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OUTCOMES OF OPEN FRACTURES OF LONG BONE

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ABSTRACT

Introduction- Open fractures of the distal femur are a uncommon and intricate type of injury that typically occur in individuals who have sustained multiple traumas. These types of fractures are often accompanied by bone loss, contamination, damaged soft tissue, and a patient's overall poor health condition. The purpose of this study is to examine the outcomes of patients who were treated for open distal femur fractures using a staged protocol, which involves initial external fixation with debridement, followed by definitive fixation using an anatomical locking plate and bone grafting at a later stage.

Method- The study included a group of 20 patients of open distal femurfractures who were operated with temporary external fixator and later on converted to definitive fixation with condylar locking plate with bone grafting. These patients were operated with our staged protocol and clinical outcome was evaluated using the functional evaluation scoring system by Sander's et al and Knee Society Scoring. Out of these 20 patients, 1 was lost to follow up at 3 months and 2 others were lost to follow up at 6 months. These 3 were excluded from our study.

Results- Fracture union was seen in all 17 patients. The average time to union was 22.65$\pm$3.3 weeks. Two patients were complicated with infection and delayed union. Ilizarov application was doneto achieve union and gain length once the infection subsided.

Conclusion- Staged protocol of temporary external fixator followed by definitive fixation with condylar locking plate and bone grafting is a safe and reliable method for the management of open distal femur fractures.

KEYWORDS-Distal Femur, Open Fractures of Distal Femur, Operative Outcomes of Distal Femur

INTRODUCTION

Fractures of the distal femur, which is the lower end of the thigh bone, are relatively uncommon, but they can cause significant health problems for patients. Although surgery is often necessary to treat these fractures, it can be challenging to perform and there is no clear consensus on the most effective type of implant to use. Despite advances in technology and research, many patients who undergo surgery for distal femur fractures still experience disability and poor outcomes. Some of these poor outcomes may be attributed to the surgical technique utilized, as there is still much to be learned about the optimal management of these types of fractures.[1,2]

Distal femoral fractures, which make up 4-6% of all femoral fractures and approximately one-third of all femoral shaft fractures, have a dual age distribution. These types of fractures tend to occur in young males from high-energy trauma and in elderly osteoporotic females from low-energy trauma.

The majority of low-energy fractures, at 85%, occur in the elderly population. The most common mechanism of injury in both instances is axial load to the leg, with rotation forces being less common. In low-energy trauma, most fractures remain extra-articular, while in high-energy trauma, over half have an intra-articular extension. Comminution, both extra-articular and intra-articular, is frequent. Open fractures occur in 19-54% of cases, with up to 80% being Gustilo type III. Additionally, approximately 1-5% of primary knee arthroplasties are complicated by periprosthetic fractures.[3,4,5,6]

Distal femoral fractures are more common in individuals over the age of 50, with around 60% of cases occurring in this age group. These fractures can present challenges in terms of fixation, as the presence of osteoporosis in older individuals can make the bones more fragile. In addition, these fractures may be accompanied by damage to the meniscus or ligaments. However, injuries to the femoral or popliteal artery, while rare, are a significant concern as they can threaten the blood flow to the entire limb. Therefore, it is important to carefully evaluate for any vascular injuries in individuals with distal femoral fractures.[7]

Open distal femur fractures are rare, complex injuries which occur in polytrauma patients and are complicated by bone loss, contamination, compromised soft tissues and poor host condition. Distal femur fractures with intra-articular extension are high velocity injuries which different methods have treated.[8]

Recent advances in emergency medical services and critical care medicine have resulted in an increasing number of polytrauma patients who survive their injuries. To promote long-term outcomes and overall wellness, many of these patients require functional orthopedic reconstruction. Effective management of extremity trauma is particularly crucial in ensuring positive outcomes for individuals who have experienced multi-system trauma.

The timing of the reconstructive process is a critical consideration to preserve the affected limbs. In addition to evaluating the condition of the muscles and bones in the affected area, the psychological state of the individual who has experienced severe trauma should also be taken into account. While immediate stabilization of the skeleton and treatment of open fractures are necessary to prevent further injury, infection, and bleeding, it may be wise to wait until the individual and the soft tissue in the area have improved before proceeding with further reconstructive surgery.[9]

Open high energy distal femur fractures with or without bone loss present unique therapeutic challenges when the pathway of limb salvage is prescribed.

In the case of severe injuries to the extremities, amputation may be the most appropriate option for reconstruction. However, it is important to also consider using a staged approach for limb salvage. Factors that must be taken into account include the extent of open fracture care, the type of skeletal stabilization used, and the strategy for soft tissue coverage and bone grafting. Complications such as nonunion, malunion, or infection can have a major impact on the recovery of patients with lower extremity injuries. Non-operative treatment is rarely used, and is typically only considered for patients who are not well enough for surgery or those with poor bone quality. There are several surgical options available, including external fixation, angular blade plate, anatomical locking plate, retrograde supracondylar nail, condylar buttress plate, dynamic condylar screw, and arthroplasty. The choice of implant will depend on the specific type of fracture. Retrograde nailing and anatomical locking plate osteosynthesis are currently the most common surgical methods used in modern practice. However, there is a lack of data in the literature regarding this type of injuries.Very few studies have been conducted on its management with variable results. Arazi et al. [10] and Kumar et al. [11] conducted a study on complex fractures treated with Ilizarov external fixator. Parekh et al. [12] conducted a study where fractures were treated with temporary external fixation and subsequent open reduction and internal fixation. None of the studies hasshown superior results forone procedure over the other.

The study intends to evaluate patients treated for open fractures (Gustilo Grade II, IIIA, IIIB and IIIC) distal end of the femur at our institution using the staged protocol of early external fixation with debridement followed by definitive fixation with anatomical locking plate and bone grafting at a later stage.

MATERIAL & METHODS

This Descriptive study was carried out Orthopaedics Department . After obtaining approval from the Institutional Ethical Committee and informed consent. A total of 20 patients of either sexwith open distal femur fractures (Gustilo Grade II, IIIA, IIIB & IIIC) were treated with an external fixator initially and condylar plate at a later stage wasincluded. However, patientswith open distal femur fractures (Gustilo Grade I), pathological fractures, debilitated medical conditions, closed fractures and young patients with epiphysis still not fused were excluded.

Radiological outcome will be assessed with the help of X-ray appearance of the lower limb on 2nd week, 6th week, 3rd month, 6th month and 1st year. Clinical outcome will be assessed on the basis of range of motion at knee, ankle and foot, limb length disparity, deformity and complication on 2nd week, 6th week, 3rd month, 6th month and 1st year. Clinical union will be defined when the fracture site is stable and when of abnormal mobility and are absent pain. Radiographic union will be defined when plain radiographs show bone trabeculae or cortical bone crossing the fracture site. Union will be determined by union in ¾ cortices.

The data for evaluation will be retrieved from previous OPD and hospital records of the patients after obtaining their consent, and only those patients with complete records will be included in the study. The information collected will be noted in proforma and the outcome will be measured using functional evaluation scoring system described by Sander's et al. [13], Knee society score [14] and Visual analogue scale.

Statistical Analysis

Statistical analysis was performed using MS Excel (R) office 365, Graph Pad prism 8.4.2 and SPSS version 25 (SPSS Inc., Chicago, IL, USA).Descriptive statistics will be analysed with SPSS version 17.0 software. Continuous variables will be presented as mean±SD. Categorical variables will be expressed as frequencies and percentages. Association between two or more variables will be done using Chi-Squared or Fisher's exact test. A p value less than 0.05 will be taken to indicate a significant difference.

RESULTS

There were 17 patients with average age of 36.53 years (±14.569). Maximum number of cases were in the age group 20-30 years, 13 were males and 4 were females. There was clear cut male preponderance in our study. [Table-1] 15 cases had RTA as the mode of injury, and 2 cases were due to fall from height. Road traffic accidents are clearly in excess of any other mode of injury in these fractures. [Table-1] 15 patients had right-sided injury, and only 2 had left-sided injury at the final follow-up. Gustilo type I was excluded from our study from the beginning. There were 4 (23.5%) type II, 6 (35.3%) type IIIA and 7 (41.2%) type IIIB in our study. [Table-1; Figure-1] There were 2 (11.8%) type-A1, 2 (11.8%) type-A2, 1 (5.9%) type A3, 2 (11.8%) type-B1, 3 (17.6%) type-C1, 3 (17.6%) type-C2 and 4 (23.5%) type C3 fractures. [Table-1] There was 1 (5.9%) clavicle fracture, 1 (5.9%) head injury, 1 (5.9%) proximal tibia fracture and 2 (11.8%) rib fractures. [Table-1] The average time interval between initial and definitive surgery was 30.76±10.42 days. Extension lag over time following surgery shows a decreasing trend signifying improvement. Degree of flexion over a period of time following surgery, showing an increasing trend signifying improvement. The average extension lag decreased from 15.59 ± 4.96^0 at 2 weeks to 5 ± 4.33^0 at 1 year follow-up, showing a significant improvement. The average flexion increased from 83.82 ± 7.18^0 at 2 weeks to 112.35±10.32 at 1 year follow-up. [Table-2] Pain (Sander's Score) was graded into 4 categories on a scale of 10 and measured at regular follow-ups. 94.1 % of cases had constant pain at 2 weeks, whereas none had constant pain at 1 year follow-up. 70.6% had no pain at 1 year follow-up. [Table-3] Pain (Knee Society Score) is graded on a scale of 50 into 7 categories, and measurement was done at 6 months and 1year follow-up. 5 cases (29.4%) had no pain at 6 months and 12 cases (70.6%) had no pain at 1 year follow-up. [Table-4] Shortening was calculated at initial surgery, followed over a time period, and was found to be constant (p-value-1.00).[Figure-2] Walking ability (Sander's Score) was graded on a scale of 6 and measured at regular follow-ups.

None of the cases waswheelchair bound/ bedridden at 1 year follow-up(p-value-<0.001). [Table-3] Walking (Knee Society Score) was graded on a scale of 50 and measured at 6 months and 1 year. None of the cases wasunable to walk or housebound at 1 year follow-up (p-value-<0.001). [Table-4] Stair (Sander's Scoring) climbing was graded on a scale of 3 and measured at regular follow-ups. 1(5.9%) case had a score of 0 at 1 year follow-up while 6 (35.3%) had no limitation (p-value-<0.001). [Table-3] Stair (Knee Society Score) climbing was graded on a scale of 50 and measured at 6 months and 1 year. 1(5.9%) case was unable to walk at 1 year follow-up and 2 (11.8%) cases could climb normal up and down at 1 year (p-value-<0.001). [Table-4]Return to Work (Sander's Score) was graded on a scale of 6, and only 1 (5.9%) was found to be unemployed at 1 year (p-value-<0.001). [Table-3] Functional evaluation was done at regular follow-ups with Sander's Scoring. No poor results were obtained at 1 year, while 1 excellent result was obtained at 1 year (p-value-<0.001). [Table-5; Figure-3] Knee Score and function score were calculated at 6 months and 1 year. Average of both the scores gave us the Knee Society Score. There was 1 (5.9%) poor result and 4 (23.5%) excellent results. Maximum number of the cases had good results i.e. 12 (70.6%) (p-value-<0.001). [Table-5; Figure-4] The average time taken for the radiological union was 22.65 ± 3.3 weeks. [Table-1]

DISCUSSION

Open high energy distal femur fractures, whether with or without bone loss, present significant therapeutic challenges when attempting to salvage the limb. These injuries often have a bimodal age distribution, with high-velocity injuries occurring in younger individuals and low/high energy injuries in the elderly with osteoporotic bones. The incidence of these fractures is on the rise due to an increase in road traffic accidents.

To evaluate the effectiveness of this protocol, a descriptive study was conducted, following 20 patients for 1 year, with 3 patients lost to follow-up. The majority of patients were male (76.5%) and the most common cause of injury was road traffic accidents (88.2%). The study also found that associated injuries were present in 11.8% of patients, and the most commonly used classification system was AO/ASIF.

The results of the study showed that there was a wide range of fractures present, with the majority classified as Gustilo IIIB (41.2%) and Type C3 fractures (23.5%). When compared to previous similar studies, our results showed a slightly different distribution of fracture types. The findings of this study provide valuable insights into the management of distal femur fractures, particularly when using the staged protocol with a temporary bridging fixator and a condylar locking plate.

The average time interval between initial and definitive surgery was 30.76 ± 10.42 days with a range from 21 to 58 days as compared to a mean of 5 days and a range of 1 to 23 days in a study conducted by Parekh et al. The significant difference betweenthe average time interval can be attributed to the inclusion of closed fractures in their study.

The average time for fracture union was 22.65 ± 3.33 weeks compared to a mean of 16 weeks in a study conducted by Arazi et al. and an average of 39 ± 9 weeks in a study conducted by Kumar et al.[11]

The average flexion at 2 weeks was $83.82^0 \pm 7.18^0$, at 6 weeks was $93.53^0 \pm 7.65^0$, at 3 months was $99.41^0 \pm 9.16^0$, at 6 months was $104.71^0 \pm 9.59^0$ and at 1 year was $112.35^0 \pm 10.32^0$. The 1-year average flexion was 112.350+10.320 as compared to 1050 and 1100+100 in type-C2 in the studies of Arazi et al [10] and Kumar et al [11] respectively. So, it was found to be a generalised increasing trend at every follow up.

The study reported two patients with deep infections who were managed differently. One was treated with implant removal and Ilizarov fixator, and the other with implant removal and temporary fixation with an external fixator followed by Ilizarov fixator. Both patients achieved union but had inferior final results compared to the rest of the group. The study's strength is that the same surgeon

operated on all patients and similar implants were used. However, it has limitations of a small sample size and short follow-up period. The findings can serve as information for patients and as a reference for future studies.

CONCLUSION

On the basis of our descriptive study for open fractures of the distal femur, we conclude that the staged protocol of temporary external stabilization and definitive fixation with condylar locking plate at a later date is a safe option with acceptable results. In cases of deep infection, where definitive surgery with plating is delayed, a more stable external fixation, i.e. Ilizaarov may be used. Cancellous bone grafting at the time of definitive surgery enhances fracture healing and decreases the chances of non-union.

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REFERENCE

1. Hoskins W, Sheehy R, Edward ER, Hau RC, Bucknill A, Parsons N, Griffin XL. Nails or plates for fracture of the distal femur? Data from the Victoria Orthopaedic Trauma Outcomes Registry. Bone Joint J. 2016; 98-B:846-850.
2. Hoffmann MF, Jones CB, Sietsema DL, Tornetta P, Koenig SJ. Clinical Outcomes of locked plating of distal femoral fractures in a retrospective cohort. J OrthopSurg Res. 2013; 8:43.
3. Kolmert L, Wulff K. Epidemiology and treatment of distal femoral fractures in adults. ActaOrthop Scand. 1982;53:957-962.
4. Papadokostakis G, Papakostidis C, Dimitriou R, Giannoudis PV. The role and efficacy of retrograde nailing for the treatment of diaphyseal and distal femoral fracturers: a systematic review of the literature. Injury. 2005;36:813-822.
5. Martinet O, Cordey J, Harder Y, Maier A, Buhler M, Barraud GE. The epidemiology of fractures of the distal femur. Injury. 2000;31:62-63.
6. Meek RM, Norwood T, Smith R, Brenkel IJ, Howie CR. The risk of peri-prosthetic fracture after primary and revision total hip and knee replacement. J Bone Joint Surg[Br]. 2011;93:96-101.
7. Auffarth A, Bogner R, Koller H, Tauber M, Mayer M, Resch H et al. How severe are initially undetected injuries to the knee accompanying a femoral shaft fracture? J. Trauma. 2009;66:1398-1401.
8. Stewart MJ, Sisk TD, Wallace SL. Fractures of the distal third of the femur. A comparison of methods of treatment. J. Bone Jt. Surg. 1966;48-A:784-807.
9. Dugan TR, Hubert MG, Siska PA, Pape HC, Tarkin IS. Open supracondylar femur fractures with bone loss in the polytraumatized patient – Timing is everything! Injury, Int. J.Care Injured. 2013;44:1826-1831.
10. Arazi M, Memik R, Ogun TC, Yel M. Ilizarov external fixationfor severely comminuted supracondylar and intercondylar fractures of the distal femur. J Bone Joint Surg[Br].2001;83-B:663-667.

11. Kumar P, Singh GK, Singh M, Bajraacharya S. Treatment of Gustilo grade IIIB supracondylar fractures of the femur with Ilizarov external fixator. ActaOrthop. Belg. 2006; 72: 332-336.
12. Parekh AA, Smith WR, Silva S, Aqudelo JF, Williams AE, Hak D, Morgan SJ. J Trauma. 2008;64(3): 736-739.
13. Sanders R, Swiontkowski M, Rosen H, Helfet D. Double plating of comminuted, unstable fractures of the distal part of the femur. J Bone Joint Surg Am. 1991;73(3):341-346.
14. Rorabeck CH, Taylor JW. Periprosthetic fractures of the femur complicating total knee arthroplasty. OrthopClin North Am. 1999;30:265-277.