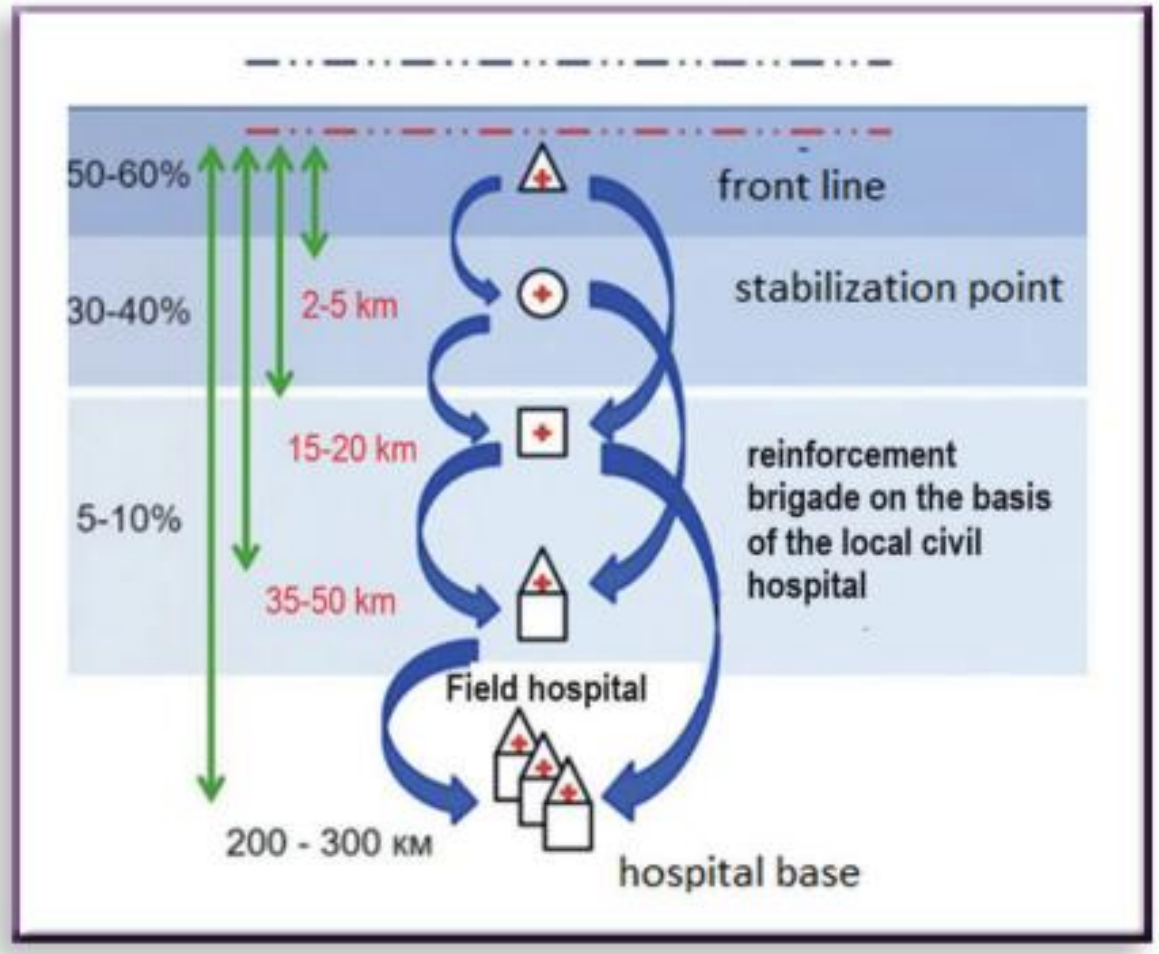
The training of Ukrainian soldiers and civilian volunteers to stop life-threatening bleeding has strongly emphasized limb tourniquets (Fig. 1). However, tourniquet training and use

These relate to recent U.S. and NATO experience in the Middle East.[1,2] There were two important differences on those battlefields:

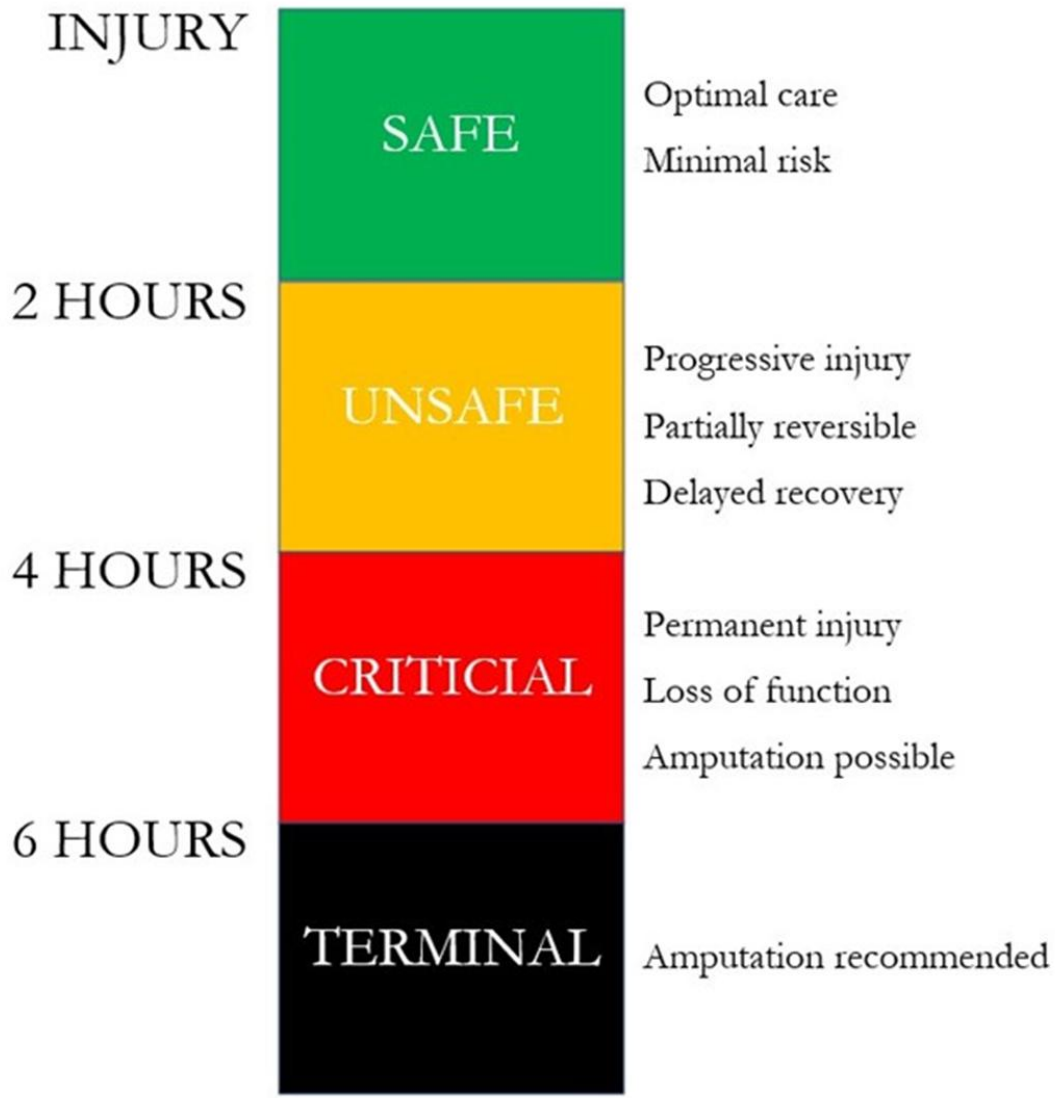
“Casualty evacuation in Ukraine often exceeds 6 hours, and the liberal use of limb tourniquets may have unintentionally increased morbidity.”

Stevens RA, Baker MS, Zubach OB, Samotowka M. **Misuse of Tourniquets in Ukraine may be Costing More Lives and Limbs than they Save**. Mil Med. 2024 Jan 17

FIGURE 1 *Use of tourniquets at the stages of tactic medical care.*



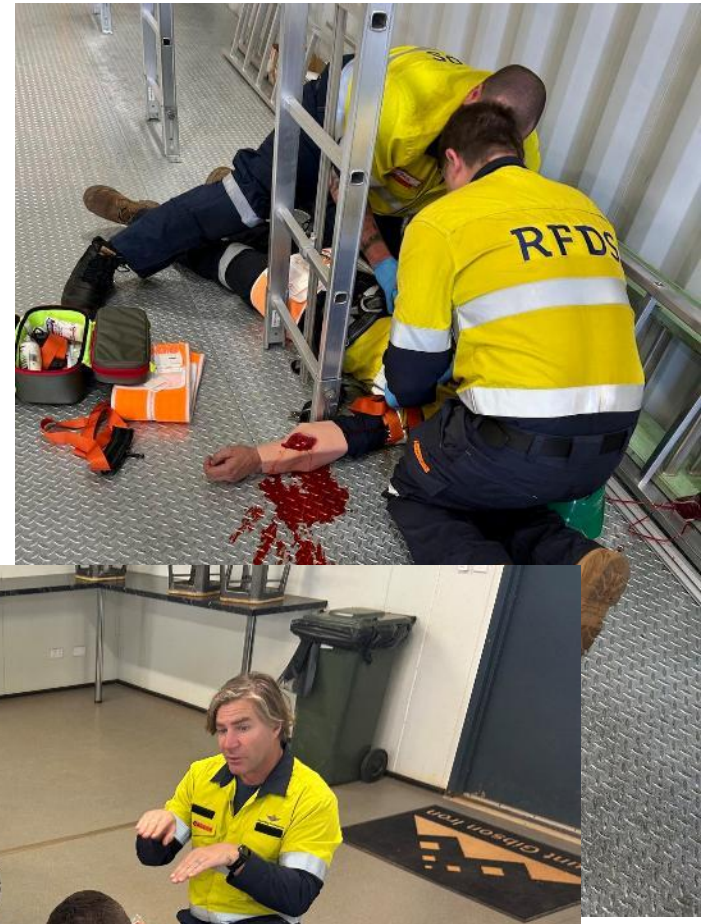
Samarskiy, I. M., Khoroshun, E. M., & Vorokhta, Y. (2024). **The Use of Tourniquets in the Russo-Ukrainian War.** *Journal of Special Operations Medicine: a Peer Reviewed Journal for SOF Medical Professionals*.

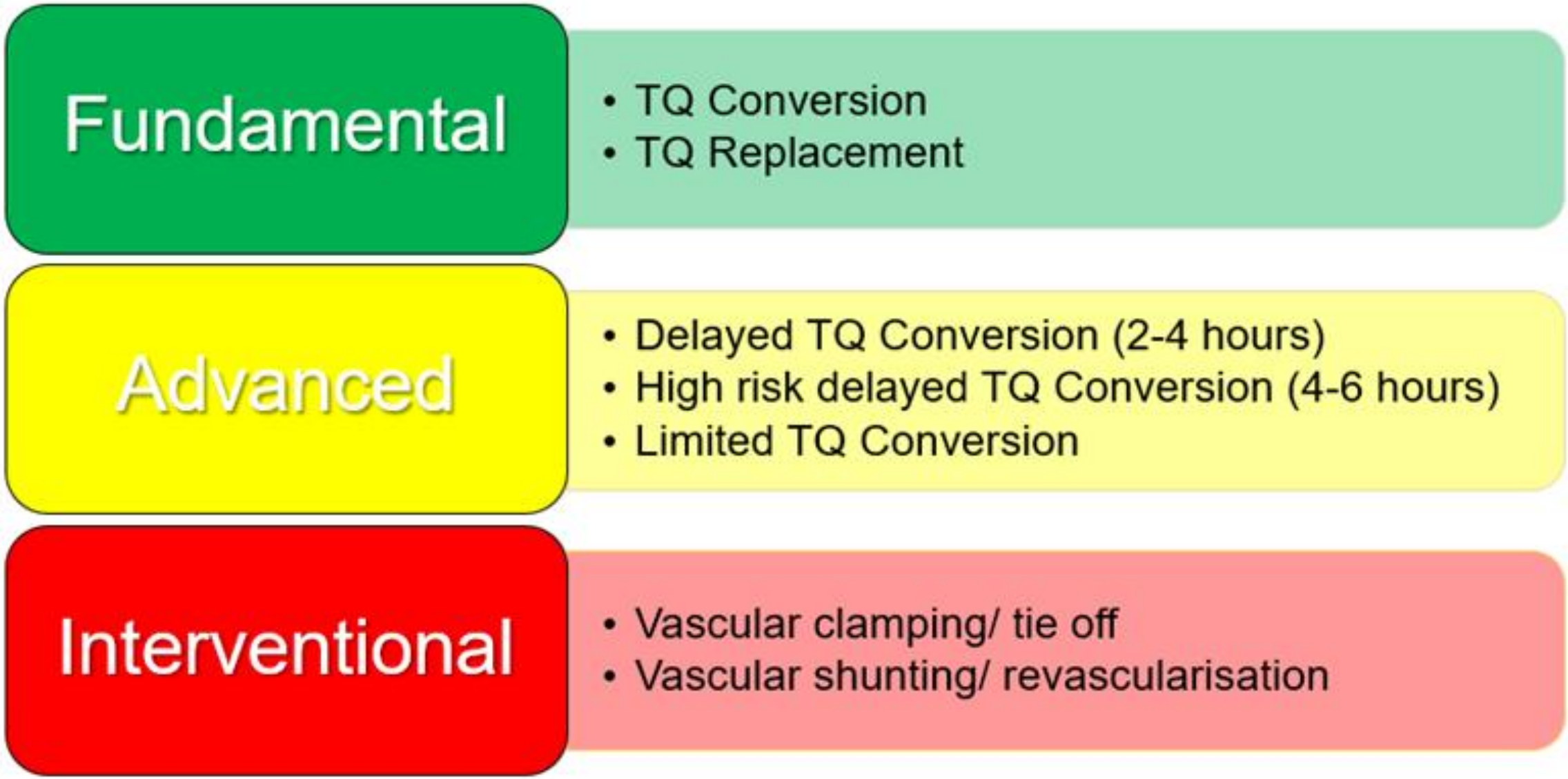

INJURY
SAFE
Optimal care
Minimal risk
2 HOURS
UNSAFE
Progressive injury
Partially reversible
Delayed recovery
4 HOURS
CRITICIAL
Permanent injury
Loss of function
Amputation possible
6 HOURS
TERMINAL
Amputation recommended


Broome
Port Hedland
Meekatharra
Kalgoorlie
Jandakot

“De-escalation represents a spectrum of skills and adjuncts used to minimise the impact of tourniquet ischaemia selected according to the clinical presentation, resources available, and an awareness of the environment”

https://cove.army.gov.au/article/tourniquet-de-escalation-framework-australian-defence-force




Fundamental
• TQ Conversion
• TQ Replacement
Advanced
• Delayed TQ Conversion (2-4 hours)
• High risk delayed TQ Conversion (4-6 hours)
• Limited TQ Conversion
Interventional
• Vascular clamping/ tie off
• Vascular shunting/ revascularisation

Tourniquet Replacement

FROM HERE, HEALTH

FACULTY OF PRE-HOSPITAL CARE
THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH

Position statement on the application of Tourniquets

July 2017

Tourniquet use has been re-introduced into civilian practice, influenced by recent military experiences. It could be argued that in a civilian setting, catastrophic external haemorrhage from a limb is rare and most bleeds can be controlled with direct pressure successfully. However, there remains a place for the use of a tourniquet and these include events such as stabbings, firearms incidents, industrial accidents and incidents in remote areas.

Tourniquets should only be used as a last resort after other stepped measures have failed except in complete traumatic amputation where a tourniquet should always be applied.

It must be reiterated that tourniquets must be used correctly or not at all.
An inappropriately used tourniquet can be harmful1 and an incorrectly applied tourniquet will cause increased bleeding from distal soft tissue injuries and damaged arteries if there is occlusion of the lower pressure venous outflow, but inadequate occlusion of arterial blood flow i.e. the tourniquet is not tight enough2.

Arterial tourniquets exist in either improvised or custom-built forms, and use a number of different techniques in order to apply a band of pressure over a body-part with the aim of arresting haemorrhage. The design of any tourniquet improvised or otherwise requires a broad band to provide adequate compression3.

Application of the tourniquet

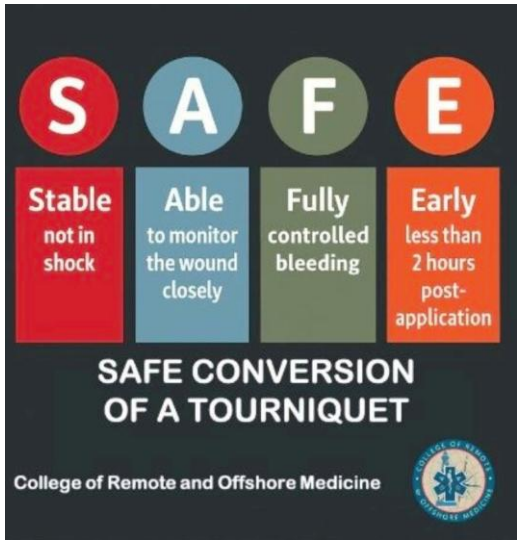
In the past, the advice has been to apply the tourniquet to a single bone only as it was thought to be more effective. This doctrine is believed to have arisen from porcine animal haemorrhage models. The model neither reflects human anatomy, nor the way a limb mangled by ballistic trauma will respond to circumferential compression4. Significant military experience has shown that applying a tourniquet as distally as possible above the wound is effective.

It is recommended that the tourniquet is:

Certain scenarios such as where self-administration, a non-permissive environment such as where there may be entrapment or access to the limb is limited, the tourniquet may need to be placed more proximally up the limb. In these cases, review of the placement should be considered when possible with a view to re applying a tourniquet closer to the wound prior to releasing the initial higher placed one to ensure haemorrhage control is maintained.

The tourniquet should be left in place, with the time of application noted, until access to higher medical capability is available.

Tourniquet Conversion



Apply haemostatic gauze or dressing to wound

Slowly release the original TQ over 1 min

If bleeding occurs re-tighten TQ (Distally)

- All TQ's must be removed from limb
- Keep reassessing for blood loss
- Prepare to re-apply a TQ

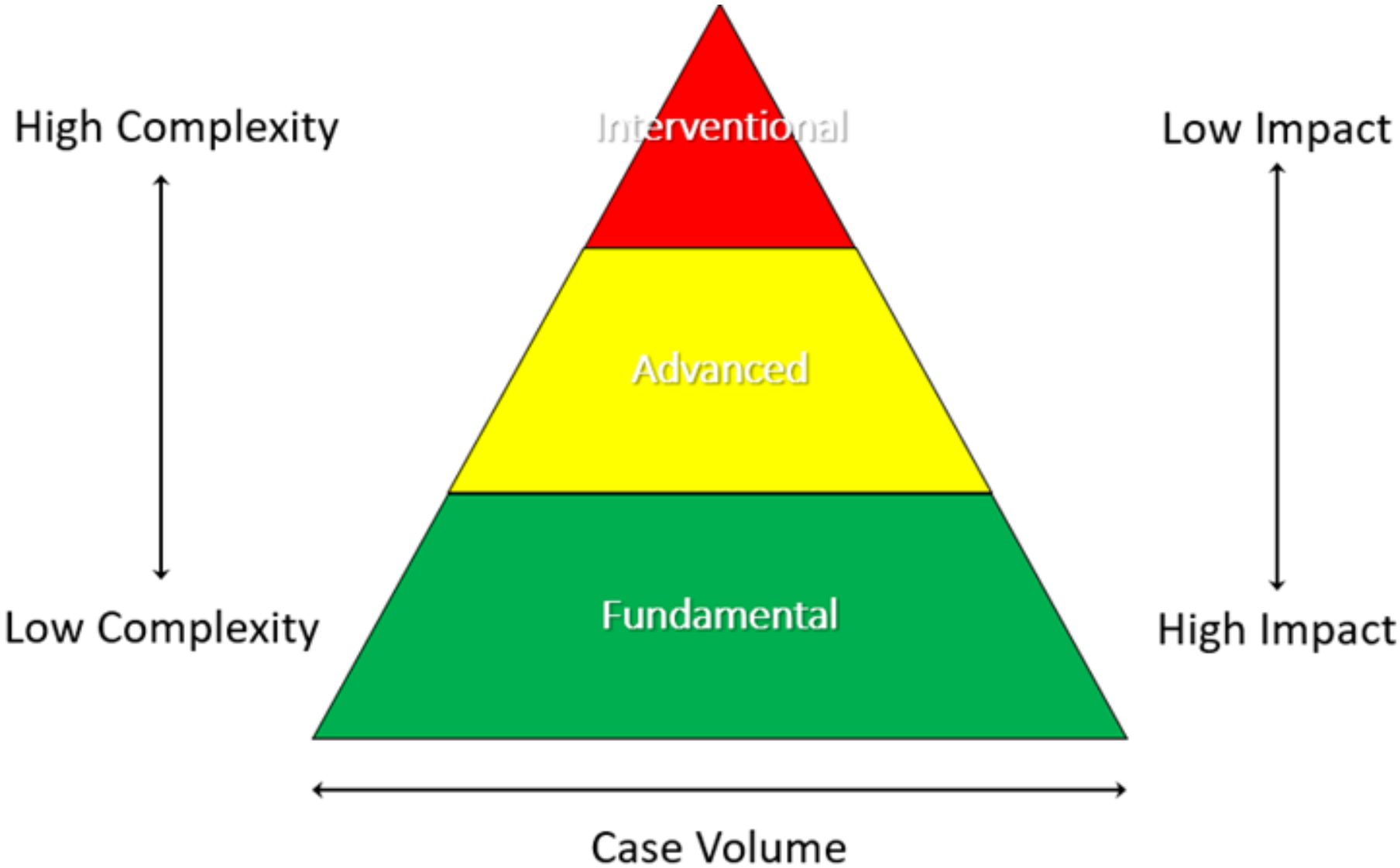
JTS/CoTCCC guideline as of 23/01/2023

SKILL SHEET: Special Operations Forces Tactical Tourniquet – Wide (SOFTT-W)	Version 1.0
DATE: 24-08-2016	Authorised: Manager, Special Operations

N.B. - Tourniquets **Are Not** to be periodically loosened or removed to facilitate perfusion of an ischaemic limb.

Method:

- Dress source of bleed with haemostatic agent/ pressure dressing	
- Apply a second tourniquet immediately next to and proximal to existing tourniquet	
- Tighten second tourniquet though **DO NOT** turn windlass at this point	
- **Slowly** release and loosen windlass and remove existing tourniquet and monitor for any sign of bleeding	
- If bleeding recommences tighten windlass on new tourniquet	


High Complexity
Low Complexity
Interventional
Advanced
Fundamental
Low Impact
High Impact
Case Volume

3.6 Tourniquet use in Exsanguinating Haemorrhage

Theory

Tourniquets are a critical tool for haemorrhage control but require careful application and management to balance lifesaving benefits with potential complications. Early transition, de-escalation or replacement should be considered, balancing risks and benefits in context of our potentially prolonged transfer times.

Two tourniquets are available in the yellow ALS bag located in each aircraft.

Note: haemostatic dressings are not currently carried by RFDS WO but may be accessible at referring location or ambulance.

Indications for Tourniquet Application

A tourniquet should be applied in the following scenarios:

1. Life-threatening haemorrhage from a limb where direct pressure, wound packing, and haemostatic dressings have failed or are impractical.
2. Traumatic amputations where bleeding cannot be controlled by other methods.
3. Situations where the responder is unable to maintain continuous direct pressure due to other priorities, such as self-rescue or treating multiple casualties.

- **All patients with tourniquets require a Priority 1 flight.**
- **The state trauma unit duty consultant should be notified immediately of any patient to be transferred with a tourniquet. (Royal Perth Hospital for Adults, Perth Children's Hospital for Children)**

Remember that while tourniquets can be lifesaving, they can cause significant morbidity. Frequent reassessment and timely consideration of the risks v benefits of de-escalation is essential.

Table 4 Time of Tourniquet Application and Complications

Injury	SAFE	Optimal Care Minimal risk
2 Hours	UNSAFE	Progressive Injury Partially reversible Delayed recovery
4 Hours	CRITICAL	Permanent Injury Loss of function Amputation possible
6 Hours	TERMINAL	Amputation recommended

De-escalation Techniques

1. Reassess the Need:
   - If bleeding is controlled and conditions allow, consider alternatives to a tourniquet.
   - Reassess every hour if time to definitive care is delayed.
2. Reassess the Site
   - If tourniquet has been sited proximally, timely consideration of re-siting to a more distal site is essential. *Remember the optimal site is around 5cm above wound (avoiding joint)*
   - Regularly assess and consider de-escalation, whether by removal (if possible) or re-siting to a better site. At times, if definitive care is delayed, assess and consider if repositioning from the 'ideal' site is appropriate to allow a period of reprieve for underlying tissue.
   - *Remember that when loosening a tourniquet, and in addition to bleeding risks, renewal of bloodflow to and from the limb products may lead to significant reperfusion injury and instability. This will be an important element in your risk/benefit assessment.*
3. Gradual Release (if safe):
   - If the patient is stable and resources allow, place a second tourniquet – initially un-tensioned. This should be optimally positioned, or, if replacing a well sited primary tourniquet, positioned just proximal to that site.
   - Ensure other alternative methods (haemostatic dressings, pressure bandages) are also accessible before releasing the primary tourniquet.
   - Loosen the primary tourniquet slowly while closely monitoring both local bleeding and overall clinical response. At all times maintain readiness to tighten the second tourniquet if required.
4. Reapply if Needed:
   - If significant re-bleeding occurs, unable to be managed with haemostatic dressings, pressure bandages, etc, immediately tighten the second tourniquet and remove the primary.

Substitution Techniques

If conditions permit and the bleeding has been controlled, aim to substitute the tourniquet with other haemostatic measures including:

1. Wound Packing with Haemostatic Dressings (see previous note regarding unavailability in RFDS WO stock):
   - Remove the tourniquet and pack the wound tightly with haemostatic gauze.
   - Apply continuous pressure for at least three minutes.
2. Pressure Bandages:
   - Apply an elastic pressure bandage over the packed wound to maintain haemostasis.
3. Splinting:
   - Use splints or other stabilization techniques to minimize limb movement and prevent disruption of the clot.

Considerations for Prolonged Transfer Times

1. Documentation:
   - Record the time of application, any adjustments, and reassessments.
2. Pain Management:
   - Administer analgesics as per protocol to manage ischemic pain.

3. Temperature Control:
   - Protect the limb from extreme temperatures to minimize additional tissue damage.
4. Communication:
   - Inform receiving medical personnel about the use and duration of the tourniquet.

Risks and Complications

1. Prolonged Ischemia:
   - Tissue damage may occur after 2 hours and may be irreversible after 6 hours of continuous application.
2. Reperfusion Injury:
   - Gradual release is essential to minimize systemic complications.
3. Nerve Injury:
   - Avoid unnecessary tightening and prolonged application.

The risk rating for this policy is:	Low	Medium	High
	☒	☐	☐


RFDS


MICHAEL
PARAMEDIC

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