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Avoiding Pitfalls from the Past: The Tourniquet Dilemma

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Over the past century, the use of tourniquets in the prehospital environment has seen both success and concern for clinical alarm when liberally applied. In the aftermath of large-scale combat operations (LSCO) during World War I and World War II, there were many examples where medical experts discouraged the liberal use of tourniquets on the frontlines due to the harm they caused (1,2). A 1916 Royal Army Medical Corps report during World War I entitled *Treatment of Wounds from Fire Trench to Field Ambulance* opined, "We are inclined to think that tourniquets are an invention of the Evil One, and that it is no exaggeration to say that many limbs have been lost during this campaign by the indiscriminate use of them" (2). The historic discouragement of tourniquet use as a "last resort" for hemorrhage control arises, at least in part, from these admonitions.

Since the days of LSCO, however, tourniquets have resurged as the standard of care for exsanguinating limb hemorrhage. Casualty data from conflicts in Iraq and Afghanistan during the Global War on Terrorism (GWOT) identified exsanguinating extremity hemorrhage as one of the causes of preventable battlefield deaths, and driven current combat casualty care best practices—including tourniquet use—in both the military and civilian setting (3-6). More recently, however, the war in Ukraine has brought combat medical care back into the realm of LSCO, where liberal tourniquet use has once again been reported to result in more lost limbs and lives than combat wounds themselves (7-9). Understanding how to best train and deploy tourniquet use continues to be challenging.

In this issue of *Prehospital Emergency Care*, Shukla et al. present a retrospective multi-center review comparing the characteristics of prehospital tourniquet use between law enforcement officers (LEO) and emergency medical services (EMS) clinicians in follow-up to their previous single-center study demonstrating increased liberal use of prehospital tourniquets among LEOs (10, 11). In this latest analysis, LEO-placed tourniquets were less likely to require operative removal, and statistically less likely to be associated with a specific named vessel injury or re-bleed after immediate removal. Total tourniquet time was 50 minutes and no complications due to tourniquet use were identified (10). The study also confirmed across multiple EMS services and trauma centers that tourniquet deployment by LEOs was more liberal compared to EMS clinicians, suggesting the need for further training on prehospital tourniquet use.

The findings described by Shukla et al. are not surprising. The Boston EMS experience also demonstrated safe and effective tourniquet use with few (if any) complications despite liberal application by EMS clinicians as evidenced by more than half of placed tourniquets being removed in the emergency department (12, 13). If prehospital tourniquet use is considered safe and effective, what is the significance of whether LEOs are deploying tourniquets more liberally compared to their EMS counterparts? The answer lies in how non-medical first responders, including LEOs—and soldiers—are trained. While liberal use may be safe in a civilian setting with timely re-assessment, prolonged use in other settings could result in patient harm if re-assessment or conversion is not possible.

The current experience in the military environment raises reason for caution. An assessment of tourniquet use in the current LSCO environment has shown unintended harm to casualties (14). A case series from Ukraine demonstrated only 24.6% of cases with tourniquet use were considered appropriate as assessed by the receiving surgical facility (8, 9). The authors felt more limbs and lives may have been lost due to inappropriate tourniquet use rather than from the limb injury itself. Complications from tourniquet use in other recent conflicts have also been described (15). Interestingly, current Tactical Combat Casualty Care guidelines for military medical personnel recommend re-assessing previously placed tourniquets and conversion to hemostatic or pressure bandages within 2 hours if certain criteria are met (5). Recent prehospital tourniquet experience must recognize the fact that successful deployment has occurred in the setting of rapid transport to definitive care, which may not be the case in all environments.

As much as we are concerned with how the military experience can be translated into civilian EMS practice, there should be equal concern on the applicability of civilian EMS practice on military battlefield care. Civilian prehospital tourniquet placement times are relatively short, suggesting that even liberal use is safe so long as they can be assessed within an hour (10, 13). This is in stark contrast to current evacuation times in Ukraine of more than 6 hours before reaching military medical care (8). The early use of tourniquets by the lay-public and civilian first responders is a result of the positive experience from training all servicemembers in life-saving hemorrhage control measures during the GWOT where evacuation allowed for rapid assessment of tourniquet use. Liberal tourniquet use, however, is only safe in the context of a permissive environment that allows for rapid transport to definitive care.

To avoid repeating the historical cycle of conflicting recommendations in tourniquet use, EMS leaders must ensure proper training on tourniquet use occurs not only for EMS clinicians but also for the general first responder community. The valuable findings Shukla et al. provide on patterns of LEO tourniquet use have implications on the practice patterns of tourniquet use by non-medical military servicemembers. The repeated pitfalls with tourniquet use are rooted in training that overly focused on the device itself as an “all-or-none” type intervention without understanding environmental context. Emergency medical services clinicians should (at minimum) be trained in reassessing previously placed tourniquets. While tourniquet conversion may not be necessary in all EMS systems, the concept is critical knowledge to clinicians involved with tourniquet placement. Non-medical responders must also be trained not only in proper tourniquet use, but also the complications that result from prolonged use. Unlike past experiences, the current narrative of tourniquet use should not result in its demise. Instead, the current experience will allow EMS leaders and educators to refine training and education on the role of tourniquets so that it remains a critical intervention in trauma care.

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