

FUNCTIONAL OUTCOME ANALYSIS OF STAGED MANAGEMENT OF COMPOUND DISTAL FEMUR FRACTURE

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Abstract

Background: Distal femur fractures are more serious injuries that cause varied degrees of permanent impairment. As the number of roadways grows and high-speed driving becomes more common, the risk of devastating injuries such as open femur fractures with polytrauma rises dramatically. Therefore, the present study is designed to determine the functional outcome of compound distal femur fractures. **Materials and Methods:** A cross sectional study was conducted at the Institute of orthopaedics and traumatology, Madras medical college, Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, from November 2019 to November 2021. During the study period, 30 patients with compound distal femur fractures who presented to the emergency department were included. **Results:** The fractures were more common in the middle-aged group individuals belonging to 36-45 years age group (26.6%), and on the right leg (66.7%). There was a definitive male preponderance of 20 (66.7%) in our study. Pedestrian vs four-wheeler (50%) was the most common mechanism of injury. The minimum and maximum duration of treatment were found to be 1 and 12 weeks respectively. **Conclusion:** Gustilo Anderson type IIIB fractures were most common. External fixation was the most common treatment, and the functional outcome was satisfactorily good in 10 (33.3%).

INTRODUCTION

Distal femur fractures are more serious injuries that cause varied degrees of permanent impairment. As the number of roadways grows and high-speed driving becomes more common, the risk of devastating injuries such as open femur fractures with polytrauma rises dramatically. A variety of bone and soft tissue loss can be seen in these traumas.^[1]

A simple to complex comminuted supracondylar femur fracture pattern with intraarticular fracture extension and severe soft tissue injuries and bone loss are all possibilities. Most orthopaedic surgeons are understandably hesitant to employ bone grafts as a first line of treatment for open injuries with severe comminution and contamination with bone loss. Fracture fixation and rehabilitation of patients in compound distal femur fracture injuries remains a problem of uncertain for many surgeons, despite changing expectations and an increase in high-velocity injuries.^[2]

In patients with high velocity road traffic accident injuries, the presence of major injuries to other areas such as the head, chest, abdomen, and injury to other appendicular skeletons frequently complicates the issue, jeopardising the treatment outcome. Compound fractures are initially stabilized with external fixation followed by bone grafting until the soft tissue has healed, while others encourage restoring both the osseous and soft tissue aspects as soon as For Gustilo Anderson Grade IIIA and IIIB fractures, traditional therapy with numerous operational procedures generally leads in a poor functional outcome and a high likelihood of late amputation.^[3]

Distal femur fractures are more complicated injuries that can be difficult to treat. These catastrophic injuries have the highest risk of causing long-term disability. The compound distal femur fracture, which includes the distal femoral metaphysis (supracondylar) and the distal femoral articular surface, is the subject of this study (intercondylar). According to evidence from multiple studies, the degree of concomitant soft tissue injury determines

the functional outcome of compound comminuted distal femur fractures.^[4]

Injuries to the head such as cranial fractures and subdural haemorrhage, thorax, abdomen, and other appendicular skeleton and blunt abdominal trauma aggravate the situation in patients who have sustained such high-velocity injuries, jeopardising the final functional outcome. Because patients do not tolerate extended periods of immobilisation and several surgical operations are risky, compound distal femur fractures provide a particularly difficult treatment challenge.^[5]

Therefore, the present study is designed to determine the functional outcome of compound distal femur fractures in terms of immobilisation time, period between initial management, and definitive fixation.

MATERIALS AND METHODS

Study Design

A cross sectional study was conducted at the Institute of orthopaedics and traumatology, Madras medical college, Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, from November 2019 to November 2021.

Study Participants

During the study period, 30 patients with compound distal femur fractures who presented to the emergency department at Rajiv Gandhi Government General Hospital, Chennai were included. The inclusion criteria were age above 18 years, both males and females, and patients with Gustilo Anderson type I and type I, IIIA and B fractures. Those patients below 18 years of age, pathological and peri-prosthetic fractures, and fractures associated with vascular injury were excluded from this study.

Study Methodology

On patients' arrival to the emergency room, initial emergency management was carried out by maintaining airway, breathing and circulation as per ATLS protocol. Thorough assessment of the patient was done to rule out head, chest, pelvic, spinal, and other associated injuries. Patients were stabilized with intravenous fluids, oxygen and blood transfusion as required. Distal neurovascular status of the patient was carefully assessed. Then the fractured extremity was immobilized in a Thomas splint and sent for radiological examination. Radiographs and CT scans were done to assess the fracture type, amount of displacement, angulation, comminution and intra articular extension. Fractures were classified according to AO/OTA and Gustilo Anderson classification of distal femur fractures.

Data Collection

On admission, a case documentation form was used for documenting the details of the patient and the injury which includes name, age, gender, mechanism of injury, type of injury, side of injury, associated injuries, and examination findings of the

patient. Relevant investigations for surgical work up were done in all patients which includes complete hemogram, renal function tests, liver function tests, electrolytes, blood sugar, blood grouping and typing and viral markers. Blood investigations were repeated in the post operative period.

Surgical Procedure

Patient was positioned supine on the operating table with a pillow below the knee to flex the knee. Limb to be operated, ipsilateral iliac crest and contralateral leg were scrubbed with povidone iodine. Approaches used include standard lateral approach in majority of the cases and swashbuckler approach in fractures with comminuted intraarticular fractures.

Lateral Approach

Incision was made directing laterally in the thigh and through the midpoint of lateral femoral condyle staying anterior to the proximal insertion of lateral collateral ligament. Incision was extended as necessary for the diaphyseal involvement of the distal femur fractures. Incision was extended distally so that it curves gently from the knee joint anteriorly to the lateral border of tibial tubercle. Fascia lata and fibres of iliotibial tract was incised in line with the skin incision. Incision was carried down incising the capsule and synovium on the lateral aspect of femoral condyle, exposing the articular surface of lateral femoral condyle. Vastus lateralis muscle was reflected off the lateral intermuscular septum in order to expose the shaft of distal femur.

Swashbuckler Approach

A midline incision was made above the fracture laterally to across the patella. Incision was extended directly down to the fascia of the quadriceps. Quadriceps fascia was then incised in line with the skin incision, which was then dissected off the vastus lateralis muscle laterally. Iliotibial band and fascia were retracted laterally, and the dissection was continued till linea aspera. Lateral parapatellar retinaculum was incised separating it from the vastus lateralis. Lateral parapatellar arthrotomy was done to expose the femoral condyles. Perforating vessels were identified and ligated. Complete hemostasis was achieved, and the wound was closed in layers over a suction drain.

All patients were followed up regularly at an interval of 4 weeks, 2 months, 3 months, 6 months, and 1 year. During every follow up, patient was assessed both clinically and radiologically. Radiological union was said to be achieved when there was evidence of bridging callus on three cortices in standard AP and lateral radiographs. Presence of varus collapse was assessed by an angle formed between two lines (frontal plane joint orientation line of knee and a line perpendicular to it). Angle formed was measured periodically during every follow up. We have used Tegner and Lysholm score and KOOS (Knee injury and osteoarthritis outcome score) score for assessing the functional outcome of patients who are treated with a staged

management procedure for open distal femur fracture.

Ethical Issues

The study was conducted after getting approval from the Institutional Ethical Committee (IEC). Informed written consent were obtained from the study participants, and their family members after explaining in detail about the study methods and the risks associated with it.

Statistical Analysis

Data was entered and analyzed using Statistical Packages for Social Sciences (SPSS) version 24. The descriptive data were expressed as numbers and percentages.

RESULTS

Out of 30 study participants, 20 (66.7%) were males and 10 (33.3%) were females. The fractures were more common in the middle-aged group individuals belonging to 36-45 years age group at 8 (26.6%), followed by individuals in the 26-35 age group at 7 (23.3%). Open distal femur fractures were common on the right side (66.7%). All patients sustained injury due to road traffic accidents, in which pedestrian vs four-wheeler (50%) was the most common mechanism of injury. The details are given in Table 1.

Table 1: Characteristics of the study participants (n = 30)

Variable	Number	Percentage	
Age	16-25 years	4	13.3
	26-35 years	7	23.3
	36-45 years	8	26.6
	46-55 years	4	13.3
	55-65 years	5	16.8
	≥ 66 years	2	6.7
Sex	Male	20	66.7
	Female	10	33.3
Distal femur fractures	Right side	20	67.7
	Left side	10	33.3
Mode of injury	Pedestrians' vs four-wheeler	15	50.0
	Two-wheeler vs four-wheeler	13	43.4
	Two-wheeler vs two-wheeler	1	3.3
	Four-wheeler vs four-wheeler	1	3.3

The duration between initial to definitive management of most of patients are found to be 3 weeks, 8 (26.6%) followed by 2 weeks at 7 (23.3%). The minimum and maximum duration of treatment were found to be 1 and 12 weeks respectively. In our study, distal femur fractures were classified according to AO/OTA (Muller's) classification in which C3 fractures 19 (63.3%) were more common than C2 fractures. In Gustilo Anderson's classification, type IIIB fractures 13 (43.3%) were more common than type II fractures. The details are given in table 2.

Table 2: Classification of distal femur fractures among the study participants

Fracture classification	Number	Percentage	
Muller's classification	A3	3	10.0
	B1	3	10.0
	B2	2	6.7
	B3	1	3.3
	C2	2	6.7
	C3	19	63.3
Gustilo Anderson's classification	Type II	11	36.7
	Type IIIA	6	20.0
	Type IIIB	13	43.3

Fractures involving the tibia, 12 (40%) were the most common associated fractures, in which tibial plateau, 5 (16%) and both bone leg fractures, 5 (16%) were the fractures associated with open distal femur fractures. Initial management of wound debridement (WD) is followed by definitive fixation in all cases, in which WD and external fixation is done in most of the cases 13 (43.33%) of patients with open distal femur fractures followed by WD, external fixation and K wire fixation in 6 (20%) patients. The functional outcome of the treatment as reported by the study participants are given in Table 3.

Table 3: Functional outcome of treatment as reported by study participants

Functional outcome	Number	Percentage
Excellent	3	10.0
Satisfactory fair	8	26.6
Satisfactory good	10	33.3
Unsatisfactory fair	5	16.8
Failure poor	4	13.3

DISCUSSION

The presence of open fractures requires thorough evaluation of the soft tissues to assess their viability. Meticulous wound debridement is mandatory and is the cornerstone of open supracondylar femur fracture treatment. Distal femur fractures treated with distal femur LCP have undoubtedly improved the stability owing to its multiple points of fixation and subsequent overall outcome with early return to function.

In our study of 30 patients of open supracondylar fractures of femur, the mean age of occurrence of fracture was 41.63 years. This is similar to the results reported in other studies, 47.2 years by JM Siliski et al.^[6], 50 years by Gellman et al.^[7]

. The incidence of fracture in the present study was high in the age group of 36-45 years. The most common mode of injury was road traffic accidents (pedestrian vs four-wheelers) in our study similar to other studies.^[1,8] There was a definitive male preponderance of 20 (66.7%) in our study.

The average time interval between injury and definitive fixation was higher in our study (ranged from 1 weeks to 12 weeks) which is attributed to the non-availability of theatre days and consistently elevated C-Reactive protein level. Bone grafting was done in fracture with gross comminution and fractures with severe osteoporosis. Rohn AR et al. recommended bone grafting two to three weeks after successful wound coverage.^[9]

In our study, we have used external fixators either alone or with cancellous screws and k-wires that resulted in good functional outcome. The use of external fixator has many theoretical advantages for helping to promote union. In the distal femur the cortex is thin and there is a widened medullary cavity with cancellous bone. In addition, the distal fragment is usually short. All these features make the stable fixation difficult to achieve.

Residual pain was rarely significant and then only when secondary arthritic changes had developed. Most patients were satisfied so long as they had strong extensor power and could flex the knee 70 degrees. This enabled them to walk on stairs normally while a lesser range of flexion forced them to climb stairs sideways.^[10] Though we achieved satisfactory union in compound supracondylar

fractures of femur, the functional outcome still remains to be poor in severe (Grade IIIB) cases. Our study is not without limitations. The sample size is small, and the study was carried out in a single centre. The validity of these results can be increased by increasing the sample size.

CONCLUSION

The compound distal femur fractures were found to be more common in males in the 36 – 45 years age group, and right leg was involved in most cases. Gustilo Anderson type IIIB fractures were most common. External fixation was the most common treatment, and the functional outcome was satisfactorily good in 10 (33.3%) study participants.

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