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Below knee long stump guillotine amputation for mine blast injury foot: a safe need to do primary management in war zone: an experience in 18 cases over 10 months

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ABSTRACT

Background: Somewhere in western sector, high intensity conflict zone, we had to manage a large number of battle causalities, especially gunshot wound abdomen, and mine blast injury foot. In our collective experience of working in battle strife- zone, we realized that the best and the least a surgical team can do is to execute an old fashioned 'long stump' below knee (BK) guillotine amputation, achieve perfect hemostasis, immobilize the limb and rapidly transport the patient to higher surgical centre. This increase in the magnitude of mine blast injuries prompted us to highlight the problem and its management.

Methods: We analyzed 18 cases of anti- personnel mine blast injury foot over a 10 months period 2000 to 2001. We have managed 18 mine blast feet in "staged- manner. Stage I- "on battle-field" long stump BK guillotine amputation, perfect hemostasis, wound toileting and stump immobilization. Stage II - at a higher surgical centre elsewhere, the patient underwent a planned BK, prosthetic compatible, posterior myo-cutaneous flap covered stump construction and stage III - On recovery the patient with healed BK stump was transferred to limb prosthesis centre where tailor made BK prosthesis was provided and patient rehabilitated.

Results: Various body regions were involved in the mine blast injuries, but the main brunt was borne by feet and legs followed by multiple body regions due to splinters. 18 patients underwent below knee (BK) amputation while 01patient required bilateral BK amputations. The initial aggressive BK Guillotine amputation saved the limb and life of all patients. Few had stump related self-limiting complications. Some had post-traumatic stress disorder (PTSD). Almost all of them had high degree of BK prosthesis acceptance.

Conclusions: Mine blast causes extensive injuries and psychological trauma. Management is needed urgently, surgery is difficult, and amputation is often inevitable. In our experience on 18 cases this "safe-need-to-do" staged management of mine blast injury foot, in high conflict area, was found to be least time consuming, less precious resource draining and hardly manpower straining strategy.

Keywords: Antipersonnel mine, Below Knee amputation, Debridement, Mine blast injury, Post-traumatic stress disorder

INTRODUCTION

Incidences of fatalities with mine blast injuries, if not treated in time, are very high. They usually occur while handling a device, stepping on a device or falling onto a device. Incidents with anti-tank mines are rare, but have invariably killed the de-miner initiating the mine. Unlike anti-tank mines, that require a weight of a battle tank to go-off, the anti-personnel mines are triggered by the mere body weight of a man, and the moment he accidentally

steps on it. Metal cased mines of the past great wars were easily detected by mine detectors, but the modern day mines are plastic encased and well camouflaged into the soil- very difficult to detect and almost impossible to predict their location. We share our experience of managing 18 mine blast injuries in the northern sector of the country.

METHODS

Study received 18 cases of mine blast injuries while mining or demining land mines in a period of 10 months. Mine blast injury to foot is an explosive/bursting trauma limitedly inflicted to the lower limb, usually involving the foot and the ankle, which effectively immobilizes and neutralizes the intruder. The ghastly injury to the lower limb results into a 'mangled foot' which is a bloody mutilated mass of muscles, bones, mud and debris- a Class-IV wound, which is terrifyingly devastating, extremely demoralizing, and certainly deadly if not treated in time. The treatment of such a mutilated foot in modern operation theatre, is a straight forward 'same sitting' BK amputation with posterior myo-cutaneous flap covered stump.

In the heat of battle, where the sheer volume of causalities, overwhelm the best of surgical teams. Such a "straight forward amputation" in make-shift operation theatres of military and civilian conflict zones, is highly susceptible, due to high grade contamination, to wound infection and wound failure. And it is certainly a time consuming, resource exhausting procedure. In war the 'best life and limb saving medicines" are- superior fire power, quick "need to do" surgical procedures and rapid transportation of the causalities to higher surgical echelon for further limb salvage and management. The mantra of any war surgery is "save life, limb and sight" - in that order.

In our collective experience of working in battle strifezone, we realized that the best and the least a surgical team can do is to execute an old fashioned 'long stump' below knee (BK) guillotine amputation, achieve perfect hemostasis, immobilize the limb and rapidly transport the patient to higher surgical centre. Study present here 18 cases of anti- personnel mine blast injury foot over a 10 months period- 2000-2001. Here we have managed 18 mine blast foot in "staged- manner"-

Stage I

On battle-field; long stump BK guillotine amputation, perfect hemostasis, wound toileting and stump immobilization.

Stage II

At a higher surgical centre elsewhere, the patient underwent a planned BK, prosthetic compatible, posterior myo-cutaneous flap covered stump construction.

Stage III

On recovery, the patient with healed BK stump was transferred to Limb prosthesis centre where tailor made BK prosthesis was provided and patient rehabilitated.

In our experience on 18 cases, this "safe-need-to-do" staged management of mine blast injury foot, in high conflict area, was found to be precious time saving, resource conserving and low manpower engaging action plan.

A sample case

- A 32 year old soldier was wheeled into our "dug-in OT" (operation theatre) somewhere in extreme conflict zone
- He had sustained mine blast injury to right foot half an hour ago. It was a mangled foot, grossly contaminated with mud, grass and debris. Patient was in hypovolemic shock
- The patient was immediately IV resuscitated, IV injected broad spectrum antibiotics. (magnex 2 gm, amikacin 750 mg, metronidazole 500 mg), narcotic pain killer (iv pethidine 50 mg and phenargan 50 mg), tetanus prophylaxis and PPI (proton pump inhibitors) such as pantoprazole



Figure 1: Mine blasted foot (medial view).

- The traumatized foot was encased in plastic bag and sealed off with micro-pore tape, around ankle, over healthy skin
- Under the effect of spinal anesthesia, right lower limb elevated, painted with antiseptics, draped in sterile towel. The mangled foot sealed in plastic casing was enclosed in sterile towel. "Timed" tourniquet applied at the mid-thigh, loudly read out tourniquet time and the tail of the tourniquet was tied to the table as a "fail-proof" reminder of tourniquet in situ. A "Tourniquet" sticker stuck on the forehead of the patient for the same.



Figure 2: Mine blasted foot (lateral view).



Figure 3: Mine blasted injury resulting in "traumatic amputation" of the leg at ankle.



Figure 4: Mine blasted traumatic amputation of the leg with debris grass and mud (Class IV wound).



Figure 5: Mine blasted traumatic amputation through the foot.



Figure 6: Mine blasted traumatic amputation at ankle.



Figure 7: Guillotine amputation at most conservative level of the leg in progress the giggle wire saw is drawn in a "wide obtuse angle", with rhythmic sawing motion of surgeon's hands, this avoids the gigli wire saw from breaking. 'acute angled 'gigli wire sawing cause the wire to heat up and break.

- A quick circular skin incision is made 2 to 4 cm proximal to the draped off mutilated foot, rapidly developed, cutting muscle tendons and nerves at the same level as skin incision up to bone. Named vessels (anterior tibial, posterior tibial and interosseous arteries) divided between double silk ligatures.
- Bones were sawed off at the level of skin with the GIGLI wire saw- first fibula and then tibia, in that order (to avoid sudden fracture break off of fibula due to weight, if tibia is sawed off first)
- Hemostasis from bleeding marrow of tibia and fibula is achieved with Bone wax.
- Tourniquet released. Hemostasis checked, stump padded and dressed. Above knee to stump enclosing POP-posterior slab applied with 10 degree flexion at the knee. Forehead tourniquet warning sticker removed.
- Once the patient hemodynamically stabilized, he was air evacuated to higher surgical unit, where a formal BK (prosthetic compliant) amputation with posterior myo-cutaneous flap covered stump was constructed.
- Four weeks later, the patient was shipped to Prosthetic centre, where a tailor-made BK prosthesis was provided, and patient rehabilitated physically, mentally and socially.



Figure 8: Guillotine amputation in progress. The Gigli wire saw is 'cooled' with spray of normal saline. heated up Gigli wire saw undergoes "metal fatigue" and snap.



Figure 9: Guillotine amputated leg. Bleeding bone marrow is sealed with bone wax.



Figure 10: A cleaned, ready to be dressed guillotine amputated leg.



Figure 11: An uncomplicated, prosthetic compatible BK stump (right).



Figure 12: Right BK stump, stockinetted before BK prosthesis insertion.



Figure 13: A BK prosthetic leg (right).



Figure 14: Mine blast victim with an uncomplicated BK stump (left).



Figure 15: A mine blast victim-a bilateral BK amputee with bilateral BK prosthesis on "stand by".



Figure 16: A mine blast victim- a bilateral BK amputee fully BK prosthesis "booted" ready to join social stream (physical rehabilitation seems satisfactory, mental traumas such as PTSD to be evaluated over months and years of counseling).

RESULTS

The mean age was 31.16 years and the entire 18 patient underwent guillotine amputation. 03 patients were civilians (01-female), 01-officer and the rest were soldiers. Out of the 18 patients 11 patients had RT side BK amputation, whereas the rest were left side, Special emphasis on only 01 patient who underwent bilateral amputation. 09 patients presented in hypovolemic shock, and 09 had associated injuries ranging from facial abrasion, gluteal laceration and hand injuries.

The formal prosthetic compatible BK amputation was carried out on an average between 07 to 14 post trauma days. Wound complications included Surgical Site Infection (SSI)-07 patients, Seroma-03 and partial dehiscence-01. The BK prosthesis was accepted in most of the cases except 04cases where it was not satisfactory. There were numerous stump related issues like neuroma, Phantom limb, and painful callositities. The fallout of these mine blast injuries was severe in relation to their psychological status as termed commonly as post traumatic stress disorder (PTSD), they varied in presentation e.g. aggressive behavior, depression, anger and aloofness.

DISCUSSION

When the foot of the victim is directly on top of the exploding mine, the blast force exceeds the structural integrity threshold of the majority of wearable materials and footwear. Furthermore, the blast waves generate a strong vertical force that accelerates, causing foot and lower leg mutilation. If the victim does not have adequate foot protection, there is a high probability of traumatic amputation. Stripping of soft tissues also occur, allowing debris from the compromised footwear, mine casing or surrounding dirt to be driven into the lower leg due to blast waves and mass wind movement effect. This contamination and effects of invisible strong blast waves leads to an escalation of the level of injury and the need for amputation of the limb further up the leg.² The Blast mines rely upon the energy released by the explosive charge to harm their target, and are normally buried by hand or placed on the ground. The injuries they produce result primarily from the explosion, but secondary fragmentation injuries are possible as the mine casing or surrounding dirt or gravel is blasted at the victim. A fragmented bone piece of the victim also acts as secondary missile. Most depend on blast alone for their effectiveness, since the target generally needs to come in contact with the mine to set it off. There are various types of mines. (i) Anti-personnel mines have been stigmatized internationally because they claim civilian lives and create impoverishment of the victim and society at large to an extent, vastly disproportionate to their military utility. Anti-personnel mines can be further divided into two main categories: blast and fragmentation. a) Blast mines are typically exploded by the pressure of a footstep.

Fragments of the mine casing, earth, grass, parts of the casualty's footwear, bone and flesh from the foot and ankle are all driven high into the wound. Traumatic amputation of the lower leg is common. Subsequent surgical amputation is normally required from a higher site of the limb to ensure that blast and fragmentationaffected tissue and bone are excised. Secondary injuries can be very severe such as blindness and serious facial, chest or abdominal injuries are common with blast mines. b) Fragmentation mines are typically exploded when a trip-wire is pulled or when the mine is disturbed directly. The mine contains a packing of fragments; usually metal or a segmented outer casing that breaks into fragments on detonation. When dispersed by the explosive force of the mine, these fragments acting as missiles are the prime cause of injuries sustained by the victim. The fragmentation effect drives metal fragments into the mine victim. These fragments rip through tissue, organs, bone and if velocity is sufficiently maintained, they can cause large lacerated exit wounds. Survivors may suffer multiple amputations, blindness, and secondary effects caused by damage to internal organs. Fragmentation mines can kill and injure multiple victims in a single incident. (ii) Anti-tank mines contain enough explosives to stop or destroy an armored vehicle. An anti-tank mine usually requires a substantial amount of pressure to be applied in order to explode. It requires about 180 Kg of the weight for its detonation. This means that anti-tank mines are not normally capable of being detonated by a person standing on them. However, civilian vehicles or people ploughing fields can activate an old anti-tank mine.3

Landmine explosions being a formidable challenge to both patients and treating surgeons. Initially the main decision to be made is to amputate or to salvage the limb.4 Amputation is a radical, often life-saving and irreversible intervention, and indications for amputation must be determined by those with great surgical experience and good knowledge of military surgical doctrine. Repeated wound debridements and stabilization by plaster of Paris or external fixator can save a large number of feet and limbs. This can be achieved in highly specialized surgical centers.^{5,6} In war time operation theatre, such a procedure is precious time and logistic depleting surgical exercise and may prove to be life threatening. Free tissue transfer is the other method of repairing extensive soft tissue defects of the foot after serial debridements. Early wound coverage is important because if the wound coverage is delayed, wound infection develops and healing is impaired. We prevented this morbidity and mortality by maintaining good hydration and repeated extensive wound debridements.⁷

CONCLUSION

To summarize mine blast injuries are common while deploying or disarming land mines during tactical operations. During these operations army provides maps of minefields and their notification and markings, but due to rain fall, winds, melting snow and soil erosion, some mines drift, ending up, years later, in different places. Nature does not respect national boundaries and these mines can be found anywhere. A mine blast causes extensive injuries and psychological Management is needed urgently, surgery is difficult, and amputation is often inevitable. People injured by mines require a multitude of things; evacuation, first aid, resuscitation, surgical care, rehabilitation including, if need be, an artificial limb, physiotherapy, vocational training and social reintegration.

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