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Original Article

An Experience in Managing an open Fracture Shaft of the Femur Due to a Gunshot with Intramedullary Interlocking Nailing

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ABSTRACT

Objective: To evaluate functional outcomes and complications in gunshot femur shaft fractures treated with intramedullary nailing primarily.

Study Design: Prospective longitudinal study

Place and Duration of Study: Department of Orthopaedic Combined Military Hospital, Nowshera, Combined Military Hospital Sialkot, Combined Military Hospital, Rawalpindi Pakistan, from Jan 2016 to Dec 2021.

Methodology: A total number of 53 cases of open fracture of the femur shaft due to gunshot were included in the study. After initial wound debridement, an X-ray was taken, and fractures were classified according to the Gustilo–Anderson classification. All fractures were fixed with titanium I/M I/L Nail in static mode by the same orthopaedic surgeon. Rehabilitation was instituted immediately after the operation, and the outcome was assessed in regards to infection, range of motion at the knee, full weight bearing and radiological union achieved.

Results: Thirty-four (64.15%) patients had Type-1 fractures of the femur shaft, and 19(35.8%) patients had Type-2 fractures. Fracture union was observed in 47(88.67%) patients after three months and 6(11.32%) over the next five months. Complications were wound infections 5(9.44%), leg length discrepancy 4(7.53%), and non-union 2(3.77%) at six months. In these two cases, bone grafting was done, and union was achieved.

Conclusion: Primary intramedullary (IM) is the preferred mode of treatment of Type 1 and 2 shafts of femur fractures if early good debridement is done. It avoids secondary procedures, has fewer complications and helps in early mobilization.

Keywords: Intramedullary nailing, Infection, bone union, Open fracture.

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INTRODUCTION

Gunshot wounds are the cause of increased mortality and blood transfusion. Orthopaedic surgeons are now encountering more open fractures due to firearm injuries than ever. High-velocity firearm injuries are usually complex and may need a team of surgeons, including the vascular, orthopaedic and plastic surgeons.[1,2] The treatment aims to salvage the limb and return to early function while avoiding infection and length discrepancies in the limb. In upper limbs, these fractures can be managed conservatively.[3] While in lower limbs, these injuries and fractures are managed with an Ex-fix. In case of a fracture of the femoral shaft, this becomes even more challenging as the application of an Ex-fix usually results in non-union, knee stiffness and conversion to internal implant is usually required at a later stage.[4,5]

Some orthopaedic surgeons keep the patient on skeletal traction until all the soft tissue injuries have healed. This not only increases the time of recovery to a very long period but also increases the risk of developing grave complications such as bedsores, DVT, and pulmonary embolism.[6,7] Intramedullary nailing can be the alternate option for treatment.[8] Transverse and oblique fractures were fixed in dynamic mode, but gunshot fractures are usually managed in static mode.[9,10] As societal violence continues to rise, the incidence of gunshot fractures is expected to grow. However, there is a lack of local data on the management of open femoral shaft fractures caused by gunshot injuries, particularly concerning intramedullary interlocking nailing. This study was conducted to evaluate the functional outcome and complications in open Type 1 and 2 femur fractures resulting from firearms and treated with primary intramedullary nailing. Harris Hip Score and Oxford Knee Score were used to check functional outcomes. This scoring system has gained popularity & preference by clinicians.

METHODOLOGY

The prospective longitudinal study was conducted at CMH Nowshera, CMH Sialkot, and CMH Rawalpindi Pakistan from January 2016 to December

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2021 after Ethics Committee approval (ERC-231). The sample size was calculated using the WHO sample size calculator, taking a complication rate of 16.1%.[11]

Inclusion Criteria: Patients aged >20 years with Type 1 and Type 2 femoral shaft fractures due to firearm injury who were fit for surgery were included.

Exclusion Criteria: Patients with pathological fractures, patients with major vessel injury, bone or tissue loss, patients representing late with infection already settled in, were excluded.

Fifty-three cases of fracture shaft of the femur due to GSW of category Gustillo I & II were treated with closed I/M I/L Nailing, and the functional outcome and complications were evaluated. Harris Hip Score and Oxford Knee Score were used.

Initially, in the Emergency Room, the fracture was immobilized using a Thomas splint, and an injection of tetanus toxoid and immunoglobulin was given to all patients. All operations were delayed for 4-7 days from the date of injury to see the condition of the wound. All patients were started with an antibiotic Injection of Augmentin 1.2 gm I/V x 8 hourly (ATD). Two debridements were carried out in all patients, and all foreign bodies were removed. A C/S test from the wound was sent on the first debridement. Patients were kept on traction and applied via POP boot with a T-slab inserted behind the ankle. Daily sterilized dressings were done. A standard pre-op AP and lateral radiographs were obtained in all cases to confirm and to see the pattern of fractures.

Fractures were fixed with I/M I/L Nailing in the static mode by the same surgeon, and daily post-op examination was carried out for the presence of any wound infection for the first week and then weekly for four weeks. Follow-up was converted to fortnightly after 04 weeks till 16 weeks and then four weekly.

Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 23.00 and MS Excel 2016 software. Mean±SD was calculated for the continuous variable. Frequency and percentage were calculated for categorical variables. The chi-square test was used to determine the association of categorical variables. The *p*-value of ≤0.05 was considered significant.

RESULTS

Among 53 cases of open Type-1 & 2 Gustilo fractures resulting from firearm injuries with age ranging from 21 years to 60 years (mean age 37.4±10 yrs). Table-I shows post-op Complications of I/M and I/L in our study subjects. Post-op infection was controlled with prolonged antibiotics with the addition of injection of Amikacin 500 mg I/V BD x 03 days. Their repeat C/S report remained negative. In one case, the implant was required to be removed to control infection, although union has occurred, and a secondary procedure was not required. Post Op fever > 100oF was observed in 6 cases. LLD discrepancy >1cm was noted in 04 cases (4/53). Weight-bearing started at 08 weeks in all cases. Radiological non-union was found in 6 cases at the end of 4 months. Dynamization of Nail was done in all 6 cases (6/53) 11.3% after 4 months. After 6 months, only two cases remained non-united. These 2 cases were grafted with autologous bone graft harvested from the iliac crest, and the nail was again converted to static mode. Bone union was achieved in due course of time. More than 110o of knee Flexion was achieved in 51 cases (96.2%) with the help of early and extensive post-op rehabilitation.

Table-I: Association of Complications with Type of Fractures (n=53)

Baseline Characteristics	Gustillo Type-I (n=34)	Gustillo Type-II (n=19)	*p*-value
Gender			
Male	26(76.4%)	19 (100%)	0.022
Female	8(23.6%)		
Types of Complications			
Length Discrepancy			
Yes	0 (0 %)	4(21 %)	.005
No	34 (100%)	15 (79 %)	
Non- union			
Yes	1(3 %)	1(3 %)	.671
No	33(97%)	18(97%)	
Infection			
Yes	0	5(26%)	.002
No	34 (100%)	14(74%)	

The functional outcome was checked according to the Harris Hip Score and Oxford Knee Score. Both these scores were combined to calculate the functional outcome, as shown in Table-II.

Table-II Functional Outcome of the Patients (n=53)

Outcome	n (%)
Excellent	30 (56.60%)
Good	14 (26.41%)
Fair	6 (11.32%)
Poor	3(5.66%)

DISCUSSION

Closed I/M I/L Nailing has almost become the gold standard worldwide. It gives excellent rigid fixation of the shaft fractures with minimal soft tissue

dissection.[11] It generally needs a traction table, image intensifier, surgical skills and instrumentation. Some studies have described procedures to do I/M I/L Nailing without an image intensifier and ortho-table.[12,13]

Our study noted early post-op infection in the GSW (Clinically, as culture remained negative) only in 5/53 cases (9.4%). These 5/53 cases were managed by adding aminoglycoside (Injection Amikacin-500 mg I/V BD x 03-05 days). In one case, the implant had to be removed after union because of persisting discharge. LLD (Shortening) >01 cm occurred in 04 cases on the affected side and was managed with heel rise only. Full weight bearing was achieved in all cases at the end of 06 months. At the same time, the range of motion at the knee was >110o in 51/53 cases (96.2%) at the end of 04 weeks. These results are comparable to any other studies. In another study, Olasinde *et al*.[14] reported wound infection in 5/31 cases (16.1%), breakage of the distal screw in 01/31 (3.2%) and delayed union in 01/31 (3.2%) case and LLD in 02/31 cases (6.4%). In another similar study done at Peshawar, 12 complete union was achieved in 42/68 cases (81.7%) at 06 months, and post-op infection occurred in 10/68 cases (10.33%). In another study conducted in Abbottabad, Rehman *et al*.[15] achieved excellent results in 9/14 cases (64.3%) with the complete union in 06 months. 1/14 case (7.1%) was showing non-union.

In our study, 02 patients had non-union at the end of 6 months of surgery. These patients had Grade 2 femur shaft fractures with more soft tissue injury. There are more chances of non-union with extensive soft-tissue injury because the blood supply to bone is compromised, as suggested by Noumi *et al*.[16] Soft-tissue injuries and debridement also cause loss of fracture hematoma. This may lead to the non-union. Brumback *et al*.[17] advised that after good debridement, immediate intramedullary nailing of Grade-1 & Grade-2 open femur fractures is the preferred treatment method, and it does not increase the risk of infection.

The functional outcome (83% excellent-to-good outcome) was found in our study. Basha *et al*.[18] showed 60% of excellent outcomes in their study.

LIMITATION OF STUDY

Only gunshot femur fractures were included in this study. Other open fractures were not included.

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CONCLUSION

Primary intramedullary (IM) is the preferred mode of treatment of Type 1 and 2 shafts of femur fractures if early good debridement is done. It avoids secondary procedures, has fewer complications and helps in early mobilization.

Conflict of Interest: None.

Authors Contribution

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

FAO & SH: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

SO & AAM: Study design, drafting the manuscript, critical review, approval of the final version to be published.

SR & NM: 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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