The Trauma Professional's Blog

Trauma MedEd

Topic: Field Amputation | Subscribe: www.TraumaMedEd.com | September 2016

Introduction

Field amputation is not thought of very often, and for good reason. It is unpleasant, uncommon, and not very safe for trauma professionals due to the austere environment. I'm going to dedicate this issue to the topic, starting with some of the facts.

First, let's start with definitions. There are two distinct procedures that are actually being discussed here.

The first, and most commonly described, is **field amputation.** This is the removal of a body part in a living person in order to extricate them from a situation in which all other attempts have failed.

The other procedure is **field dismemberment**. This is surgical alteration of a dead body in order to extricate another living person who is entrapped, where there is no other route of egress. This is less taxing, both surgically and psychologically, for all involved. For this reason, I'll focus on field amputation for the rest of this issue.

In reality, these procedures are talked about much more often than actually performed. And there are far more papers written than actual documented cases. There is one old paper that is cited frequently which consisted of a survey from 1996! A search of the literature at that time only yielded two case *descriptions.*

Inside This Issue

Trauma Calendar of Events

American Association for the Surgery of Trauma
Location: Hilton Waikoloa, Hawaii
Date: September 28 – October 3, 2015

Trauma Center Association of America
Trauma Medical Director Course
Location: Hard Rock Hotel, San Diego, California
Date: October 6-7, 2016

In the 1996 study, surveys were sent out to EMS directors in the 200 largest metropolitan areas in North America. A total of 143 directors responded.

Here are the factoids:

- There were **26 amputations performed over a five-year period**
- Nine additional cases were identified where it was believed that the procedure was indicated but no performed
- The most common mechanism was motor vehicle crash (27%), followed by industrial machinery (23%)
- 53% were (or would have been) performed by a trauma surgeon, 36% by an emergency physician, and a paramedic in 14%. Five respondents had no idea who would do it. *(More than one choice was possible, hence total is > 100%)*
- **No training was available** for this procedure, although a few had training on how to deal with the amputated part
- **Only 2 EMS systems had an existing policy or protocol (1%)**

An informal poll of trauma surgeons at a national American College of Surgeons meeting several years ago showed that only five had ever been called to do

a field amputation, and only two had actually done it.

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

And if there are no policies or guidance, it is possible that the procedure may actually not be done in cases where it should. Therefore, effective policies must be put in place to accomplish these five things:

1. Define situations where in-field amputation may be necessary
2. Notify on-line medical direction of possible need for amputation
3. Notification and mobilization of the appropriate physician
4. Transport of the response team and equipment to the scene
5. Transport of the patient to the appropriate receiving facility

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

Indications For Field Amputation

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, exploding, etc.
- **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 to amputate. It is helpful to have another physician to discuss the facts with, but as the treating trauma professional, the ultimate decision is yours. If appropriate, there may also be an opportunity to discuss with the patient and/or their family.

Who Performs It?

Various trauma professionals (prehospital, emergency physician, surgeon) may provide this "service" at various places around the world. In the US, it is usually a physician, and typically a surgeon. **In my opinion, anyone can be trained to do a basic field amputation.**

Much depends on local policies and procedures, training, as well as **availability**. Prehospital providers are on scene in most cases, so it makes sense that they could do a field amputation with appropriate training. Emergency physicians have more experience with airway management, sedation, and anesthesia, and can thus add value to the process.

But again, in my opinion, **a trauma surgeon is the best choice for performing this procedure**. They have the technical skills, and are usually facile with anesthesia and sedation. But **they also have a deep understanding of the anatomy involved, and the eventual reconstruction process**. This allows them to tailor the amputation to optimize the eventual recovery from this operation. The surgeon does not necessarily have to resort to a guillotine type amputation. And they are better versed in performing amputations that involve the upper extremity, as well as more proximal amputations (shoulder, upper thigh). And **if unexpected bleeding occurs** that cannot be controlled by a tourniquet, they know what to do.

The only downside to using a physician is availability. There will always be extra time involved in getting them to the scene since they are typically hospital-based, whereas the prehospital providers are already present and are used to working in an austere environment.

Bottom line: There is no cookbook for developing a field amputation policy and procedure. Look at your local resources, and the logistics imposed by environment, traffic, your hospital, and other factors. Then figure out what works for you. Borrow from other centers and agencies, and make the process as simple as possible. Due to the very rare need for field amputation, you will need to periodically review the process and the location of your packs so people don't forget.

Logistics – The Challenging Stuff

Now it's time to look at the logistics involved in carrying out a field amputation/dismemberment. **There are two main considerations here: getting the right people and equipment to the scene, and keeping them safe.** The following presumes that the procedure will be done by a physician who is based at a trauma center. It will be different if performed by other trauma professionals.

Getting there includes an obvious problem: **what happens when the physician leaves the hospital?** For emergency physicians, there are generally several on duty, so one will not be missed too much. For surgeons, it's a bit different. During the daytime, other surgeons may be available in the hospital, although they may have other responsibilities keeping them busy. At night it becomes much more of an issue, as there may be only one surgeon (or ED physician for that matter) available for the hospital. And once involved in the field amputation process, they will probably be unavailable for several hours.

The easiest solution is to utilize the backup trauma surgeon. All Level I and II centers must have one available within a "reasonable" time frame, typically 30 minutes. There are two possibilities here: the in-house trauma surgeon leaves and the backup proceeds to the hospital for coverage (if in-house is required), or the backup surgeon is transported to the scene, leaving the on-call surgeon to manage as usual.

The choice is up to the trauma center, 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 physician 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: Each trauma program and EMS agency must think through these details in advance and develop a policy for who goes to the scene and how they get there. And safety for all is of paramount importance.

The Equipment

We've covered all the preparation for field amputation. Now, it's time to do it! But wait, exactly what equipment is needed? There are two principles that you must adhere to: **figure it all out in advance, and keep it simple.**

It is crucial that the 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. I have included a link to a sample equipment at the end of the newsletter, and I encourage you to download and 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 should be intubated prior to starting the procedure. This airway may be difficult due to patient positioning, so be prepared to perform a surgi-

cal airway. Ketamine is a good drug in cases where intubation is not possible. Finally, don't assume that the patient will be conveniently 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 the backup surgeon needs to be mobilized!

The Procedure Itself

Preparation and planning will get you just so far. But then, you actually have to act. There are four phases in this procedure. I'll break them down one by one.

Patient preparation. The area should be shielded from curious onlookers, and to control any airborne contaminants (dust, debris) at the scene. Portable monitors should be attached. Good IV/IO access needs to be in place, and the airway controlled via intubation. Adequate anesthesia, analgesia, and sedation must be provided. In addition to pain medication, broad spectrum antibiotics should be considered, and tetanus toxoid given at some point.

Limb preparation. Expose the extremity, especially the entire area around the amputation site. Wash gross debris off with saline. Place a tourniquet at least 2 inches proximal to the amputation site so it does not interfere with the procedure. Do not tighten until ready to begin. Then prep with betadine or other antiseptic.

The amputation. Administer anesthesia if that has not yet been done, and tighten the tourniquet. Choose an amputation point as distal as practical to preserve as much future function as possible. Generally speaking, a guillotine amputation is performed; nothing fancy here. Use large blades on the skin, and have plenty of extra blades. It is likely that the blades will get dull quickly in the scene environment. Cut through muscles next, saving the neurovascular bundles until last. These tend to retract when cut, so it is recommended that they be tied first.

Identify the spot where the bone will be cut, and scrape away the periosteum with the scalpel blade. Use an appropriate saw to actually separate the bone. Battery powered hand-held saws are convenient and reduce the work. But they may not readily fit into the space available, so a flexible wire (Gigli) saw may be preferred.

Always make sure that someone has been assigned the task of monitoring the patient during the procedure. They need to make sure that everyone is aware of any adverse change in vital signs so that proper adjustments can be made.

Once the amputation is complete, inspect for bleeding, clamping anything that is a problem. It may not be possible to suture and tie given space limitations, so leaving the clamps in place works just fine. **Then apply a bulky and compressive dressing, and get out of the way so the EMS providers can do their thing.**

The aftermath. Once the patient has been extricated, double check the patient's ABCs. Make sure the airway is well-placed and secure, or provide one now. Ensure adequate ventilation, and double-check for any bleeding from the amputation site or anywhere else. Then get the patient to definitive care so the trauma team can get to work.

But wait, what about the amputated part? If possible, it should be "dry-packed" in ice (remember the old bag within a bag?) and sent with the patient or soon after. Have you ever wondered why we do that? There is no hope for reimplantation, even if the amputation went flawlessly. There is little real return of function for extremities amputated above the fingers/toes. However, we can use skin and soft tissue from the lost part to help reconstruct the lost limb.

Supplemental Resources

I've put together a rather extensive bibliography, sample policies and an equipment list for those of you who want to jump-start the implementation of your own infrastructure for this rare yet challenging problem. You can find it at:

www.TheTraumaPro.com/amputation