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Original Article

Negative pressure wound therapy in the management of mine blast injuries of lower limbs: Lessons learnt at a tertiary care center

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ABSTRACT

Background: Mine blast injuries of foot are devastating injuries that result in composite tissue loss or amputations. Negative pressure wound therapy has helped in the management of such combat-related wounds. The aim of this study was to report experiences gained in managing such injuries at a tertiary care center.

Methods: 17 combatants who sustained mine blast injuries were included in this study. Severity of foot injury was assessed as per Foot and Ankle Severity Score. After wound debridement, negative pressure wound therapy was started and foot defect was appropriately reconstructed. Following wound healing, the foot was assessed for Foot and Ankle Severity Score in terms of impairment. The patients were then suitably rehabilitated by shoe modifications, orthosis, or custom-made prosthesis.

Results: Mean age of soldiers who sustained mine blast injuries was 30.2 years. The mean Foot and Ankle Severity Score was 3.76. Temporary wound closure was achieved using negative pressure wound therapy and it prevented local and systemic infection. The defect could be reconstructed appropriately using split skin graft, regional fasciocutaneous flap, or microvascular free flap. Mean time to definitive reconstructive procedure was 16.5 days. Mean Foot and Ankle Severity Score in terms of impairment was 4.11. All soldiers could be rehabilitated and were returned to their respective units and were able to perform sedentary duties assigned to them.

Conclusion: The negative pressure wound therapy was helpful in preventing proximal amputations due to mine blast injury and was helpful in satisfactory reconstruction of foot defects.

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Introduction

Mine blast injuries are devastating injuries that can result in loss of life and limb. The victims who survive these injuries are often incapacitated for life. The massive contamination and a composite tissue loss in the limb require an urgent attention. The reconstruction is aimed at achieving a pain free and functional limb. In the absence of satisfactory wound management and reconstruction, the rates of below-knee amputation are significantly high.[1] Negative pressure wound therapy (NPWT) has become an accepted modality in the management of such combat-related wounds and its benefits are well reported in literature.[2–4] This study was conducted at a tertiary care center, which receives casualties from forward areas. Aim of this study was to report the experiences gained while managing such injuries.

Materials and methods

A prospective, longitudinal study was conducted at a tertiary care center between April 2014 and November 2015. 17 combatants who sustained mine blast injury to the foot and lower limbs were included in this study. They were evaluated for hemodynamic stability, local tissue damage, and for injuries in other body parts. The anatomical site of injury was categorized as forefoot, midfoot, and hindfoot, severity of injury was assessed as per Foot and Ankle Severity Score (FASS) as described by trauma committee of American Orthopedic Foot and Ankle Society.[5] All patients were subjected to routine hematological and biochemical tests. Radiographs of the affected foot and other injured areas were obtained to ascertain the nature and extent of skeletal injury.

Once hemodynamic stability was established, injured limb was examined under combined spinal and epidural anesthesia. Wounds were irrigated with copious saline and surgically debrided under loupe magnification and tourniquet control. Skeletal stabilization was achieved using K wires. Wound was covered with antibiotic impregnated gauze pieces. Compression bandages were applied to ensure hemostasis. After 48 h, wounds were reexamined and debrided further in the presence of necrotic tissue. Foot defects were assessed based on classification by Hidalgo et al.[6] Once devoid of nonviable tissue, NPWT was applied to prepare the wound for skin/soft tissue cover. Under sterile conditions, the wound covered with reticulated open cell foam (ROCF) dressings was secured with adhesive waterproof dressing. This was connected to NPWT device, which maintained a subatmospheric pressure of 100–125 mmHg. The dressing changes were made after 72 h, and during each dressing change, the wound was inspected and evaluated for reduction in its size, the amount and quality of granulation tissue, and its microbiology.

When the wound was found healthy, appropriate skin/soft tissue cover was provided keeping in view the reconstructive requirements. After wound healing, patients were evaluated by FASS in terms of impairment (FASS-I).[5] The patients were then suitably rehabilitated at the artificial limb centre (ALC), Pune by shoe modifications, orthosis, and custom-made prosthesis. At final follow-up, functional outcome was assessed in terms of their fitness to return to active military duty.

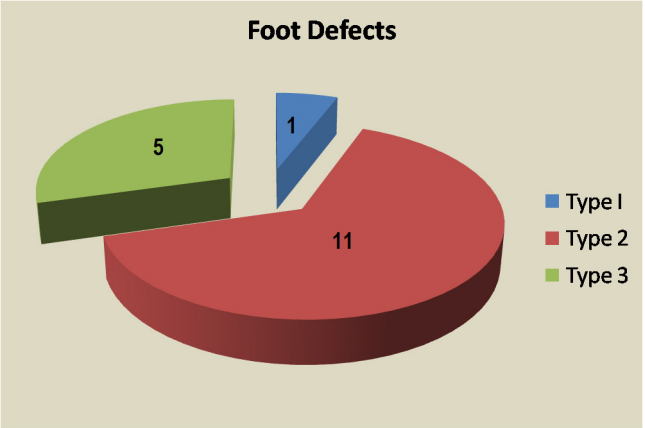

Fig. 1 – Foot defects.

Results

The results have been summarized in Table 1. The anatomical location of foot injury is shown in Table 2 and the type of foot defects is depicted in Fig. 1. The NPWT helped in temporary wound closure and prevented local and systemic infection. It promoted robust granulation and wound could readily be covered with simple reconstructive procedures like split skin grafting (SSG). However, in weight-bearing regions of foot and stumps that required prosthesis, full-thickness cover in form of fasciocutaneous flap or muscle flaps was necessary (Figs. 2 and 3). SSG at the stump was found unstable despite adequate granulation requiring stump revision (Fig. 4). In all patients who presented to us with complex mine blast injuries, below-knee amputation could be avoided while adhering to the protocol of repeated wound debridement, NPWT, and delayed definitive reconstruction, thus enabling us to achieve limited plantigrade ambulation and normal ambulation after prosthetic rehabilitation (Fig. 5). Mean FASS was 3.76 (range 3–5) and mean FASS-I was 4.11 (range 3–6). Mean time to definitive reconstructive procedure was 16.5 days (range 10–21). Most common complication seen was breakdown of scar at the flap and SSG interface, which healed conservatively. All soldiers could be rehabilitated and were returned to their respective units and were able to perform sedentary duties assigned to them. However, none of them was found fit for active military duty in the follow-up period.

Discussion

Anti-personnel mines are small explosive devices that are laid under the ground and are activated either by pressure or by a trip wire. They are designed to inflict damage to the soldier ending his role as a combatant. Injuries resulting from mine blasts are due to pressure waves entering limb, penetrating injuries from splinters of mines, soil, stones, and foot wear. There is extensive osseous and soft tissue destruction at the

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