CONVERT: Civilian outcomes of emergency department tourniquet conversion

Aaron L. Fox, MD, Meghan Stuart, MSPH, Michael Clemens, MD, *and* **David W. Callaway, MD,**
Charlotte, NC

BACKGROUND: Tourniquet conversion (TC) involves the removal of a tourniquet with the achievement of hemostasis using wound packing, hemostatic dressings, and/or pressure bandages as a less invasive method of hemorrhage control. TC is routinely performed in emergency departments to reduce ischemic complications associated with prolonged tourniquet use. Despite increasing civilian prehospital tourniquet application, empirical data guiding TC remain limited, and existing protocols rely largely on expert opinion.

METHODS: We conducted a retrospective cohort study of trauma patients presenting with prehospital-applied extremity tourniquets to a Level I trauma center between March 2021 and December 2024. TC was defined as the removal of a tourniquet with replacement by wound packing, hemostatic dressings, and/or pressure bandages. Outcomes were categorized as successful conversion, procedural intervention, or operative intervention. Secondary outcomes included injury-related complications, attribution of complications to tourniquet use, and factors associated with delayed or failed conversion. Multivariable logistic regression was used to identify predictors of successful conversion.

RESULTS: Among 647 patients, 543 (83.9%) underwent successful TC in the emergency department without procedural or operative intervention. Median tourniquet duration was 40 minutes (interquartile range, 30–59). Sixty patients (9.3%) experienced injury-related complications, with none attributed to tourniquet use. Complications were more common in patients requiring operative intervention compared with those successfully converted (44.4% vs. 4.6%). Increasing tourniquet duration was independently associated with decreased odds of successful conversion per 30-minute interval [odds ratio (OR), 0.41; 95% CI, 0.32–0.53]. Upper extremity tourniquets were less likely to be successfully converted than lower extremity tourniquets (OR, 0.61; 95% CI, 0.38–0.97).

CONCLUSIONS: TC in the emergency department is successful for most patients with prehospital-applied tourniquets. Complications appear primarily related to the inciting injury rather than tourniquet use, particularly when the duration is under 2 hours. These findings support existing conversion protocols and highlight the importance of timely reassessment to minimize duration-associated complications. (*J Trauma Acute Care Surg* 2026;00:000–000

LEVEL OF EVIDENCE: Prognostic/Epidemiological; Level III.
KEY WORDS: Tourniquet, tourniquet conversion, hemorrhage control, mass casualty.

Tourniquets have been used for centuries to control life-threatening extremity hemorrhage, yet their popularity has fluctuated widely due to evolving doctrine, persistent misconceptions, and inadequate training. Tactical Combat Casualty Care (TCCC), shaped by extensive data from the US conflicts in Iraq and Afghanistan,[1,2] emphasizes early application, frequent reassessment, and timely conversion of rescue tourniquets.[3] Extremity tourniquet application is indicated for obvious life-threatening hemorrhage in a single patient, potential life-threatening hemorrhage in mass casualty incidents, or during the initial assessment of polytrauma patients where the immediate source of shock is unclear. Tourniquet conversion (TC) involves the removal of a tourniquet with hemostasis achieved using wound packing, hemostatic dressings, and/or pressure bandages when three conditions are met: absence of traumatic amputation, no ongoing hemorrhagic shock, and the ability to closely monitor for rebleeding.[4] To minimize complications such as nerve injury, compartment syndrome, or ischemic necrosis, TC should be attempted as soon as reasonably possible. In military literature, the Joint Trauma System has found that to achieve functional or quality limb salvage, arterial flow must be restored in the injured limb within 3 hours, and in 1 hour or less in patients who are in hemorrhagic shock.[5] However, civilian conversion protocols largely quote <2 hours as the target maximum tourniquet time for all patients, without differentiation based on hemodynamics.[6] Although perceived to be

Submitted: March 12, 2026; Revised: May 27, 2026; Accepted: May 28, 2026; Published online: Month DD, YYYY.
From the Department of Emergency Medicine (A.L.F., D.W.C.), Carolinas Medical Center, Charlotte, North Carolina; Department of Acute Care Surgery (M.S., M.C.), Carolinas Medical Center, Charlotte, North Carolina.
Address for correspondence: Aaron L. Fox, MD, Department of Emergency Medicine, Medical Education Building Third Floor, 1000 Blythe Blvd, Charlotte, NC 28203; email: aaron.l.fox@advocatehealth.org
Supplemental Digital Content is available for this article. Direct URL citations are provided in the HTML and PDF versions of this article on the journal's website, www.jtrauma.com.

DOI: 10.1097/TA.0000000000005106

riskier, TC is usually still attempted in an intermediate time window of 2 to 6 hours. However, TC is relatively contraindicated after prolonged (>6 h) application.[1,7] Regardless of quoted maximal time frames, there is universal agreement that TC should be attempted as soon as feasibly possible.

Recognizing the need for analogous guidance in civilian settings, the Tactical Emergency Casualty Care (TECC) guidelines were introduced in 2011 to adapt TCCC military teaching for high-threat civilian prehospital environments.[6] TECC maintained the core principles of TCCC but removed combat-specific language and adjusted protocols for civilian operations, leading to widespread adoption in EMS, fire, and law enforcement operations. In both the military and civilian settings, tourniquets are now routinely applied by nonmedical personnel and first responders with less comprehensive health care training. This broad adoption contributed to a dramatic rise in civilian prehospital tourniquet use: from 0 documented EMS tourniquet applications in 2008 to nearly 4,000 applications in 2016.[8,9] Whereas urban EMS systems typically allow for rapid evacuation, rural and austere environment transport times often exceed 2 hours, making TC ever more critical.[10] Although civilian conversion protocols do exist, and while they provide systematic approaches for TC, their recommendations are based primarily on expert panels and observational experience. Large-scale empiric data to guide TC are surprisingly scarce.[11,12]

This study examines the outcomes of TC attempts upon patient arrival to an emergency department (ED) at a Level 1 trauma center. By analyzing 647 patients who had rescue tourniquets placed prehospital and attempted conversion in the ED, we aim to identify patient criteria for TC, quantify conversion success rates, characterize associated complication frequency, and determine the extent to which those complications were attributable to tourniquet use versus the inciting injury itself. Secondarily, we can examine the wound characteristics associated with delayed or failed conversion. These findings will provide an empiric basis of evidence to further inform TC protocols and optimize prehospital hemorrhage control in both civilian and military settings. We hypothesize that TC in the ED is an effective and safe practice for the majority of patients presenting with prehospital-applied rescue tourniquets.

METHODS

Study Design

This study is a retrospective cohort study of trauma cases using data from the institutional trauma registry. The study examines outcomes of prehospital-applied extremity tourniquets and their subsequent management in the ED between 2021 and 2024. No prospective data collection or modification of standard care was performed. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (SDC 1, Supplemental Digital Content 1, http://links.lww.com/TA/F554).

Study Setting

The study was conducted in the ED at a Level I trauma center located in the United States.

Participants

The study population included trauma patients who presented to a Level I trauma center in the United States between March 17, 2021, and December 31, 2024, with a prehospital-applied extremity tourniquet still in place upon arrival and survived until departure from the ED. The start date of March 17, 2021, coincides with the hospital's adoption of a new electronic medical record system that allows for tourniquets to be separately logged and tracked.

Inclusion criteria:

- patients of any age or sex; and
- traumatic blunt or penetrating extremity injury requiring prehospital application of a tourniquet.

Exclusion criteria:

- patients whose tourniquets were removed before arrival in the ED;
- patients who died before leaving the ED; and
- patients with nontraumatic tourniquet use (eg, hemorrhage from a dialysis fistula).

Patients with tourniquets placed for hemorrhage without a traumatic injury were not captured in the trauma registry and therefore not included in the initial cohort. Of the initial 701 eligible patients, 37 were excluded for having tourniquets removed before hospital arrival. Another 17 were excluded as they were deceased before the time of ED departure; all had tourniquets intact at the time of death (SDC 2, Supplemental Digital Content 2, http://links.lww.com/TA/F555).

Interventions

This study involved no interventions. All medical management decisions regarding TC, surgical intervention, and resuscitation were performed at the discretion of the treating clinicians as per the standard of care. Decisions regarding conversion were made at the discretion of the treating trauma team based on clinical judgment, including factors such as hemodynamic stability, wound characteristics, and concern for ongoing hemorrhage.

Outcome Measures

The primary outcome was the result of TC attempts in the ED, with the three outcomes being conversion, procedural intervention, and operative intervention. A TC attempt was defined as the removal of the tourniquet and replacement with wound packing, hemostatic gauze, and/or pressure dressings. A successful conversion was defined as one in which primary hemostasis was achieved

through TC without the need for a tourniquet to be reengaged or additional procedural/surgical intervention to be taken. Failed conversion attempts required reengagement of the tourniquet and additional procedural/operative measures to be taken to achieve primary hemostasis. Procedural intervention was defined as a tourniquet removal requiring additional procedural techniques in the ED, such as hemostatic suture placement, venous/arterial ligation, or any procedure performed in the ED/trauma bay (not requiring an operating room). Wound washout and skin closure did not constitute a procedural intervention, as this is standard wound care and not a technique to achieve primary hemostasis. Operative intervention was defined as any wound requiring a tourniquet to remain in place until the wound could be explored and/or repaired in the operating room, whether the wound was eventually found to be arterial in nature or not.

Secondary outcomes included

- incidence of tourniquet-related complications (eg, compartment syndrome, infection, ischemic necrosis, nerve injury, vascular injury, etc);
- presence of any clinician documentation indicating such complications were believed to be a result of tourniquet use rather than the nature of the inciting injury;
- injury characteristics associated with delayed or failed conversion (blunt vs. penetrating mechanism, upper vs. lower extremity injury); and
- duration of tourniquet application.

Data Collection

Data were extracted from electronic medical records and the institution's trauma registry. Variables of interest included patient demographics, mechanism and site of injury, tourniquet placement (including duration and placement provider), attempted and successful TCs, complications, and interventions performed. Complications were tracked by examining the medical decision-making and diagnoses of all emergency and surgical clinicians from the time of patients' ED arrival to hospital discharge and through their first follow-up appointment (when applicable). Complications were attributed to tourniquet use if a diagnosis or medical decision-making segment of any clinician's note expressed concern that observed complications were tourniquet-induced rather than injury-induced.

Data Analysis and Sample Size

Descriptive statistics were used to summarize patient and injury characteristics, conversion success rates, and complication rates, with significant variations denoted by $p < 0.05$. Hypothesis-generating regression modeling was performed, with covariates of age, sex, mechanism of injury, location of injury, duration of tourniquet use, provider who applied initial tourniquet, and associated complications. Independent associations were reported via odds ratio (OR) point estimates and 95% Wald CIs where $\alpha = 0.05$.

Research Ethics

This study was approved by the institutional review board with a waiver of informed consent and HIPAA authorization (IRB 00122649) due to its retrospective design and use of existing medical record data. All data were deidentified before analysis to ensure patient confidentiality and minimize risk. The authors utilized Claude (Anthropic) to assist with manuscript editing and to improve readability. This tool was not used in the collection, analysis, or interpretation of data, nor in the formulation of scientific conclusions. All intellectual content, data, and conclusions are solely the responsibility of the authors.

RESULTS

Among 647 patients with tourniquets in place, 83.9% (n = 543) were successfully converted to alternative hemostatic methods in the ED without procedural or surgical intervention (Fig. 1). While wounds necessitating tourniquet placement had an overall complication rate of 9.3% (n = 60), there were 0 documented cases where complications were attributed to tourniquet use rather than the damage sustained in the primary injury (Table 1). Complication rates in the conversion group were 4.6% (n = 25); complications were more common in the operative group (44.4%, n = 32) when compared with the conversion group ($p < 0.0001$). Demographics, including age and sex, as well as injury mechanisms (blunt vs penetrating), were largely similar across groups (Table 1).

The strongest predictors for failed conversions subsequently requiring operative or procedural intervention were total tourniquet duration and location of injury. The median tourniquet duration for the operative intervention and procedural intervention groups was 71.5 minutes and 43 minutes, respectively, while the conversion group had a shorter time frame of 38 minutes ($p < 0.0001$, Table 1). In total, median tourniquet time was 40 minutes across all groups. As supported in the regression model (Table 2), increased duration was independently associated with decreased odds of successful conversion. For each additional 30-minute interval that a tourniquet was in place, the odds of successful conversion decreased (OR, 0.41, 95% CI, 0.32–0.53). Regarding injury location, upper extremity tourniquets were associated with a decreased likelihood of successful conversion and experienced a higher rate of procedural/operative management, whereas lower extremity tourniquets were more likely to see successful conversion in the ED. The regression model further establishes this trend as an independent association, in which the odds of converting an upper extremity tourniquet were 39% lower when compared with lower extremity tourniquets (OR, 0.61, 95% CI, 0.38–0.97).

DISCUSSION

Interpretation

Overall, the data above support the effectiveness of TC, as 83.9% (n = 543) of the 647 tourniquets were suc-

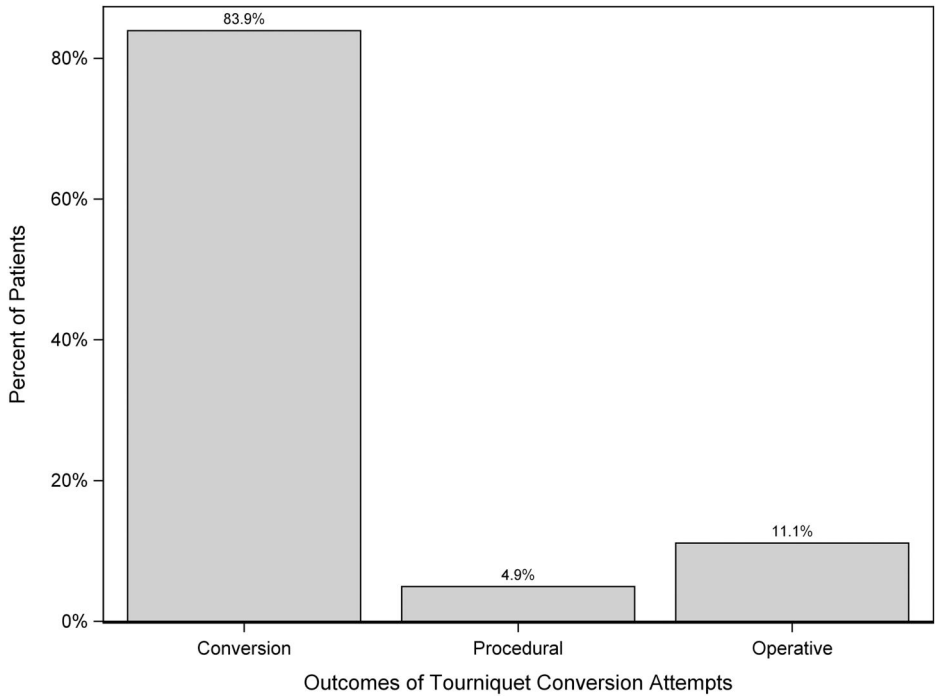

Figure 1. Bar chart of conversion outcome distribution.

cessfully converted in the ED trauma bay without requiring further procedural or operative intervention. This suggests that TC is feasible in a substantial majority of traumatic injuries where prehospital tourniquets are applied, and in these cases, hemostasis can be effectively maintained using wound packing, hemostatic gauze, and pressure bandages. There were 0 documented cases where wound complications were attributed to tourniquet use rather than the damage sustained in the primary injury, and while surprising, this finding is likely related to the remarkably short median duration of tourniquet time (40 min) seen in this urban trauma setting. While the decision as to whether to initially place a tourniquet is beyond the scope of this study, it nevertheless highlights the importance of prompt tourniquet reassessment and attempted conversion (ideally within the first 2 h of placement), as complications and comorbidities resulting from prolonged tourniquet use have been previously thoroughly documented.

For each additional 30-minute interval that a tourniquet was in place, the odds of successful conversion continuously decreased (OR, 0.41, 95% CI, 0.32–0.53). When compared with the conversion and procedural groups, it appears the group of patients with operative outcomes experienced more variability in the amount of time until definitive treatment as expressed by a larger IQR (Fig. 2). Therefore, the causality of TC failure as a product of time cannot be assumed, as it is unclear whether extended duration made conversion attempts less successful, or simply that more severe wounds that could not be converted had tourniquets in place for a longer duration while operative resources were being mobilized. In addition, while the independent association with upper extremity injuries and decreased odds of conversion is statistically significant, this association does not imply causation. The observed difference can be speculated to result from various root causes, such as anatomic proximity of arterial vasculature to surrounding bony structures or the nature/force associated with common upper extremity injuries, among other potential explanations. The rate of successful conversion of the left upper extremity was 81.3% (109 conversions/134 attempts) and of the right upper extremity was 78.0% (92 conversions/118 attempts), suggesting conversion attempts of any extremity have a substantial likelihood of success, and extremity location alone should not change the clinical decision to attempt TC.

Just as notable as the factors that were associated with decreased odds of successful conversion are the factors that were not. Patient age, sex, mechanism of injury (blunt vs. penetrating), or initial care provider who applied the tourniquet did not have statistically significant associations with the odds of TC. This seems to suggest that any patient is a candidate for TC, and no demographic contraindications exist.

Clinical Implications

There are several existing algorithms and protocols for TC that are promoted by various entities within the field of trauma care. The goal of this study is not an

Table 1. Patient Demographics, Injury Characteristics, and Tourniquet Outcomes (N = 647)

Variable	Conversion (n = 543)	Procedural (n = 32)	Operative (n = 72)	Total (N = 647)	*p*
Age (y), n (%)					0.52†
0–20	69 (12.7)	3 (9.4)	8 (11.1)	80 (12.4)	
21–40	277 (51.0)	15 (46.9)	43 (59.7)	335 (51.8)	
41–60	139 (25.6)	9 (28.1)	18 (25.0)	166 (25.7)	
≥ 61	58 (10.7)	5 (15.6)	3 (4.2)	66 (10.2)	
Sex, n (%)					0.45†
Female	82 (15.1)	4 (12.5)	7 (9.7)	93 (14.4)	
Male	461 (84.9)	28 (87.5)	65 (90.3)	554 (85.6)	
Injury type, n (%)					0.38†
Blunt	154 (28.4)	6 (18.8)	23 (31.9)	183 (28.3)	
Penetrating	389 (71.6)	26 (81.3)	49 (68.1)	464 (71.7)	
Location, n (%)					0.0002*†
LLE	182 (33.5)	5 (15.6)	25 (34.7)	212 (32.8)	
LUE	109 (20.1)	10 (31.3)	15 (20.8)	134 (20.7)	
RLE	160 (29.5)	2 (6.3)	21 (29.2)	183 (28.3)	
RUE	92 (16.9)	15 (46.9)	11 (15.3)	118 (18.2)	
Duration (min)					0.0001*‡
Median (IQR)	38 (30–53)	43 (34–62)	71.5 (45–107)	40 (30–59)	
0–60, n (%)	436 (80.3)	21 (65.6)	30 (41.7)	487 (75.3)	
61–120, n (%)	101 (18.6)	10 (31.3)	29 (40.3)	140 (21.6)	
> 120, n (%)	6 (1.1)	1 (3.1)	13 (18.1)	20 (3.1)	
Application source, n (%)					–
EMS	177 (32.6)	14 (43.8)	36 (50.0)	227 (35.1)	
Police	138 (25.4)	4 (12.5)	7 (9.7)	149 (23.0)	
First responder	130 (24.0)	11 (34.4)	20 (27.8)	161 (24.9)	
Bystander	11 (2.0)	0 (0.0)	2 (2.8)	13 (2.0)	
Self	4 (0.7)	1 (3.1)	0 (0.0)	5 (0.8)	
Other/unknown	83 (15.3)	2 (6.3)	7 (9.7)	92 (14.2)	
Complications, n (%)					0.0001*†
None	518 (95.4)	29 (90.6)	40 (55.6)	587 (90.7)	
Any§	25 (4.6)	3 (9.4)	32 (44.4)	60 (9.3)	
Amputation	5 (0.9)	1 (3.1)	13 (18.1)	19 (2.9)	
Compartment Syndrome	0 (0.0)	*0 (0.0)*	1 (1.4)	1 (0.2)	
Infection	2 (0.4)	0 (0.0)	3 (4.2)	5 (0.8)	
Ischemic necrosis	1 (0.2)	0 (0.0)	0 (0.0)	1 (0.2)	
Nerve injury	13 (2.4)	0 (0.0)	3 (4.2)	16 (2.5)	
Vascular injury	5 (0.9)	3 (9.4)	17 (23.6)	25 (3.9)	

*Denotes statistical significance ($\alpha = 0.05$).
†*p* values calculated using the χ^2 test for categorical variables.
‡*p* values calculated using the Kruskal-Wallis test for continuous variables.
§Sub-items are not mutually exclusive, and patients may have had more than 1 complication.
EMS, emergency medical services; IQR, interquartile range; LLE, left lower extremity; LUE, left upper extremity; RLE, right lower extremity; RUE, right upper extremity.

attempt to supersede or alter these algorithms, but rather to supplement them with the empiric data that has previously been lacking. This represents one of the largest civilian data sets of TC to date and supports what trauma clinicians have anecdotally known for years: TC works for most people, and timely TC is crucial to minimize complications. As mentioned, the Tactical Emergency Casualty Care (TECC) curriculum adapts previously established TC doctrine from the military setting for use in a high-threat civilian/mass casualty environment. Given the civilian nature of this retrospective analysis, these results most directly validate the TC recommendations of the TECC curriculum. While this specific study was performed in an ED, the skills of wound packing, applying hemostatic dressings, and wrapping compression bandages are also well within the education and scope of EMTs and paramedics. Consequently, the results of this study also carry implications for the prehospital setting and could be used to support existing and/or future prehospital TQ protocols.

Strengths and Limitations

This study's strengths include a large sample size, externally valid data from a Level I trauma center, and a de-

Table 2. Multivariable Logistic Regression for Successful Tourniquet Conversion

Effect	Odds Ratio	95% Wald CI	*p*
Age (per 10 y)	1.03	0.89–1.21	0.68
Sex: male vs. female	0.65	0.31–1.37	0.25
Injury type: penetrating vs. blunt	0.58	0.33–1.02	0.057
Tourniquet location: upper vs. lower extremity	0.61	0.38–0.97	0.038*
Tourniquet duration (per 30 min)	0.41	0.32–0.53	0.001*
Application source			
EMS	0.54	0.24–1.21	0.13
Police	1.40	0.53–3.72	0.49
First responder (Fire)	0.48	0.21–1.11	0.085
Bystander	0.91	0.15–5.35	0.91
Self	0.47	0.05–4.85	0.53

*Denotes statistical significance ($\alpha = 0.05$).

tailed breakdown of conversion outcomes and complications. However, the retrospective design limits control over confounding variables and causal interpretations. In addition, reliance on electronic medical records introduces potential for incomplete documentation. The study also did not collect data on long-term management after injury. More robust information on long-term limb function or quality of life outcomes would provide further insights into tourniquet-related morbidity. Attribution of the cause of injury complications relied on clinician documentation and may underestimate tourniquet-related complications.

Research Implications

Future research should include prospective investigation of existing TC protocols, with standardized assessment of outcomes such as limb perfusion, neurologic function, and long-term recovery. Given that military, rural, austere transport environments routinely exceed 2 hours, prospective prehospital studies would be particularly valuable to evaluate whether conversion protocols applied in the field yield outcomes comparable to those observed in the ED. In addition, multicenter studies incorporating diverse trauma systems and transport times would strengthen the generalizability of these findings beyond the urban Level I trauma center setting examined here. Future work should also prospectively adjudicate the etiology of wound complications using blinded reviewers to decrease reliance on clinical documentation.

CONCLUSIONS

TC attempts in the ED are successful for a substantial majority of patients who arrive with prehospital-applied tourniquets in place. Complications experienced in wounds that required tourniquets appear to be largely related to the inciting injury rather than the placement of a tourniquet, especially when tourniquet time is under 2 hours. As prehospital tourniquet application has steadily increased over the last 20 years, these findings reinforce the effectiveness of TC and emphasize the necessity of protocols to ensure frequent tourniquet reassessment and timely conversion to minimize known duration-associated tourniquet complications.

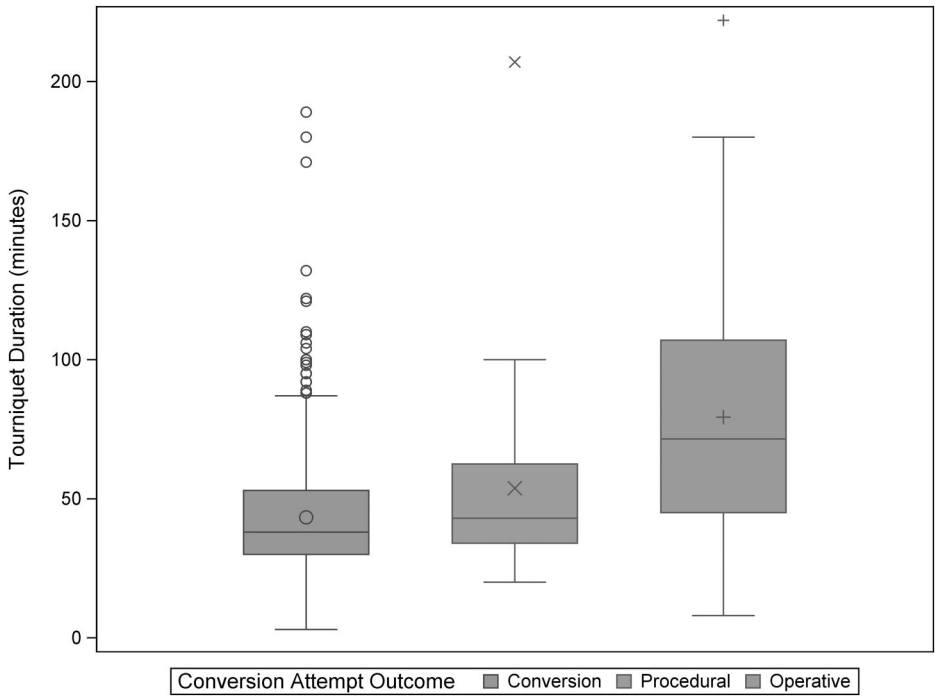

Figure 2. Boxplot of tourniquet duration by outcome group.

AUTHORSHIP

A.F., M.S., M.C., and D.C. contributed to conception and study design. A.F. and D.C. contributed to the literature review. A.F. and M.S. contributed to data acquisition. A.F. and M.S. were involved in data analysis and interpretation. A.F. and M.S. contributed to the drafting of the manuscript. A.F., M.S., M.C., and D.C. contributed to critical revision of the manuscript.

ACKNOWLEDGMENTS

The authors thank Mrudhvika Kotha, Evan Duvivier, and Kara Michaud for their assistance with data acquisition, and Ziqing Yu for his assistance with statistical analysis and interpretation.

DISCLOSURE

Conflict of Interest: JTACS Conflict of Interest Disclosure forms for all authors have been supplied and are provided as Supplemental Digital Content, http://links.lww.com/TA/F556.

REFERENCES

1. Kragh JF Jr, Walters TJ, Baer DG, Fox CJ, Wade CE, Salinas J, et al. Practical use of emergency tourniquets to stop bleeding in major limb trauma. *J Trauma*. 2008;64(2 suppl):S38–S49.
2. Walters TJ, Wenke JC, Kauvar DS, McManus JG, Holcomb JB, Baer DG. Effectiveness of self-applied tourniquets in human volunteers. *Prehosp Emerg Care*. 2005;9(4):416–422.
3. Blackbourne LH, Baer DG, Eastridge BJ, Kheirabadi B, Bagley S, Kragh JF Jr, et al. Military medical revolution: prehospital combat casualty care. *J Trauma Acute Care Surg*. 2012;73(6 suppl 5):S372–S377.
4. Committee on Tactical Combat Casualty Care. Tactical Combat Casualty Care (TCCC) Guidelines for Medical Personnel: 15 December 2021. *J Spec Oper Med*. 2022;22(1):11–17.
5. Vuoncino M, Gifford S, Causey W, Rasmussen T, Propper B, Sampson J, et al. Vascular Injury: Joint Trauma System Clinical Practice Guideline (CPG ID 46). Joint Trauma System, Defense Health Agency, US Department of Defense. 2025. Accessed July 17, 2025. https://jts.health.mil/index.cfm/products/cpgs
6. Callaway DW. Translating Tactical Combat Casualty Care lessons learned to the high-threat civilian setting: Tactical Emergency Casualty Care and the Hartford Consensus. *Wilderness Environ Med*. 2017;28(2 suppl):S140–S145.
7. Holcomb JB, Dorlac WC, Drew BG, Butler FK, Gurney JM, Montgomery HR, et al. Rethinking limb tourniquet conversion in the prehospital environment. *J Trauma Acute Care Surg*. 2023;95(6): e54–e60.
8. Goodwin T, Moore KN, Pasley JD, Troncoso R Jr, Levy MJ, Goolsby C. From the battlefield to main street: tourniquet acceptance, use, and translation from the military to civilian settings. *J Trauma Acute Care Surg*. 2019;87(1 suppl):S35–S39.
9. Ode G, Studnek J, Seymour R, Bosse MJ, Hsu JR. Emergency tourniquets for civilians: can military lessons in extremity hemorrhage be translated? *J Trauma Acute Care Surg*. 2015;79 (4):586–591.
10. Joarder M, Noureddine El Moussaoui H, Das A, Williamson F, Wullschleger M. Impact of time and distance on outcomes following tourniquet use in civilian and military settings: a scoping review. *Injury*. 2023;54(5):1236–1245.
11. Levy MJ, Pasley J, Remick KN, Eastman AL, Margolis AM, Tang N, et al. Removal of the prehospital tourniquet in the emergency department. *J Emerg Med*. 2021;60(1):98–102.
12. Standifird CH, Kaisler S, Triplett H, Lauria MJ, Fisher AD, Harrell AJ 4th, et al. Implementing tourniquet conversion guidelines for civilian EMS and prehospital organizations: a case report and review. *Wilderness Environ Med*. 2024;35(2): 223–233.

