

INTERESTING ARTICLE ON TOURNIQUET USE IN FIRST AID

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Tourniquet First!

Safe & rational protocols for prehospital tourniquet use

Few issues in the long and colorful history of medicine have generated as much controversy and confusion as the use of tourniquets to arrest severe extremity hemorrhage. As with many strongly held, traditional beliefs, the tradition is strong, but the evidence weak.

Conventional teaching has upheld the belief that a tourniquet is a tool only to be applied as a last resort.¹ However, evidence is now available, both from the recent military use of tourniquets² and their long, safe history of operative use for bloodless extremity surgery,^{3,4} which compels a reevaluation of this potentially lifesaving device in civilian prehospital care. This article presents suggested protocols for the safe and rational use of extremity tourniquets by civilian EMS.

It is our opinion that any blood loss is detrimental to the patient's wellbeing and should be avoided. Modern tourniquets have been demonstrated to rapidly and effectively stop extremity hemorrhage, thus minimizing blood loss. Pressure dressings are, of course, also effective tools to stop bleeding, and are the preferred method of hemorrhage control because they do not risk limb ischemia or other complications. However, effective pressure dressing application requires more time, hands and supplies to apply, and may require a rescuer to stay with the patient to continue to apply pressure sufficient to arrest severe hemorrhage.

A tourniquet, on the other hand, can be applied quickly, with minimal personnel and no other equipment. In fact, most modern tourniquets are designed to be self-applied, if necessary.

This immediate hemorrhage control allows the rescuer to turn their attention to the airway, breathing, and circulation and assessment of other injuries. After completing this evaluation and stabilization, and when time and resources better allow—and if the wound allows—the well-trained EMS provider can remove the tourniquet and replace it with a standard pressure dressing.

Although this protocol contradicts the traditional dogma that a tourniquet, once placed, can be removed only by a physician when the patient arrives at definitive care, it's simply common sense to train EMS personnel to reassess the wound and replace the tourniquet with a pressure dressing if the situation allows.

Considerations for Use

Ischemic complications from tourniquet use have been found to be related to the amount of time the tourniquet is left in place.^{4,5} Extensive experience with operative tourniquet use has demonstrated that the incidence of injury is very low with tourniquet times of two hours or less; military experience has confirmed the safety of this two-hour limit in the field.^{4–8}

Urban EMS agencies, with generally short transport times, would rarely be confronted with this limitation. However, rural agencies in isolated areas will frequently encounter longer transport times that may exceed this safe interval. In these cases, attempts to replace the tourniquet with a less aggressive method of hemostatic dressing must be made to avoid the possibility of limb ischemia.

In the rare event that severe hemorrhage persists beyond two hours during a long transport, the medical rule “life over limb” is invoked. In these cases, it must be kept in mind that a patient with extremity hemorrhage severe enough to require a tourniquet for more than two hours would certainly have died without it.

Another consideration for the use of tourniquets: pain. The effective application of a tourniquet above arterial pressure will cause pain to the distal extremity, sometimes severe. Patients will generally require opiate pain medication, such as morphine or fentanyl, titrated to control such pain, particularly if the tourniquet is to be left in place for more than a short period of time.

Tourniquet Protocols

The following protocols provide a safe and rational technique for civilian EMS agencies to use tourniquets to minimize blood loss and morbidity in extremity trauma while reducing the risk of ischemic complications. These protocols are based on military battlefield and civilian operative experience.

1 Design: To minimize complications, particularly those related to direct injury to skin, muscle and neurovascular structures, emergency personnel must use a commercial tourniquet specifically designed for the purpose. Such tourniquets feature wide straps without sharp edges, uniform application of pressure and ease of application and removal.

Field-expedient and hastily devised tourniquets (such as the cravat and stick, belt, cord or twine) are much less likely to be effective because it's difficult to get them tight enough. Because of narrow girth, sharp edges and difficulty in accurately controlling tightness, such makeshift tourniquets are also much more prone to compressive neuropathy and other injuries resulting from direct trauma to the underlying tissues.

2 Models: A number of commercial tourniquets are available and have proven effective in testing and combat use. It's worth mentioning that a standard BP cuff can often be utilized as a safe and effective tourniquet. However, BP cuffs are not designed to hold pressures above arterial systolic pressure for prolonged periods of time. A cuff that

gradually loses pressure could result in recurrence of hemorrhage, which initially may go unnoticed by the busy EMS provider.

In addition, the BP cuff's wide girth, while minimizing the risk of underlying neurovascular or skin compressive injuries, may be difficult to apply to the short stump of an amputated extremity. So, while a BP cuff is probably the safest and most easily accessible improvised tourniquet available to you, wide-band commercial tourniquets are more versatile and reliable for severe extremity hemorrhage.

3 Tightening the Tourniquet: How tight you make the tourniquet depends on how severe or profuse the bleeding is, and whether it's arterial or venous bleeding (or both). Simply stated: The tourniquet should be gradually tightened until all hemorrhage ceases. With arterial bleeding, this will require a tourniquet pressure above the arterial pressure. <snip> Tourniquet pressure will require frequent reassessment as the resuscitation of the patient proceeds, and further tightening may be required as perfusion improves.

4 Initial Application: Figure 1 illustrates our suggested protocol for evaluation and application of a tourniquet to a bleeding extremity. The patient is initially assessed and determined to have severe extremity bleeding controllable with the equipment or resources immediately at hand.

This may simply mean that EMS personnel must open their kit and assemble the gauze, tape or elastic bandage necessary to apply a pressure dressing, and may need to apply a tourniquet to the patient for just the one or two minutes required to complete this task. Or this may mean the patient has severe extremity bleeding with other severe injuries, such as an unstable airway or an open chest injury. In this case, the tourniquet may be applied initially to stop the extremity hemorrhage, leaving the EMS provider free to focus their attention on stabilizing these other life-threatening problems.

If a short transport time (less than 30 minutes) is anticipated, then the tourniquet may be safely left in place, or replaced with a pressure dressing whenever the provider feels they have the time and resources to devote to this task. If transport is anticipated to be longer than 30 minutes, an effort to replace the tourniquet should be undertaken to minimize any possibility of limb ischemia and decrease the pain the patient may experience from prolonged effective tourniquet application.

Note: We strongly suggest 30 minutes as the time limit for replacing a tourniquet with a pressure dressing. Although the studies cited in the discussion above indicate two hours to be a safe limit, we use 30 minutes as a protocol guideline to ensure a wide margin of safety.

5 Reassessment: When the EMS provider has sufficient time, equipment and resources, they may decide to attempt to replace the tourniquet with a pressure dressing. Figure 2 outlines the Tourniquet Reassessment Algorithm to assist the medic

in determining if tourniquet replacement is advisable and safe and to suggest that the tourniquet be left in place if the patient or the overall situation is unstable.

6 Removal: If the EMS provider determines that the patient and clinical situation are stable, they should proceed to the Tourniquet Removal Algorithm, as shown in Figure 3. Note: In cases of amputation or near-amputation, the tourniquet should be left in place because of the difficulty of applying a pressure dressing to such wounds.

A pressure dressing is applied to the wound site and the tourniquet is then carefully loosened. If there's no further bleeding, the tourniquet should be left loosely in place in case it's needed again. For example, bleeding could resume as the patient is resuscitated and perfusion and flow to the injury are improved. If further bleeding isn't controllable with the pressure dressing, the tourniquet can be easily retightened until the bleeding is once again controlled.

7 Mass-Casualty Use: The Mass Casualty Algorithm (Figure 4) is designed to incorporate the tourniquet into the initial triage of patients at the scene of a large, resource-taxing MCI. As triage is performed, EMS providers can use tourniquets to control any visible extremity hemorrhage. They then assign a triage label to the patient and move to triage the next victim. Note: We recommend that any patient who receives a tourniquet be initially triaged at least "yellow-urgent" to ensure the victim is attended to (and the tourniquet reassessed) in a timely fashion.

It's possible that subsequent providers could overlook a tourniquet on a severely injured patient, as they attend to more obvious or urgent injuries. To minimize this risk, we recommend that any patient treated with a tourniquet should be clearly marked with the letters "TK" on their forehead and on the triage tag; the time the tourniquet was applied should also be noted prominently.

If possible, the tourniquet itself should be marked with brightly colored tape to make it stand out to all subsequent caregivers. If the patient is conscious, they should be instructed to tell every subsequent provider that a tourniquet is in place.

Conclusion

The tourniquet has traditionally been thought to be a dangerous tool of last resort. However, it is clear from recent experience with tourniquets on the battlefield and in the operating room that modern tourniquets are not only safe and useful, but lifesaving. It is our intent to encourage the safe and rational use of tourniquets in civilian EMS, using simple protocols and training to ensure they're used properly and safely.

In the past, the rule was "tourniquet last"; however, it's time we begin teaching the principle of "Tourniquet First!" in severe extremity hemorrhage.

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