The Trauma Professional's Blog

Trauma MedEd

Emphasis: Extremities Subscribe: www.TraumaMedEd.com November 2013

Field Amputation – Background

Field amputation is not thought of very often, and for good reason. It is unpleasant, uncommon, and not very safe. Let's start with some of the facts about this procedure.

In reality, field amputation is talked about much more often that it is actually performed. There is one old paper that is cited frequently which consisted of a survey of EMS directors 19 years ago! A total of 143 people responded and noted the following:

- There were 26 amputations over a five year period
- The most common mechanism was motor vehicle crash
- 53% were performed by a trauma surgeon and 36% by an emergency physician. (Who did the other 12%???)
- No training was available for this procedure
- Only 2 EMS systems had an existing protocol

An informal poll of trauma surgeons at an American College of Surgeons meeting a few years ago showed that only 5 had ever been called to do a field amputation, and only 2 had actually done it.

Uncommonly performed procedures are always problematic. It is extremely difficult to keep skills sharp and to remember the protocol (or even where to find it). Furthermore, these procedures are prone to error and pose considerable risk to all.

Reference: In-Field Extremity Amputation: Prevalence and Protocols in Emergency Medical Services. Prehospital and Disaster Medicine 11(1):63-66, 1996.

Trauma Calendar of Events

Advances In Trauma
Location: Westin Crown Center, Kansas City, MO
Date: December 18-22, 2013

Eastern Association For The Surgery Of Trauma
Location: Waldorf Astoria Naples, Naples, FL
Date: January 14-18, 2014

Inside This Issue

Field Amputation – Indications

There are basically four indications, two absolute and two relative:

- Absolute #1: entrapped extremity with a lengthy extrication and a physiologically impaired patient who does not respond to fluids. In this case, there is occult blood loss into other areas that is killing your patient and they need to get out quickly for definitive management.
- Absolute #2: entrapped extremity with a lengthy extrication and an unstable physical environment. Examples include entrapment in a structurally damaged building or a vehicle in danger of falling.
- Relative #1: entrapped extremity with a lengthy extrication in a patient who was initially hypotensive but responded to IV fluids. It is possible to wait for additional

extrication efforts, but vital signs must be monitored closely. At the first sign of recurrent hypotension, it's time to amputate.

- Relative #2: entrapped extremity and physiologically normal, but extrication may take many hours or may be impossible. Once again, there is time to wait and let rescue workers continue their efforts. However, the more time that passes, the less likely the extremity will ultimately be functional.

Obviously a lot of thought and judgment goes into making the decision amputate. It is helpful to have another physician to discuss the facts with, but as the treating surgeon, the ultimate decision is yours.

Field Amputation – Logistics

Now it's time to look at the logistics. There are two main considerations here: getting to the scene, and staying safe.

Getting there includes an obvious problem: what happens when the trauma surgeon leaves the hospital? During the daytime, other surgeons may be available, although they may have elective procedures or other tasks to keep them busy. At night it becomes more of an issue, as they may be the only surgeon available for the hospital. Once involved in the field amputation process, they may be unavailable for hours.

The easiest solution is to utilize the backup trauma surgeon. All Level I and II centers must have one. There are two possibilities here: the trauma surgeon leaves and the backup proceeds to the hospital for coverage (if in-house), or the backup surgeon is transported leaving the on-call surgeon to manage as usual.

The choice is up to the trauma program, but this is an issue that needs to be thought out in advance. The best solution takes geography into consideration. Since most transports to the scene will be made by helicopter, it is easier to use the trauma center's helipad to pick up the on-call surgeon. If an in-house surgeon is not used, consideration must be given to the nearest safe landing zone and this may mean that an out-of-house surgeon would have to travel to the hospital for pick-up.

Once on scene, the surgeon must ascertain that the area of the incident is safe. This is important for the well-being of the patient, the rescue crews and the patient. If the scene cannot be made safe, it is not possible to render care, even if the patient is in grave trouble.

Bottom line: The trauma program must think through these details in advance and develop a policy for who goes to the seen and how. And safety for all is of paramount importance.

Field Amputation – Action!

We've now covered all the prep for field amputation. Now, it's time to do it. What equipment is needed? **There are two key principles**: figure it all out in advance, and keep it simple.

It is crucial that your trauma program design and assemble equipment and drug packs in advance, otherwise critical equipment may not make it to the field. The pack needs to be conveniently located, have fresh instruments and batteries for the equipment, and should have essential anesthetics included. A sample list is available here, and I encourage you to modify it to suit your needs.

Paralytics, sedatives and analgesics are essential. I prefer vecuronium, midazolam and fentanyl, but there are many other choices. I would discourage the use of propofol because it is difficult to titrate outside the hospital and may contribute to hypotension.

The patient must be intubated prior to starting the procedure. This airway may be difficult due to patient positioning, so be prepared to perform a surgical airway. Finally, don't assume that your patient will be nicely positioned supine. Rescue workers may need to support the patient (or you) if he or she is in an awkward position.

Finally, don't assume that you will accompany the patient (and possibly their limb) back to the hospital. Based on the specific aircraft used, there may not be room available. You may return by ground transportation or another aircraft. That's why your backup surgeon needs to be mobilized!

Field Amputation – Suggested Equipment List

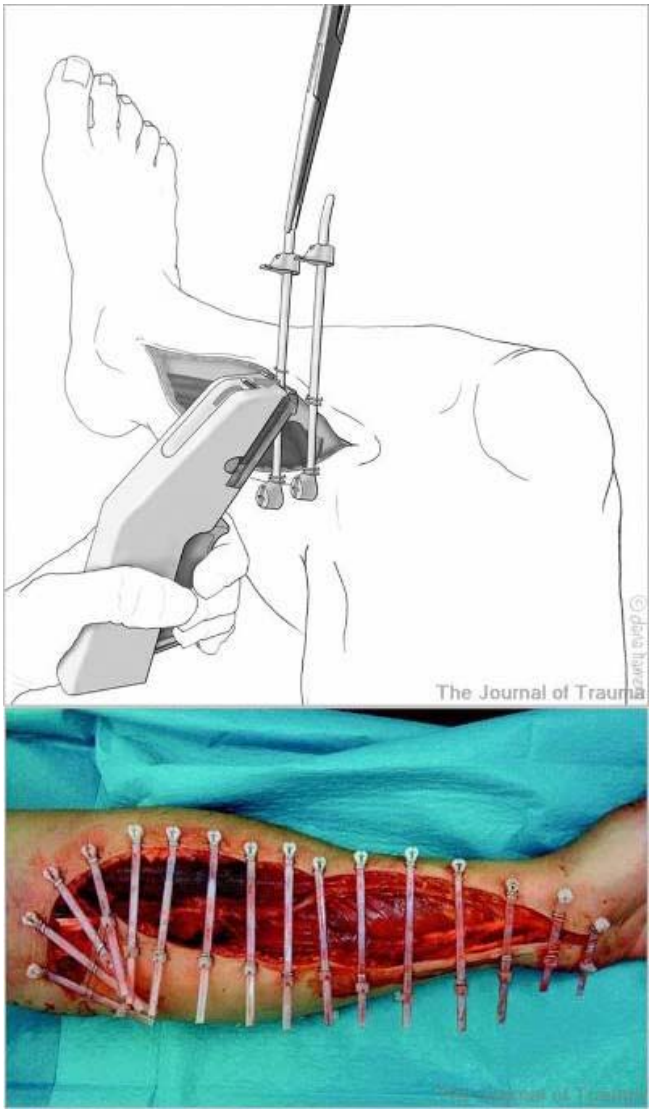
- Drugs
  - Paralytic agent, preferably longer acting
  - Analgesics
  - Sedative, preferably longer acting
  - Ketamine (optional)
- Personal protective equipment
  - Gown
  - Mask
  - Goggles
  - Gloves (3 pairs size 7.5)
- Draping materials
  - Sheets (two 3/4 sheets)
  - Towels (two 4-packs)
  - towel clips (for patients in unusual position s)
- Preparation materials
  - Tourniquet(s)
  - Povidone/iodine solution
  - Saline
- Surgical equipment
  - Mayo scissors (1 straight, 1 curved)
  - Kelly clamps (4)
  - Hemostats, large and small (8 each)
  - Needle holder
  - Hand-held sagittal saw
  - Extra blades and battery for hand-held saw
  - Gigli saw handles and blade
  - Scalpels (3 ea #10, 3 ea #20)
  - Suture (three packs of 2-0 silk ties)
- Dressing supplies
  - ABD pads
- 4x4 gauze pads
  - Gauze rolls
  - Large Ace bandages

Novel Technique For Fasciotomy Closure

Fasciotomies are much more easily opened than closed! Once the edematous muscle is released, it's not easy to get the skin to close over it again. On occasion, an immediate closure can be carried out. But in most cases, the process is performed with one or more additional operations.

Continuous tension across the skin edges is important. This keeps the wound from getting wider while the edema decreases. A number of creative techniques have been employed to keep the wound from widening, including using sutures, vessel loops, and fancy (expensive) plastic fasteners. And although the KCI VAC dressing reduces edema, it does not do much to pull the wound edges together.

Surgeons in the Netherlands came up with a novel technique using a cheap device that can be found in any hardware store and gas sterilized. The Ty-Rap closure device is commonly used to secure chest tubes to their connectors. Bigger versions are used by police in lieu of handcuffs.



The tail of one Ty-Rap is cut off and the hub is placed on the tail end of another. This assembly is placed across the wound, and one staple is placed over it on each side of the wound. This process is repeated for the entire length of the wound (picture). The Ty-Raps are tightened, and then slowly retightened daily until the wound comes together. An additional week to 10 days is allowed for wound healing before removal of the Ty-Raps.

The authors used this technique on 23 extremity fasciotomy wounds. The wounds were closed after an average of 6 days, and the TyRaps were removed after 16 days. There was no skin necrosis, but there were two instances of cellulitis. The cost of the materials (TyRaps and a surgical stapler) was $23, excluding assembly and sterilization.

Bottom line: This is an interesting technique with good closure results. The surgeon does have to plan ahead and get hospital clearance to use these devices, though.

Reference: Ty-Raps in trauma: a novel closing technique of extremity fasciotomy wounds. J Trauma 69:972-975, 2010.

The Arterial Pressure Index

Simple penetrating injuries to the arms and legs are often over-treated with invasive testing and admission for observation. Frequently, these injuries can be rapidly evaluated and disposed of using physical examination skills alone.

Stabs and low velocity gunshots (no rifles or shotguns, please) should be thoroughly examined. This includes an examination of the entire, unclothed body. If this is not carried out, there is a risk that additional penetrating injuries may be missed.

For gunshots, look at the wounds and the estimated trajectory to try to demonstrate that the object stayed clear of neurovascular structures. This exam is imprecise, and must be accompanied by a full neurovascular exam and evaluation of the bones and joints. If there is any doubt regarding bony involvement, plain radiographs with entry markers should be performed. Any abnormal findings will require more in-depth evaluation and inpatient admission.

If the exam is negative but the trajectory is "in proximity" to a major vessel, an arterial pressure index (API) should be measured. This test involves the calculation of the ratio of the systolic pressure in the injured extremity to the contralateral uninjured extremity. It should not be confused with the ankle brachial index (ABI) which compares the systolic pressure in the ipsilateral uninjured arm or leg.

The magic ratio is 0.9. If the API is less than this, there is some likelihood that a vascular injury is present. If the API is higher, there is virtually no chance of injury.

The final test that must be performed before discharge is a function test. If the injured extremity is too painful to use or walk on, the patient may need to be admitted for pain management and therapy. Patients managed in this way can avoid arteriography, CT angiography or admission and save thousands of dollars in hospital charges.

Reference: Journal Am Coll Surgeons 2009;209:740-5.

Christmas Tree Trauma!