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Submissions and supporting documentation should be sent to editor@JSOMonline.org.

Submission Criteria

1. Use the active voice when possible. This is our most common editorial problem and often requires extensive re-writes. Use the sequence "subject - verb - object." Possible exceptions are times when the passive voice is more appropriate than active voice to help preserve the goals of research (i.e., to focus on the results rather than on the author).

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4. Special Operations require sensitivity to natives of host countries, occupied regions, and so on. We feel that patronizing terms generally are inappropriate for our pages. Realistic language of Operators (including some "four-letter" words) may be tolerated in anecdotal and historical articles, especially when used as direct quotes or when such use is traditional among Operators. We will delete or change blatantly offensive use.

5. All articles written by USSOCOM members must be reviewed and pre-approved by your commander, component surgeon, and PAO prior to submission to the JSOM. Authors must adhere to standard OpSec practices and refrain from mentioning specific units, specific locations, troop strengths, names of actively serving SOCOM personnel, TTPs, vulnerabilities, and any other information that could be of use to an adversary.

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The title page should have the following information:

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2. Authors' names with each author's highest academic degree(s), and institutional affiliations.

3. The name of the department(s) and institution(s) to which the work should be attributed

4. A brief informational bio on each author that includes military rank.

5. Disclaimers, if any. Authors should disclose any funding sources and any other disclosures? E.g.,

Financial Disclosure: The authors have indicated they have no financial relationships relevant to this article to disclose.

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6. Contact information for corresponding authors. The name, mailing address, telephone and fax numbers, and e-mail address of the author responsible for correspondence about the manuscript (the "corresponding author;" this author may or may not be the "guarantor" for the integrity of the study). The corresponding author should indicate clearly whether his or her e-mail address can be published.

7. The number of figures and tables. It is difficult for editorial staff and reviewers to determine whether the figures and tables that should have accompanied a manuscript were actually included unless the numbers of figures and tables are noted on the title page. You can either designate within the text of the manuscript were you want your figures and tables placed or you can place them in the text. However, ALL graphs and images need to be provided as separate hi-res images (prefer jpegs).

8. Provide a list of keywords for all feature articles

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CASE REPORT

Abdominal Aortic Tourniquet™ Use in Afghanistan

Submitted by a deployed physician
who has requested anonymity due to operational security issues.

ABSTRACT

The Abdominal Aortic Tourniquet™ was used recently used in Afghanistan to control severe hemorrhage in a casualty who had traumatic bilateral amputations of the lower extremities. Excerpts from the medical provider's account of the tactical evacuation phase of care are provided.

KEYWORDS: *Abdominal Aortic Tourniquet™, AAT, hemorrhage, amputations*

Introduction

In accordance with current Tactical Combat Casualty Care Guidelines, the Abdominal Aortic Tourniquet™ (AAT; Compression Works LLC; compressionworks.net) (NSN 6515-01-616-4999) was used to control severe hemorrhage in a casualty who had traumatic bilateral amputations of the lower extremities (see Figure 1). Several Special Operations Forces (SOF) units from International Security Assistance Force (ISAF) member nations currently carry the AAT. A medical provider in charge of the evacuation of the casualty was given access to an AAT and followed the packaged instructions for use in applying it. Excerpts from the medical provider's account of the tactical evacuation phase of care follow.

Case Report

As the patient was brought to the door of the helicopter, it was noted that he was completely floppy and lifeless. As he was placed in the helicopter, a high-flow oxygen mask was applied with the end-tidal carbon dioxide ($EtCO_2$) monitoring device in place. There was minimal respiratory effort with only small CO_2 complexes showing on the monitor. The casualty had no palpable carotid pulse. Current-generation Combat Application Tourniquets (CATs) were placed around both thighs; his lower legs were mangled, and there was a pool of bright red blood on the stretcher between his legs. I asked the

Figure 1 *The* Abdominal Aortic Tourniquet *is made by Compression Works LLC (compressionworks.net) and distributed exclusively in the United States by Speer Operational Technologies (speeroptech.com).*

medic to check the perineum. This was reassessed several times in flight to ensure that hemorrhage was controlled. The medic was able to quickly achieve access via a sternal intraosseous (IO) line and began to give blood and fresh-frozen plasma (FFP). The second medical provider assisted with the decision to perform rapid sequence intubation (RSI) to protect and control the airway. I flushed the sternal IO line and then gave 150mg of succinylcholine.

Before RSI, the monitor showed a bradycardic broad complex rhythm that was taken to be agonal. This is usually a terminal rhythm that occurs before death. Direct laryngoscopy was preformed with a size 8 endotracheal tube. The initial $EtCO_2$ at that time was 1.2kPa (for reference, normal is 4.5–6.0 kPa). The paramedic was transfusing blood, and patient was connected to the ventilator with a tube holder in place. Assessment of expansion of the chest appeared equal bilaterally. The flight medic placed another humeral IO line and commenced transfusion of FFP. At this stage, the patient was given 50mg rocuronium, 1g tranexamic acid, and 1g calcium chloride via the sternal IO line. At that time, $EtCO_2$ was 0.6kPa and falling despite transfusion. There was no clinical suspicion of pneumothorax. A pelvic fracture or pelvic hemorrhage could not be excluded, and the patient continued to deteriorate.

The patient was now in sinus tachycardia of greater than 120 with normal complexes and the $EtCO_2$ was still low.

Despite continued transfusion, given the lack of a carotid pulse and a catastrophically low $EtCO_2$, The AAT was placed using the log roll as an opportunity to do this—as it was believed it was in the best clinical interest of the patient and served to avoid a second roll. The AAT was inflated; in doing so, the $EtCO_2$ rose immediately. By arrival at the treatment facility, 2 units of packed red blood cells (PRBCs) and 2 units of FFP had been transfused. While in transport, the AAT worked as expected and bled off at bladder pressures greater than 300mmHg. On the journey to the emergency department, another unit of PRBCs was transfused. The $EtCO_2$ continued to be about 5.4kPa at 12 respirations/min via manual ventilation, and the patient had a carotid pulse on arrival. The patient required no sedation, and care was transferred to the trauma team. The AAT was transitioned in the operating room for surgical hemorrhage control, and the patient survived. The patient underwent a through-the-knee amputation on one leg and an above-the-knee amputation on the other leg.

It is worth mentioning that there was no evidence of renal failure or ischemic bowel at any time in the first 48 hours following his surgery.

Disclosure

The author has nothing to disclose.

Abdominal Aortic Tourniquet™ Commentary

John Croushorn, MD, FACEP; David Callaway, MD, MPA

One proven method of hemorrhage control is achieved when adequate pressure is applied to proximal vasculature to stop the flow of arterial blood to the point of wounding. In the circumstance of junctional bleeding, this currently is the method of choice in achieving hemorrhage control.

The effectiveness of any junctional control technique is dependent on several factors including the depth of the vessel(s) needing to be compressed, the diameter of the vessel, and the pressure of the flow through the vessel. Supporting and surrounding anatomic structures also affect compressibility. Regardless of the anatomy, the more tissue that can be displaced by external pressure, the more internal displacement is available to compress the vasculature. There is also a difference in whether the displacement occurs by a fixed-volume formed shape or a variable-volume, pneumatic-filled bladder. The bladder on the AAT was designed to conform to the anatomy of several areas of the upper and lower junctional regions.

The AAT was designed to "turn off the faucet" in a sense by stopping all arterial flow to the pelvis and lower extremities. Massive lower extremity and pelvic trauma, especially from complex dismounted blast injuries, is a major threat to our forces. A recent study by Walker and Eardley[1] demonstrated that a large number of casualties with lower junctional hemorrhage also had damage involving significant pelvic vasculature. The AAT answers the lower pelvic–junctional question by externally cross-clamping the aorta. It is the only junctional device to have independent live human studies to support its efficacy and safety.

The AAT also addresses a major challenge in resuscitation of critically injured patients: dilution of life-saving therapeutic interventions. During trauma resuscitation, medications, blood, and blood products are circulated throughout the entire available system although they are needed most in the core physiological areas of the brain, heart, lungs, and kidneys. The casualty's pulmonary system's efficiency was also affected by the overall circulatory volume. The casualty's end-tidal CO_2 ($EtCO_2$) was dropping regardless of wisely chosen and timely interventions. However, when the AAT was applied, the involved systemic vascular volume was dramatically decreased. The capability of the lungs to exchange O_2 and CO_2 increased and resulted in a very rapid increase in $EtCO_2$ to fully normal levels. Ventilation improved because of this dynamic but also because the medications, blood, and FFP were being concentrated in the core physiological areas involved in survival. The casualty care report presented in the JSOM again demonstrates the capabilities of the AAT to radically and rapidly change core physiology resulting in improved survival.

With new human studies showing effectiveness in isolated groin applications, axilla applications, and those in the base of the neck, the AAT is the only device that has the capability of providing hemorrhage control for all junctional hemorrhage areas including the pelvis. In addition to the cessation of bleeding, its ability to so rapidly change core physiological parameters of circulatory volume provides benefit to almost every other prehospital resuscitative measure in practice.

Reference

1. Walker NM, Eardley WH. UK combat-related pelvic junctional injuries 2008–2011: implications for future interventions. *J Trauma*. 2013. In press.

Dr. Croushorn has been involved in hemorrhage control research since 2005. He is a board-certified emergency physician. He was a former Command Surgeon, Task Force 185, OIF 2004.

Dr. Callaway is an associate professor of emergency medicine, Carolinas Medical Center in Charlotte, NC. Dr. Callaway was a former Navy physician and works as the co-director of the Operational Medicine Institute.

Disclosure

Dr. Croushorn is one of the inventors of the Abdominal Aortic Tourniquets and the President of Compression Works LLC, which developed the device. Dr. Callaway has nothing to disclose.