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Single-Centre Study: Managing Lower Limb Open Fractures in Accordance with the Bapras Guidelines

Rana Hassan Javaid, Syed Faraz Anwar, Aneeq Ahmed Awan, Farah Naz, Sadia Khan, Shahid Iqbal

Department of Plastic Surgery, Pakistan Navy Station Shifa Hospital, Karachi Pakistan

ABSTRACT

Objective: To evaluate the management of lower limb open fractures, specifically Gustilo-Anderson class III fractures, and assess adherence to British Association of Plastic, Reconstructive, and Aesthetic Surgeons (BAPRAS) guidelines.
Study Design: Retrospective observational study.
Place and Duration of Study: PNS Shifa Hospital, Karachi Pakistan, from Aug 2021 to Feb2023.
Methodology: Adult patients with Gustilo-Anderson class III fractures were included, with a minimum follow-up time of 6 months. Patients with polytrauma and severe life-threatening injuries were excluded. Comprehensive medical records review was conducted, and outcome measures including infection rates, wound healing, complications, functional recovery, and patient satisfaction were assessed.
Results: The study involved 20 patients (age: 22-65, mean 40.30±12.22). Initial debridement was on admission day. Time from debridement to soft tissue coverage was at mean 19.95±8.21 days, shorter for milder damage treatable with SSGs and local flaps, longer for microvascular flaps. Internal fixation occurred at 44.25±7.77 days post soft tissue coverage. Mean hospital stay was 67.00±14.82 days.
Conclusion: Despite challenges such as resource limitations and delayed presentations, the study highlights the importance of tailored treatment approaches in managing lower limb open fractures. Although deviations from strict timing recommendations were noted, favorable outcomes were achieved, emphasizing the need for continuous evaluation and adaptation of treatment protocols. Multidisciplinary collaboration remains crucial in optimizing patient care.

Keywords: Open Fractures, Soft Tissue Injuries, Treatment Outcome, Wound Healing.

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INTRODUCTION

When soft tissue injuries coexist with lower limb fractures, the resulting injuries are frequently severe and complicated, posing a major challenge to both orthopaedic and reconstructive surgeons. Open fractures are typically linked to higher-energy trauma, which has longer healing durations and higher incidence of complications, such as infection.[1-3] Open tibial fractures are most commonly associated with gram-negative infections, although Staph aureus is the most prevalent source of recurrent infections.[4-7] Malunion and non-union, which can happen in up to 8% of closed and 3–17% of open tibial fractures, are among the most common complications that come with open fractures.[8,9] Closed tibial fractures usually have less severe soft-tissue injury and a simpler fracture pattern than open tibial shaft fractures.[10,11]

Depending on the degree of tissue damage and viability, orthopaedic surgeons will often do soft tissue repair as soon as feasible after the initial phase of wound washing, debridement, and fracture stabilisation. Even after final soft tissue reconstruction, the external fixator may be maintained in situ until the soft tissue covering has healed appropriately. Internal fixation is then performed at a later time.[12] These findings clearly show that stringent treatment protocols are necessary for open fractures.[13-15] Regarding the treatment of open lower limb fractures, the British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS) has proposed a set of guidelines that support the use of a multidisciplinary team and the completion of a definitive soft tissue reconstruction within seven days of the injury.[16] A study was conducted in Madagascar where the general guidelines were:

The emergency physician evaluated the injuries at the emergency room, cleaned the wound, and applied sterile dressing.

Anti-tetanus prophylaxis and the antibiotic Amoxicillin-Clavulanic Acid were administered upon admission.

Correspondence: Dr Syed Faraz Anwar, Department of Plastic Surgery, Pakistan Navy Station Shifa Hospital, Karachi Pakistan
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Regardless of the nature of skin lesions, surgical care involved debridement and methodical wound cleaning. Skin closure was performed for all fractures, if feasible, without strain. Based on the patient's socioeconomic status, the available implant, and the surgeon's experience, the fracture was definitively stabilised.[17]

In this article, we have explored the challenges and complexities involved in managing lower limb open fractures with associated soft tissue injuries, namely; lack of resources and specialists or consultants, and how best to manage them in a single center, taking into key considerations-early assessment and resuscitation, wound management, fracture stabilization, soft tissue coverage, and rehabilitation.

METHODOLOGY

This retrospective study conducted in tertiary care hospital of Karachi within the period of August 2021 and February 2023. Minimum follow up follow-up time was 6 months. Prior ethical approval was sought from review board (ERC/2023/Plastic Surg/49). Sample size was calculated using World health organization online calculator, keeping margin of error of 90% and anticipated frequency of open reduction and internal fixation to 7% and confidence interval of 95%.[18] Non probability consecutive sampling was done.

Incusion Criteria: It included adult patients who presented with lower limb open fractures {Gustilo – Anderson class III (>18 years)} and no other associated injury.

Exclusion Criteria: Patients admitted with polytrauma having severe life-threatening injuries were excluded. A comprehensive review of medical records was conducted to identify eligible cases, and patients with incomplete or insufficient data were also excluded from the analysis.

After receiving the patients in the emergency and managing them as per Advanced Trauma Life Support (ATLS) protocol, the patients were admitted under the combined care of Orthopedics and Plastics care (Ortho-Plastics). In the majority of the cases, initial wound debridement was undertaken on the same day or within 48 hours, followed by external fixation of the fractured segments. Multiple debridements were done according to the severity of soft tissue damage and contamination, after which definitive soft tissue coverage was planned and undertaken, ranging from coverage by split-thickness skin graft to using locoregional to free tissue flaps.

After satisfactory soft tissue coverage was achieved, definitive internal fixation was done by the Orthopedic surgeons to allow patients to fully-weight bear with the help of rehabilitation and physiotherapy. The patients were called for regular follow-up to assess the results 2 weeks, 1 month, 3 months and 6 months.

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 23. Mean±SD was reported for normally distributed quantitative variables as age, duration of hospital stays, time of flap, duration of internal fixation and duration of full weight bearing. Shapiro-Wilk test wasused to assess the normality distribution. Qualitative variables were assessed and represented in percentages.

RESULTS

A total of 20 patients ranging in age from 22 to 65 years (mean 40.30±12.22), with open fracture of lower limb (Gustilo-Anderson classification Type III) were included in the study. There were 6(30%) females and 14 (70%) males.

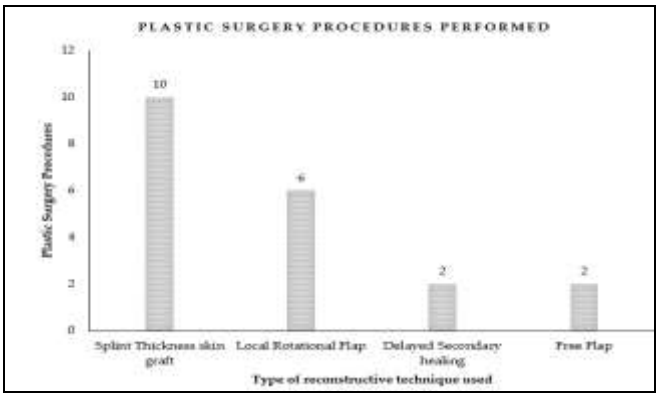

Figure-1: Showing Various Plastic Surgery Procedures Performed (n=20)

The time recorded between initial debridement and definitive soft tissue coverage was 19.95±8.21 days, with shorter times associated with mild degree of soft tissue damage which was amenable to repair with the help of split-thickness skin grafts (SSGs), local flaps and internal fixation and full weight bearing. We also examined lengths of hospital. Consequently, the delay was longer in wounds which required free microvascular tissue flap. The various plastic surgery procedures performed in each case is shown in Figure-

1. Various stages of wound healing are shown in Table-I.

Table-I: Showing Mean Time Duration in Various Stages of Wound Healing (n=20)

Stages of Wound Healing	Time Duration (days)
Tissue coverage followed by internal fixation of fracture fragments	44.25±7.77
Time between temporary external fixation and definitive internal fixation	64.2 0±15.12
Internal fixation and full-weight bearing	87.55±4.89
Total duration of hospital stay	67.00±14.82

Figure-2: Fracture Healing Achieved by Secondary Intention Closure

Figure-3: Fracture Coverage Attained by Split Thickness Skin Graft

DISCUSSION

There has been debate on when Gustilo Anderson type 3 A/B/C patients should have soft tissue repair. The British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS) guidelines were compared to the analysis of type 3B fractures in this study using the following time periods: first debridement and soft tissue coverage; external fixation and internal fixation; initial soft tissue coverage and internal fixation; stays, problems in open fractures, and various soft tissue reconstructive techniques. As a third-world nation, we have several issues with the present healthcare system. The majority of government settings are devoid of medical facilities. There are also few patient arrivals in a suitable tertiary care setting with an ortho-plastics staff on hand. The disparities between our outcomes and the BAPRAS standards can be attributed to a number of factors, including a lack of theatre space, a shortage of orthopaedic and plastic surgery doctors, and an inadequate supply of resources and paramedical staff. The results were not worsened by the delay in reconstruction, despite the differences in time. When free flap coverings were done within 15 days of lower-extremity injuries, there was no difference in flap failure, osteomyelitis, or bone union between the two groups.

Figure-4: Fracture Coverage Achieved by Rotation Flap and Split Thickness Skin Graft

According to the principles of early radical debridement, a second look operation, muscle or musculocutaneous flap cover within five days of injury, external pin fixation, and ambulation within the first three weeks of injury, Byrd HS *et al.*, conducted a study in which 18 patients with lower extremity wounds with underlying bone fractures were treated using a combined ortho and plastic surgical approach. They discovered that, on average, 4 months passed before any fractures joined. The average length of stay for their patients was 4.2 weeks. No osteomyelitis, non-union, tissue degradation, shortening, or persistent infection have occurred.[19]

According to Qui *et al*., there should be a 72-hour gap between the first debridement and soft tissue repair. This will reduce the risk of infection and the likelihood that a free flap would fail.[20] A recent study indicated that although early repair was proven to be beneficial, the early reconstructive phase might be prolonged to as long as 10 days following damage. On the other hand, in our study, a number of circumstances led to delayed soft tissue restoration. For example, in certain cases, patients were admitted late and the initial debridement was performed more than two days after the injury, which resulted in recipient site infections. In several instances, individuals were deemed unsuitable for extended anaesthesia and cosmetic procedures. Soft tissue repair took place over the course of 19 to 27 days when the patient and wound bed were optimized.

According to recent research, the transition from external to internal fixation can be completed in a single, two-step technique. According to current research, internal fixation with an intramedullary nail should be accomplished within 72 hours of the injury when aiming for soft tissue covering. Intervals of 4–28 days are safe if the infection is increasing. However, contamination of the intramedullary canal has been seen at the external fixator pin locations.[7-10] In our setup, a single-stage two-procedure technique was not used, as most of the wound beds were heavily infected despite adequate washout and debridement. The average time from soft tissue coverage to internal fixation was 44 to 52 days. The time it took to shift from external fixation to internal fixation was about 64 to 70 days.

Following internal fixation, it is often recommended that delayed full weight bearing be initiated six to twelve weeks following internal fixation, and early or partial weight bearing be initiated as early as day one.[7,11,12] In our patients, weight bearing was generally advised by the orthopedics team. Full weight bearing was allowed on average at 12 to 13 weeks post internal fixation.

Length of hospital stay depends on the plan for reconstruction of soft tissues as well as bony fixation, delayed repair results in prolonged hospital stays, and healing processes. A study was performed in which length of stay was plotted in an early and delayed repair, which stated that Length of Stay (LoS) was 36.39±8.09 days in the delayed-repair group, which was 1.71 times longer than the early-repair group, in which the LOS was 21.32±3.77 days. Wound healing time and bone healing time were significantly longer in the delayed. In a study conducted in India, the mean hospital stay with SD in the immediate flap cover group was 7.5 2.5 days, while in the late flap cover group, it was 29.5±8.5 days repair group. The duration of internal fixation and full weight bearing was 5.61±1.17 weeks and 9.08±2.54 months, respectively in the delayed flap cover group whereas as it was 3.21±0.48 weeks and 5.71±0.96 months respectively in early flap cover group. In our study the total duration of hospital stay was 67 to 82 days.

CONCLUSION

This research examines the treatment of open fractures in the lower limbs, specifically Gustilo-Anderson class III B fractures, with an emphasis on following the British Association of Plastic, Reconstructive, and Aesthetic Surgeons' (BAPRAS) standards. The conclusions and conversations shed important light on the difficulties, complications, and results related to these injuries. The research offers significant perspectives on the management of exposed lower limb fractures, emphasising the need to follow BAPRAS recommendations. It draws attention to the difficulties and complications encountered in an actual clinical context as well as the effects of postponing repair on results. The results highlight the significance of treating each patient individually and the necessity of a multidisciplinary approach. The study indicates that comprehensive treatment can still lead to favourable results even when exact scheduling guidelines are not followed. In the care of complicated open fractures, this study emphasises the significance of ongoing assessment and modification of treatment regimens to enhance patient outcomes.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

RHJ & SFA: Data acquisition, data analysis, critical review, approval of the final version to be published.

AAW & FN: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SK & SI: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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