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Case:

Penetrating Pediatric Trauma

Pre-Hospital

EMS is dispatched to the scene in a rural area where an 11 year old male fell approximately 10 feet out of a tree landing on a metal pole which penetrated his right upper thigh. First responders arrived and the child was found lying on the ground, bleeding profusely from his right thigh wound. The steel pole was removed before the first responders arrived and found next to the child. The child was anxious and incontinent of stool. Vital signs were 155/27, 143, 22. His GCS was 15. EMS personnel initially applied pressure to the wound while placing a tourniquet on the right leg above the wound. The child was placed on a long back board with a rigid c collar. An 18 gauge IV was started. Oxygen was applied and 4 mg of Morphine administered for pain. The child was transported via ground to the nearest Level I Pediatric Trauma center 22 minutes away. Prehospital personnel activated the trauma team.

ED Course:

The trauma team was present upon patient arrival. A Trauma Team Activation time-out was performed (allowing EMS to provide a brief, pertinent standardized report providing key information to the team) and the team then completed the primary and secondary surveys. Vitals signs upon arrival were 98/62, 130, 15, 97.5. The child's GCS was 15. A second IV was established and PRBC's started via the pediatric massive transfusion protocol. The child's right leg was covered in blood, the tourniquet was in place. The tourniquet was effective in controlling the bleeding. Distal sensation was decreased and he was unable to move his leg. His hemoglobin was 6.5 and INR 1.6. A FAST and portable right leg x-rays were taken and the child was transported emergently to the operating room.

Operating Room:

Vascular surgery was consulted as the child arrived and met the team up in the operating room. There were 3 attending trauma surgeons, 2 vascular surgeons, 1 pediatric surgeon, and 4 residents in the operating room for this case. The tourniquet was removed in the OR. Severe injury of the right superficial femoral artery and vein were identified. The procedures performed were a ligation of the profunda femoral artery, and a vein patch using the left leg saphenous vein to repair the right superficial femoral vein. In total, 8 units of PRBC's were given, 6 units of plasma, a 6 pack of platelets, 160 ml of cell saver blood, and 500 cc's of crystalloid. The child was transported to the PICU following the case.

PICU and General Trauma Care:



The child remained in the PICU for 4 days recovering. He then was transferred to general care where he was discharged after 2 days. He received physical and occupational therapy and was using crutches to ambulate. His pain was well controlled with oral medications and he had normal motion and sensation to his leg.

Follow up Care:

He returned to the vascular surgery clinic and within 3 weeks of this injury had no evidence of any injury. He was walking without crutches, had normal CMS to his leg, and was back to normal with his daily activities. He returned to the hospital to an event where the EMS agency was given an award for the care provided and prompt transfer to a level I pediatric trauma center. As it turned out, the child's father was a first responder and was the first responder on this scene. The child thanked the services and clinicians that cared for him when he said "I thought I was going to die, and now I'm fine".

Learning Points:

In this case, the prompt application of the tourniquet and transport to a Level I Pediatric Trauma Center was lifesaving.

The use of tourniquets in the civilian adult population has been widely studied. It has been found to be safe and effective in the civilian population. Most of these studies are focused on adult patients. The use in pediatric patients has not been studied. It is suggested that the safety in the adult population also correlates to the pediatric population.

Recommendations relating to tourniquet use provided by the ACEP Clinical Policies Committee and Pearls identified in the literature include:

- Government and international authorities believe that education in first aid should be universal, as all can and should learn first aid, and that the use of tourniquets fits in to the realm of first aid. Tourniquets should be used in the prehospital setting for the control of significant extremity hemorrhage if direct pressure is ineffective or impractical.
- It is recommended that commercially produced windlass, pneumatic, or ratcheting devices that have been demonstrated to occlude arterial flow be utilized to control bleeding.
- The use of narrow, elastic, or bungee-type devices is not recommended.
- It is recommended that improvised tourniquets be applied only if no commercial device is available.
- It is not recommended that the tourniquet that has been properly applied in the prehospital setting be released until the patient has reached definitive care.



- The literature shows that tourniquets are used safely and appropriately in civilians with major limb trauma that occur via blunt and penetrating mechanisms.
- Tourniquet use in the civilian sector is associated with a low rate of complications.
- The use of topical hemostatic agents, in combination with direct pressure, for control of significant hemorrhage in the prehospital setting in anatomic areas where tourniquets cannot be applied and where sustained direct pressure alone is ineffective or impractical is recommended.

The Stop the Bleed is a program sponsored by the American College of Surgery Committee on Trauma (ACS-COT) and the Hartford Consensus which is also gaining popularity. This program is designed to train clinicians as well as the public how to stop life threatening bleeding using a variety of tools and resources. Tourniquet training is included as well as how to pack a wound to control bleeding. According to the website, the program has trained over 16,160 instructors and 133,113 people around the world.

Resources:

Jacobs LM, Burns KJ, Langer G, Kiewiet de Jonge C. **The Hartford Consensus: a national survey of the public regarding bleeding control.** *J Am Col Surg.* 2016;222 (5):948-955.

Bulger EM, Synder D, Schoelles K, et al. **An evidence-based prehospital guideline for external hemorrhage control: American College of Surgeons Committee on Trauma.** *Prehosp Emerg Care.* 2014;18:163-173.

Inaba K, Siboni S, Resnick S, et al. **Tourniquet use for civilian extremity trauma.** *J Trauma Acute Care Surg.* 2015 Aug;79(2):232-7.

Scerbo MH, Mumm JP, Gates K et. al. **Safety and Appropriateness of Tourniquets in 105 Civilians.** *Prehosp Emerg Care.* 2016 Nov-Dec;20(6):712-722.

Schroll R, Smith A, McSwain NE Jr et al. **A multi-institutional analyses of prehospital tourniquet use.** *J TraumaAcuteCare Surg.* 2015 Jul;79(1):10-4.

The Trauma Professional, Blog www.regionstraumapro.com

American College of Surgeons Committee on Trauma and Hartford Consensus **Stop the Bleed**
www.bleedingcontrol.org