

Paramedic – Evidence Based Medicine (P-EBP) Program

Paramedic CAT (Critically Appraised Topic) Worksheet

Title: Pre-hospital Tourniquet Application in Life-threatening Extremity Trauma: Efficacy and Safety.

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Clinical Scenario: Paramedics arrive on-scene of a 32 Y/O male who has sustained a deep laceration to the medial aspect of his left upper thigh following a motor vehicle collision. There is obvious uncontrolled arterial bleeding from the wound. The paramedics consider the use of a commercial mechanical tourniquet to control the hemorrhage.

PICO (Population – Intervention – Comparison – Outcome) Question:

(P) In pre-hospital patients with life-threatening external extremity trauma, (I) are mechanical tourniquets a safe and effective intervention (C) as compared to direct pressure (O) in effectively managing hemorrhage and increasing survival?

Search Strategy:

((((Tourniquet) AND Trauma) AND Hemorrhage) AND Bleed)

Search Outcome: 297 Results on PubMed.

Relevant Papers:

AUTHOR, DATE	POPULATION: SAMPLE CHARACTERISTICS	DESIGN (LOE)	OUTCOMES	RESULTS	STRENGTHS/ WEAKNESSES
Passos E. 4 Dec. 2013. McMaster University, dept. of Surgery, Canada.	190 adult Pts w/ arterial injuries from extremity	Retrospective study. LOE: II.	Primarily: Mortality, Secondary: Compartment syndrome,	8 Pts had TQ applied, none died.	+Pts with significant associated injuries were excluded.



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	trauma at 2 Canadian Lvl 1 Trauma centres.		amputation, transfusion, length of stay.	6 Pts total died of exsanguination without TQ. TQ Pts tended to be more hypotensive and acidotic. No difference in age, sex, injury score or physiologic presentation between Pts w/TQ and those w/o	+Long study period (9 yrs) Spread across 2 trauma centres in different cities. -Study was retrospective. -Confounders: MOI? Time to TQ application? Type of TQ? Was TQ applied correctly? No follow up, condition at discharge? -No direct comparison to other methods.
Kragh JF, Jr. Walters TJ. January 2009. US Army Institute of Surgical Research, Fort Sam. Houston, TX. USA.	2838 Civ/Mil Pts w/ major limb trauma. Combat hospital in Baghdad in 2006.	Retrospective study. LOE: II.	Survival rates and limb outcome.	There were 31 deaths (13%). TQ use when shock was absent was strongly associated with survival (90% vs. 10%; $P < 0.001$). PH TQ were applied in 194 patients, 22 died (11% mortality), whereas 38 patients had ED application of which 9 died (24% mortality; $P = 0.05$). 5 casualties indicated for TQ but had none used had a survival rate of 0% versus 87% for those casualties with TQ used ($P < 0.001$). 4 Pts (1.7%) sustained transient nerve palsy at the level of the tourniquet. No amputations resulted solely from tourniquet use.	+Large sample size. Incl. military/civilian population. +Elements of randomization. +High level of accuracy in results. +Pts were followed up with (28 days). -Retrospective. -Uncontrolled. -Not compared directly to other forms of hemorrhage control. -Unknown what other interventions used, possibly in conjunction w/ TQ.



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					-Unknown if TQ placement correct.
Inaba K, Siboni S. August 2015. Department of Surgery, University of South California. LA.	Adult (>18 yrs) w/extremity trauma requiring TQ application from January 2007- June 2014.	Epidemiologic/prognostic study, level III.	Limb loss, Death, length of stay, complications.	87 pts met inclusion criteria. Tourniquets placed in PH setting: 50.6%, in the emergency department: 39.1%, and in the operating room: 10.3% of patients. The windlass type TQ was the most common (67.8%), pneumatic system (24.1%) and self-made TQ (8.0%). The median duration of use was 75 minutes. 80.5% had a vascular injury (70.1% arterial), and a total of 99 limb operations were performed, including 15 amputations. Fourteen amputations (93.3%) occurred at the scene or were directly attributed to the extent of tissue damage. 7 Pts sustained 13 other complications; however, none was directly attributed to tourniquet use.	<ul style="list-style-type: none"> +Large sample size with many varying patients receiving pre-hospital TQ application. +Elements of randomization. -Retrospective review. -Uncontrolled. -Does not specify standard of care given to Pts w/o TQ application. -No direct comparison to other forms of hemorrhage control. -Confounders: Mechanism of injury. Associated injuries. -Unknown if TQ placement correct.

Comments: Very few studies existed that are not retrospective in nature, perhaps in part due to the logistical and ethical difficulty in conducting RCTs in severe civilian trauma and combat zones. Many studies focus on the safety and effectiveness of tourniquets but do not specifically compare them to a baseline standard of care (Ex, direct pressure) In each study there are many variables that are difficult to account for. (Ex, time from injury to hemorrhage control, time to definitive care, mechanism of injury, other interventions used along with TQs, other associated injuries).



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Consider: There are many outside factors and confounders, as such it is difficult to reach a concrete result. A reason to not change current practice would simply be the lack of RCTs studying tourniquets, as well as the lack of evidence that compares to other traditional means of hemorrhage control and shows them to be specifically less effective.

Clinical Bottom Line: There is a large body of clinical evidence that supports the liberal application of mechanical tourniquets pre-hospitality. Tourniquets are inexpensive and are strongly associated with a low level of complication and a high level of effectiveness at controlling severe hemorrhage if used quickly and appropriately thus improving outcomes and mortality rates from severe extremity trauma. More research should be conducted into the specific differences between TQ application and other methods of hemorrhage control.

References: 1. Tourniquet use for peripheral vascular injuries in the civilian setting. Passos E, Dingley B. Canadian Trauma Trials. 4 December, 2013. PMID: 2436074.
2. Survival with emergency tourniquet use to stop bleeding in major limb trauma . Kragh JF, Jr. Walters, TJ. Ann Surg. January 2009. PMID: 19106667.
3. Tourniquet use for civilian extremity trauma. Inaba K, Simonides S. August 2015. Department of Surgery, University of Southern California, LA. PMID: 26218691.



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