

Implementation and Evaluation of a First-Responder Bleeding-Control Training Program in a Rural Police Department

James R. Reed, DNP, CRNA, RN^{1*}; Margaret J. Carman, DNP, ENP-BC, RN²;
Frank J. Titch, DNP, CRNA, RN³; Russ S. Kotwal, MD, MPH⁴

ABSTRACT

Background: In the prehospital environment, nonmedical first responders are often the first to arrive on the scene of a traumatic event and must be prepared to provide initial care at the point of injury. In civilian communities, these nonmedical first responders often include law enforcement officers. Hemorrhage is a major cause of death in trauma, and many of these deaths occur in the prehospital environment; therefore, prehospital training efforts should be directed accordingly toward bleeding control. **Methods:** A bleeding control training program was implemented and evaluated in a rural police department in Pinehurst, North Carolina, from February to April 2017. A repeated measures observational study was conducted to evaluate the training program. Measured were self-efficacy (pre- and post-test), knowledge (pretest, post-test 1 [immediate], post-test 2 [at 4 weeks]), and limb-tourniquet application time (classroom, simulation exercise). **Results:** The study population was composed of 28 police officers (92.9% male) whose median age was 37 (interquartile range, 22–55) years. Mean self-efficacy scores, equating to user confidence and the decision to intervene, increased from pre- to post-training (34.54 [standard deviation (SD) 4.16] versus 35.62 [SD 4.17]; $p = .042$). In addition, mean knowledge test scores increased from pre- to immediately post-training (75.00 [SD 16.94] versus 85.83 [SD 11.00]; $p = .006$), as well as from pre- to 4 weeks post-training (75.00 [SD 16.94] versus 84.17 [SD 11.77]; $p = .018$). Lower limb-tourniquet application times were more rapid in the classroom than during the simulation exercise (23.06 seconds [SD 7.68] versus 31.91 seconds [SD 9.81]; $p = .005$). **Conclusion:** First-responder bleeding-control programs should be initiated and integrated at the local level throughout the Nation. Implementation and sustainment of such programs in police departments can save lives and enhance existing law enforcement efforts to protect and serve communities.

KEYWORDS: *bleeding control; first responder; hemorrhage; limb tourniquet; prehospital; trauma*

Introduction

The US military continues to achieve lower case fatality rates^{1,2} despite advancements in enemy tactics and modern weaponry. Although prehospital and hospital progress has been made, frontiers in battlefield medicine still exist and have been identified through comprehensive study of preventable death

and potentially survivable injuries.^{3,4} Evidence-based practice guidelines and performance improvement programs that reduce preventable death in the military, such as Tactical Combat Casualty Care (TCCC) and the Ranger First Responder program, have been translated and can also reduce mortality within civilian communities.^{1,5-7}

Traumatic mass casualty events in civilian communities are increasing in incidence as are reports of them in media headlines. These events, whether natural or manmade, are often challenging to those who respond.^{8,9} Common among these events are mass shootings and terrorist activities directed against large numbers of citizens assembling in open and public places. Responding and caring for the wounded during these incidents can prove difficult. Contingency planning, coordination, rehearsals, and resourcing for such events impose a major burden on local, state, and national medical systems.

According to data from the National Center for Injury Prevention and Control, highlighted by the landmark 2016 National Academy of Sciences, Engineering, and Medicine report on trauma, approximately 30,000 preventable deaths occur annually from trauma in the United States.¹ Similar to combat, hemorrhage was a major cause of death in many civilian trauma events.^{1,10} In the civilian community, traumatic hemorrhage also poses a challenge to those who reside or conduct activities in rural or wilderness environments.¹¹

After the Sandy Hook Elementary School shooting, and in support of a Presidential Policy Directive for national preparedness, the White House initiated the “Stop the Bleed” program. National trauma experts also formed the Hartford Consensus to make recommendations to improve casualty response to mass casualty events, particularly through empowerment of bystanders.¹² The Hartford Consensus, in conjunction with the National Tactical Officers Association (NTOA), recommended that law enforcement personnel should adopt, train, and maintain core competency first-responder and bleeding-control skills similar to that of the military.¹³ Nonmedical first responders usually arrive first on the scene; thus, widespread use by law enforcement of tourniquets for bleeding control has potential to reduce morbidity and mortality from trauma.¹³⁻¹⁷

The purpose of this study was to implement and evaluate a first-responder bleeding-control program in a rural police department as recommended by the Hartford Consensus and

*Correspondence to Duke University School of Nursing, 307 Trent Dr, Durham, NC 27710; or james.r.reed@duke.edu

¹Dr Reed, ²Dr Carman, and ³Dr Titch are at Duke University School of Nursing, Durham, NC. ⁴Dr Kotwal is at the Department of Defense Joint Trauma System, Joint Base San Antonio–Fort Sam Houston, TX.

NTOA. This study specifically examined limb-tourniquet application for bleeding control and measured associated competence and confidence levels during and after a simulation exercise.

Methods

A bleeding-control training program was implemented and evaluated in a rural police department in Pinehurst, North Carolina, from February to April 2017. A repeated measures observational study was conducted to evaluate the training program. Measured were self-efficacy (pre- and post-test), knowledge (pretest, post-test 1 [immediate], post-test 2 [at 4 weeks]), and limb tourniquet application time (classroom, simulation exercise).

Pinehurst is 70 miles from the nearest level I trauma center. This small, rural village of 15,000 people hosts major sporting events that can attract as many as 350,000 visitors; thus, creating the potential for a significant mass casualty event. Approval to implement and evaluate this training program was received from the Pinehurst Police Department. Approval to conduct this study was provided by the Institutional Review Board at Duke University.

A convenience sample of sworn police officers volunteered and participated in this study. Evaluated and described were performance and confidence of rural law enforcement personnel in responding to a simulated bleeding-control casualty scenario. The study team was blinded to participant identities in this pre- and post-test design project.

Prior to training, study participants completed an anonymous demographic survey that included questions on age, sex, length of service as a police officer, length of service with the Pinehurst police department, prior military experience, prior tourniquet training, and prior use of tourniquets. Study participants also completed a pre-event five-question cognitive assessment test of bleeding-control knowledge, and a general self-efficacy (GSE) questionnaire to measure confidence. Cognitive assessment questions were developed and refined to be congruent with TCCC and Tactical Emergency Casualty Care (TECC) course examination questions on bleeding control. The cognitive assessment test and GSE questionnaire were both administered again immediately after completion of training. A third cognitive assessment test was administered 4 weeks after completion of training.

The GSE questionnaire is an internationally recognized, 10-question tool that uses a Likert scale.¹⁸ This tool is valid and reliable; individuals with a high degree of self-efficacy and confidence in an activity or task have been shown to be more likely to participate and be successful in that activity.^{18,19}

The Combat Application Tourniquet (C-A-T; Generation 7; C-A-T Resources Inc., <http://combattourniquet.com/>) was used during training simulations. This tourniquet is one of the models recommended by TCCC and TECC courses endorsed by the NTOA. Funding for initial training, as well as future recurrent training, was allocated and approved by the police department. To accommodate various work shifts, didactic training was provided through the departmental intranet. A narrated, 15-minute, PowerPoint (Microsoft, www.microsoft.com) presentation with embedded one- and two-handed tourniquet

application videos produced by the tourniquet manufacturer was used. Didactic training content included historical background on bleeding control, indications for limb-tourniquet use, steps for proper limb-tourniquet application, measures to check therapeutic efficacy, and how and why to document time of application. One-hour, group hands-on practice sessions were conducted using a TCCC instructor who trained the participants to apply direct pressure to a wound, place a tourniquet 2–3 inches above a simulated wound over clothing using the two-handed method, tighten the tourniquet strap, and then turn and secure the tourniquet windlass rod to eliminate the distal pulse on a hypothetically wounded limb. Participants then documented the time it took to apply the tourniquet to the casualty.

After practicing tourniquet application, an observation and measurement of participant ability to use the two-hand method to apply a tourniquet to a simulated wounded lower limb was conducted. This occurred in the classroom 2 weeks before the simulation exercise. The lower limb was chosen over the upper limb because it is a larger target with larger blood vessels that have a higher potential for rapid exsanguination during a real-world occurrence. The event was timed and measured to the hundredth of a second using an Ultrak 360 Stopwatch, model C-521 (Ultrak, <http://www.cei-ultrak.com/>). The time interval between initiating and completing tourniquet application was measured and recorded on a data collection tool. Correct tourniquet placement was defined as properly applying the tourniquet 2–3 inches above the simulated wound. Proper tourniquet application included having the windlass rod tightened and secured in accordance with manufacturer guidelines and time of tourniquet application documented.

An active-shooter simulation exercise was undertaken in accordance with TECC guidelines, which instruct officers to first secure the scene and then render aid. The officers were given the scenario of having to respond to an improvised explosive device-initiated active-shooter attack at a local youth soccer event.

After officers were briefed on the simulation exercise, they were positioned in a stationary vehicle. On cue, they exited the vehicle and responded to the scenario in accordance with their training. The scenario included a casualty drag of a 165-lb low-fidelity adult manikin (Rescue Randy; Simulaid, <https://www.simulaid.com>), as well as two other simulated victims (infant and child manikins). Also used was a shooting target that simulated an attacker armed with a handgun. The officers were expected to secure the scene with a laser pistol, move the victims to cover, and then render care. The officers were timed in their ability to successfully apply a tourniquet to a wounded lower limb of the adult manikin. The time interval between initiating and completing tourniquet application was measured and recorded as in the classroom training. Officers were debriefed after each measurement.

Demographic variables were analyzed using descriptive statistics. Paired *t* tests were used to compare pre- versus post-education self-efficacy questionnaires and classroom versus simulation exercise tourniquet-application time. A one-way repeated measures analysis of variance was used to compare knowledge scores before, immediately after, and at 4 weeks after training. SPSS, version 24 (IBM, www.ibm.com) was used to conduct statistical analyses with α set to .05.

Results

Demographics

A total of 28 sworn police officers participated in the study. The study population had a median age of 37 (interquartile range [IQR], 22–55) years and was primarily male (92.9%; $n = 26$). All 28 participants completed the didactic PowerPoint training, and 92.9% ($n = 26$) completed the hands-on practice sessions. Due to routine departmental mission requirements, 85.7% ($n = 24$) of participants completed the active-shooter training exercise. Analysis deemed this attrition as not significant. A summary of study population characteristics is provided in Table 1, and a summary of repeated measures used to evaluate the program is given in Table 2.

TABLE 1 Summary of Population Characteristics for Pinehurst Police Department Bleeding Control Program Study

Category	Data
Sworn police officer, no. (%)	28 (100.0)
Age, median (IQR), years	37 (22–55)
Male sex, no. (%)	26 (92.9)
Service as police officer, no. of years (IQR)	11 (1–27)
Service with Pinehurst Police Department, median (IQR)	8.21 (1–25)
Prior military, no. (%)	7 (25.0)
Prior tourniquet training or use, no. (%)	20 (71.4)

IQR, interquartile range.

TABLE 2 Summary of Repeated Measures Used to Evaluate the Pinehurst Police Department Bleeding-Control Program

Category	Total	<i>p</i> Value
General self-efficacy questionnaire, no.	26	
Mean pre- and post-training scores	34.54, 35.62	.042
Knowledge assessment test, no.	24	
Pretest, post-test 1, mean (SD)	75.00 (16.94), 85.83 (11.00)	.006
Pretest, post-test 2, mean (SD)	75.00 (16.94), 84.17 (11.77)	.018
Post-test 1, post-test 2, mean (SD)	85.83 (11.00), 84.17 (11.77)	.539
Tourniquet application time, no.	24	
Classroom vs simulation exercise, mean, sec	23.06 vs 31.91	.005

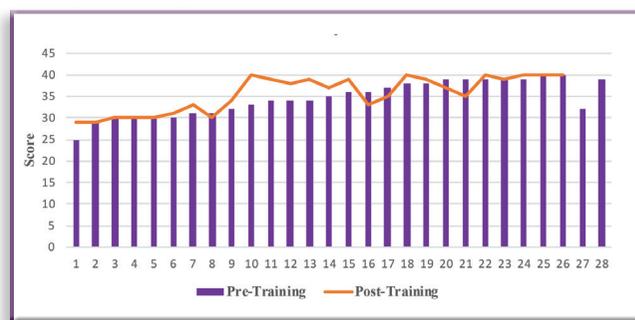
SD, standard deviation.

The study population had a median of 11 (IQR, 1–27) years of service as a police officer, and a median of 8.21 (IQR, 1–25) years of service with the Pinehurst Police Department. It was notable that 25.0% ($n = 7$) of participants also had prior military service, 71.4% ($n = 20$) had prior tourniquet training, and 25.0% ($n = 7$) had previously used a tourniquet to treat a casualty.

General Self-Efficacy Questionnaire

From the study population, 92.9% ($n = 26$) completed the GSE questionnaire before and after training. The mean self-efficacy score, equating to user confidence and the decision to intervene, increased significantly from pre- to post-training (34.54 [standard deviation (SD) 4.16] versus 35.62 [SD 4.17]; $p = .042$). This increase in self-efficacy score after bleeding-control training equates to a commensurate increase in the individual's belief in their own ability to respond to casualties who require bleeding control. Individual GSE scores are shown in Figure 1.

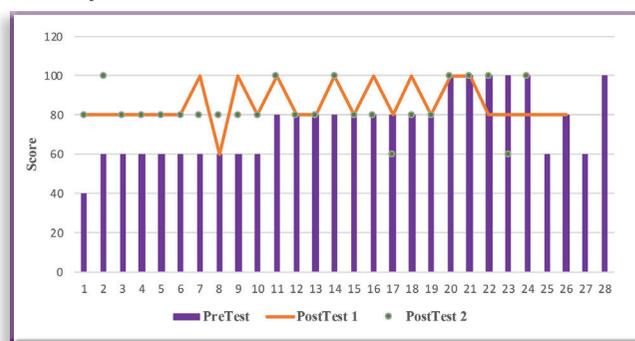
FIGURE 1 General self-efficacy questionnaire scores, pretraining versus post-training.



Knowledge Assessment Test and Tourniquet Application Time

The one-way repeated measures analysis of variance revealed a nonsignificant Mauchly test of sphericity ($p = .227$); thus, sphericity assumed results were interpreted. Significance ($p = .004$) demonstrated an increase in knowledge with each test through time. Based on a perfect test score of 100%, pairwise comparisons showed an increase in pre- to immediate post-training knowledge test score mean (75.00 [SD 16.94] versus 85.83 [SD 11.00]; $p = .006$), as well as an increase in pre- to 4-week post-training knowledge test score mean (75.00 [SD 16.94] versus 84.17 [SD 11.77]; $p = .018$). However, no difference ($p = .539$) was seen between immediate post-training and 4-week post-training test score means. Individual knowledge assessment test scores are shown in Figure 2.

FIGURE 2 Knowledge assessment test scores, pretest versus post-test 1 versus post-test 2.

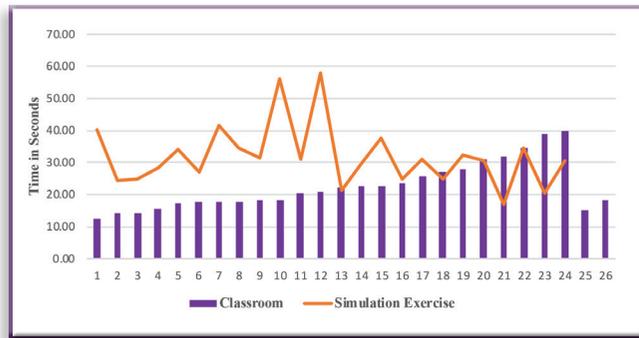


There was an increase in the mean tourniquet application time measured in the classroom versus the simulation exercise (23.06 [SD 7.68] seconds versus 31.91 [SD 9.81] seconds; $p = .005$). Although this difference was significant, testing conditions shifted from a single-task focus in a relatively static environment to multitasking in a stressful and dynamic environment. Notable was that all subjects properly applied the tourniquet in less than 60 seconds in both the classroom and simulation exercises. Individual tourniquet application times are shown in Figure 3.

Discussion

Use of the tourniquet has made an evidence-based resurgence in modern medicine.¹⁶ Despite historic use of tourniquets as a last resort on the battlefield, it is estimated that more aggressive tourniquet use in recent conflicts in Afghanistan and Iraq have resulted in 1,000 to 2,000 lives saved.^{20,21} From 2001 to 2006, potentially preventable death from limb hemorrhage was 7.8% among US military forces.²² This rate was relatively

FIGURE 3 Tourniquet application time, classroom versus simulation exercise.



unchanged from the 7.4% seen during a previous conflict in Vietnam.²³ However, after tourniquets were rapidly and ubiquitously fielded to deploying US military personnel in 2005 to 2006, preventable death from limb hemorrhage decreased 67%.² Training and equipping of military nonmedical first responders has resulted in more aggressive tourniquet use, which, in turn, has saved lives.

Integrating military first-responder and bleeding-control techniques among civilian law enforcement personnel has garnered increasing support from the civilian medical community and leadership.^{17,24} However, national standards for tourniquets, tourniquet training, and tourniquet use must continue to be solidified.²⁵ Data from law enforcement and other nonmedical first-responder bleeding-control programs must also be collected, consolidated, and evaluated for performance improvement. The NTOA Tactical Emergency Medical Support section has recommended that all police officers receive basic medical training, integrate established basic core competencies to address operational hazards, and support the adaptation of the military TCCC program.²⁶

Our community-based performance improvement study examined all three domains of learning through knowledge, confidence, and competence. A previous retrospective study of police rendering medical care prior to Emergency Medical Services arrival in 94.6% of cases guided our efforts.²⁷ As in the case of the Ranger First Responder program, our study also demonstrated that teaching tourniquet application techniques to nonmedical personnel can be done effectively in a short time with a modest amount of resources.

Our results demonstrate improvements in knowledge and confidence. Fidelity may have been affected by military veterans and those with prior tourniquet experience in the study population, and these factors should be considered in future investigations. Confidence is associated with the decision to intervene, and individuals are more aggressive and willing to provide care if they feel more confident in their abilities. As evidenced in our study, changes in self-efficacy scores after medical training suggest a positive psychological benefit to this training. In a developmental or spiral fashion, assessing one's own skills and experience is based on one's skills and experience, especially when assessing one's own skills and experience. In addition, because proper and timely tourniquet application was performed in all instances, the training also had a positive practical benefit. When confronted with limb hemorrhage, timely and effective tourniquet application can be paramount to survival.^{12,16}

The methods used in this study can prove beneficial to other police departments implementing similar bleeding-control programs. Results are consistent with previous studies that have demonstrated success in training nonmedical first responders to apply tourniquets.^{28,29} The project's inexpensive, cost-effective, and simple design can provide justification to law enforcement leadership for similar training and studies within other police departments. Survival benefits of tourniquet application are evident from combat data. As data accumulate in the civilian sector, evidence should continue to affirm the efficacy of bleeding-control techniques and promote benefits over potential risks.

Limitations of this study include the small homogeneous nature of the convenience sample. Caution should be advised when generalizing results to larger or more diverse police department populations. Study participants reporting previous tourniquet experience (71.4%) and real-world tourniquet application (25.0%) may prove anomalous. However, because these participants had more skills and experience than others, they may be expected, based on prior science, to be relatively better than others in self-assessment. Although other recommended tourniquets are commercially available, the only tourniquet used in this study was the C-A-T. This tourniquet was chosen because of its widespread use by all US military services, as well as its endorsement by the Department of Defense Joint Trauma System and Committee on TCCC. Realistic tourniquet effectiveness testing during hands-on training was not optimal given the model of manikin. Use of human role players would provide more accurate assessment and verification of limb arterial blood-flow cessation after tourniquet application through the measurement of distal pulses as either present or absent.

Conclusion

Law enforcement officers are often called upon to provide life-saving interventions under chaotic conditions and before trained medical personnel arrive on the scene. This is not unlike situations encountered by military forces. Large numbers of casualties generated by terrorist or active-shooter events encourage the development and implementation of nonmedical first-responder programs on behalf of public safety. The Stop the Bleed campaign provides a cornerstone for implementing a community-based approach to bleeding control. A similar campaign and approach should continue to propagate throughout the law enforcement community to increase the potential for saving lives. Implementation and evaluation of bleeding-control programs in police departments can help "to protect and to serve" local communities.

Disclosure

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

Author Contributions

JRR and RSK had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. JRR and RSK were involved in study concept and design. JRR was involved in data collection, consolidation, and organization. JRR and RSK were involved in statistical analysis. JRR, MJC, FJT, and RSK were involved in acquisition, analysis, or interpretation of data. JRR and RSK drafted the manuscript. JRR, MJC, FJT, and RSK critically

revised the manuscript for important intellectual content. JRR provided administrative, technical, or material support. JRR and RSK supervised the study. All authors approved the final manuscript.

References

1. Berwick DM, Downey AS, Cornett EA, eds. Committee on Military Trauma Care's learning health system and its translation to the civilian sector, National Academies of Sciences, Engineering, and Medicine (NASEM) report. *A National Trauma Care System. Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths After Injury*. Washington DC: The National Academies Press, 2016. <https://www.nap.edu/catalog/23511/a-national-trauma-care-system-integrating-military-and-civilian-trauma>. Accessed 23 April 2018.
2. Kotwal RS, Howard JT, Orman JA, et al. The effect of a golden hour policy on the morbidity and mortality of combat casualties. *JAMA Surg*. 2016;151(1):15–24.
3. Eastridge BJ, Mabry RL, Seguin P, et al. Death on the battlefield (2001-2011): implications for the future of combat casualty care. *J Trauma Acute Care Surg*. 2012;73(6 Suppl 5):S431–437.
4. Eastridge BJ, Hardin M, Cantrell J, et al. Died of wounds on the battlefield: causation and implications for improving combat casualty care. *J Trauma*. 2011;71(1 Suppl):S4–8.
5. Kotwal RS, Montgomery HR, Kotwal BM, et al. Eliminating preventable death on the battlefield. *Arch Surg*. 2011;146(12):1350–1358.
6. Fisher AD, Callaway DW, Robertson JN, et al. The Ranger First Responder program and Tactical Emergency Casualty Care implementation: a whole-community approach to reducing mortality from active violent incidents. *J Spec Oper Med*. 2015;15(3):46–53.
7. Kotwal RS, Montgomery HR, Miles EA, et al. Leadership and a casualty response system for eliminating preventable death. *J Trauma Acute Care Surg*. 2017;82(6S Suppl 1):S9–S15.
8. Levy MJ. Intentional mass casualty events: implications for prehospital emergency medical services systems. *J Spec Oper Med*. 2015;15(4):157–159.
9. King DR, Larentzakis A, Ramly EP, et al. Tourniquet use at the Boston Marathon bombing: lost in translation. *J Trauma Acute Care Surg*. 2015;78(3):594–599.
10. Davis JS, Satahoo SS, Butler FK, et al. An analysis of prehospital deaths: who can we save? *J Trauma Acute Care Surg*. 2014;77(2):213–218.
11. Kragh JF, Dubick MA. Bleeding control with limb tourniquet use in the wilderness setting: review of science. *Wilderness Environ Med*. 2017;28(2S):S25–S32.
12. Pons PT, Jerome J, McMullen J, et al. The Hartford Consensus on active shooters: implementing the continuum of prehospital trauma response. *J Emerg Med*. 2015;49(6):878–885.
13. Levy MJ, Smith R, Gerold KB, et al. Clinical encounters in tactical medicine: a mission-specific analysis of the Maryland state police experience. *J Spec Oper Med*. 2014;14(2):98–104.
14. Eastman AL. The continuing threat of active shooter and intentional mass casualty events: local and law enforcement and hemorrhage control. *J Spec Oper Med*. 2015;15(4):146–148.
15. Jacobs LM, Eastman A, Mcswain N, et al. Improving survival from active shooter events: The Hartford Consensus. *Bull Am Coll Surg*. 2015;100(1 Suppl):32–34.
16. Holcomb JB, Butler FK, Rhee P. Hemorrhage control devices: tourniquets and hemostatic dressings. *J Spec Oper Med*. 2015;15(4):153–156.
17. Aberle SJ, Dennis AJ, Landry JM, et al. Hemorrhage control by law enforcement personnel: a survey of knowledge translation from the military combat experience. *Mil Med*. 2015;180(6):615–620.
18. Robertson DS, Felicilda-Reynaldo RF. Evaluation of graduate nursing students' information literacy self-efficacy and applied skills. *J Nurs Educ*. 2015;54(3 Suppl):S26–30.
19. Kandakai TL, King KA. Perceived self-efficacy in performing life-saving skills: an assessment of the American Red Cross's responding to emergencies course. *J Health Educ*. 1999;30(4):235–241.
20. Butler FK. Military history of increasing survival: the US military experience with tourniquets and hemostatic dressings in the Afghanistan and Iraq conflicts. *J Spec Oper Med*. 2015;15(4):149–152.
21. Kragh JF Jr, Walters TJ, Westmoreland T, et al. Tragedy into drama: an American history of tourniquet use in the current war. *J Spec Oper Med*. 2013;13(3):5–25.
22. Kelly JF, Ritenour AE, McLaughlin DF, et al. Injury severity and causes of death from Operation Iraqi Freedom and Operation Enduring Freedom: 2003-2004 versus 2006. *J Trauma*. 2008;64(2 Suppl):S21–26.
23. Maughon JS. An inquiry into the nature of wounds resulting in killed in action in Vietnam. *Mil Med*. 1970;135(1):8–13.
24. Fabbri WP. The continuing threat of intentional mass casualty events in the US observations of federal law enforcement. *J Spec Oper Med*. 2015;15(4):142–145.
25. Ramly E, Runyan G, King DR. The state of the union: nationwide absence of uniform guidelines for the prehospital use of tourniquets to control extremity exsanguination. *J Trauma Acute Care Surg*. 2016;80(5):787–791.
26. Pennardt A, Callaway DW, Kamin R, et al. Integration of tactical emergency casualty care into the national tactical emergency medical support competency domains. *J Spec Oper Med*. 2016;16(2):62–66.
27. Stiles CM, Cook C, Sztajnkrzyer MD. A descriptive analysis of tactical casualty care interventions performed by law enforcement personnel in the state of Wisconsin, 2010-2015. *Prehosp Disaster Med*. 2017;32(3):284–288.
28. Jacobs LM, Burns KJ. Tourniquet application training for individuals with and without a medical background in a hospital setting. *J Trauma Acute Care Surg*. 2015;78(2):442–445.
29. Goolsby C, Branting A, Chen E, et al. Just-in-time to save lives: a pilot study of layperson tourniquet application. *Acad Emerg Med*. 2015;22(9):1113–1117.



JDOM

JOURNAL of SPECIAL OPERATIONS MEDICINE™



THE JOURNAL FOR OPERATIONAL MEDICINE AND TACTICAL CASUALTY CARE

Inside this Issue:

- › Judgment in Tourniquet Use
- › Your Metric Matters!
- › Mechanical Forces During Movement in Mountainous Terrain
- › Shoulder Reduction Techniques Comparison
- › iTClamp for External Hemorrhage Control
- › Swedish Specialized Boarding Element Members' Experiences of Naval Hostile Duty
- › Four Intraosseous Blood Transfusion Strategies
- › First-Responder Bleeding-Control Training Program
- › Facial Trauma Care in the Austere Environment
- › Chemical Contamination Transfer During Casualty Care
- › Role of Pain in Tourniquet Training
- › Self-Application of C-A-T Versus TMT
- › 2018 SOMSA Research Abstracts
- › Ongoing Series: Human Performance Optimization, Infectious Diseases, Injury Prevention, NSOCM Course, Prolonged Field Care, SOFsono Ultrasound, Unconventional Medicine, Book Review, TCCC Updates, and more!

*Dedicated to the
Indomitable Spirit
and Sacrifices of
the SOF Medic*