Forward assessment of 79 prehospital battlefield tourniquets used in the current war

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INTRODUCTION: Battlefield tourniquet use can be lifesaving, but most reports are from hospitals with knowledge gaps remaining at the forward surgical team (FST). The quality of tourniquet applications in forward settings remain unknown. The purpose of this case series is to describe observations of tourniquet use at an FST in order to improve clinical performance.

METHODS: War casualties with tourniquet use presenting to an FST in Afghanistan in 2011 were observed. We identified appliers by training, device effectiveness, injury pattern, and clinical opportunities for improvement. Feedback was given to treating medics.

RESULTS: Tourniquet applications (79) were performed by special operations combat medics (47, 59%), flight medics (17, 22%), combat medics (12, 15%), and general surgeons (3, 4%). Most tourniquets were Combat Application Tourniquets (71/79, 90%). With tourniquets in place upon arrival at the FST, most limbs (83%, 54/65) had palpable distal pulses present; 17% were pulseless (11/65). Of all tourniquets, the use was venous in 83% and arterial in 17%. In total, there were 14 arterial injuries, but only 5 had effective arterial tourniquets applied.

DISCUSSION: Tourniquets are liberally applied to extremity injuries on the battlefield. 17% were arterial and 83% were venous tourniquets. When ongoing bleeding or distal pulses were appreciated, medics tightened tourniquets under surgeon supervision until distal pulses stopped. Medics were generally surprised at how tight a tourniquet must be to stop arterial flow & convert a venous tourniquet into an arterial tourniquet. Implications for sustainment training should be considered with regard to this life-saving skill.

“A tourniquet must occlude arterial inflow, as occluding only the venous system can increase hemorrhage.”

“Ineffective venous tourniquets have been shown to be a relatively common occurrence that increases blood loss and complications.1-3 Optimal use of limb tourniquets must result in both cessation of bleeding and stoppage of the distal pulses in the extremity.”
- Optimizing the use of Limb Tourniquets in Tactical Combat Casualty Care: TCCC Guidelines Change 14-02 (October, 2014)
An evaluation of two tourniquet systems for the control of prehospital lower limb hemorrhage.
Taylor DM, Vater GM, Parker PJ.

Abstract

BACKGROUND:
Hemorrhage remains the main cause of preventable death on the modern battlefield. As Improvised Explosive Devices in Afghanistan become increasingly powerful, more proximal limb injuries occur. Significant concerns now exist about the ability of the windlass tourniquet to control distal hemorrhage after mid-thigh application. To evaluate the efficacy of the Combat Application Tourniquet (CAT) windlass tourniquet in comparison to the newer Emergency and Military Tourniquet (EMT) pneumatic tourniquet.

METHODS:
Serving soldiers were recruited from a military orthopedic outpatient clinic. Participants' demographics, blood pressure, and body mass index were recorded. Doppler ultrasound was used to identify the popliteal pulses bilaterally. The CAT was randomly self-applied by the participant at mid-thigh level, and the presence or absence of the popliteal pulse on Doppler was recorded. The process was repeated on the contralateral leg with the CAT now applied by a trained researcher. Finally, the EMT tourniquet was applied to the first leg and popliteal pulse change Doppler recorded again.

RESULTS:
A total of 25 patients were recruited with 1 participant excluded. The self-applied CAT occluded popliteal flow in only four subjects (16.6%). The CAT applied by a researcher occluded popliteal flow in two subjects (8.3%). The EMT prevented all popliteal flow in 18 subjects (75%). This was a statistically significant difference at p < 0.001 for CAT versus EMT.

CONCLUSION:
This study demonstrates that the CAT tourniquet is ineffective in controlling arterial blood flow when applied at mid-thigh level. The EMT was successful in a significantly larger number of participants.
Abdominal Aortic and Junctional Tourniquet Controls Hemorrhage From a Gunshot Wound of the Left Groin

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A Combat Application Tourniquet® (CAT) (North American Rescue LLC; http://www.narescue.com) was applied proximal to the wound, and bleeding stopped (Figure 1). After the second unit of PRBCs and the first liter of normal saline were transfused, the patient became more alert and began complaining of the discomfort from the CAT tourniquet. His systolic blood pressure was measured at 75mmHg. His heart rate decreased to 130 bpm. At this time, bleeding was noted from the inner proximal thigh wound on the left leg. An attempt to place a second CAT tourniquet was made; however, the first CAT tourniquet abutted the perineum, and there was no room for a second tourniquet to be placed above the first.