

Research Article

Study of distal femoral fractures

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Abstract

Introduction: Modernization has resulted into increase in number of road traffic accidents resulting into higher frequency and severity of distal femur fractures. Vulnerable for injuries in accidental injuries fracture, since bumper of most of the car is at the knee height.

Methods and materials: A detailed study of distal femur fractures was carried out on 39 patients at Dhiraj General Hospital, Pipariya from May-2009 to November-2011 which is a tertiary care centre in a rural area

Result and Conclusion: Distal femur fractures are most commonly seen in males & most common cause is road traffic accident. - Distal femoral locking plate gives good results then condylar buttress plate. - Close fractures unite earlier then open fractures irrespective of type of the fracture.

Keywords: Femoral locking plate, Fracture

1. Introduction

Modernization has resulted into increase in number of road traffic accidents resulting into higher frequency and severity of distal femur fractures. Knee joint is most vulnerable for injuries in accidental injuries fracture, since bumper of most of the car is at the knee height. Vehicular accidents invariably lead to higher incidences of bumper fractures (fracture around knee)¹.

In elderly patients distal end of femur fractures occur after minor trauma or slip because of osteoporotic bones. These fractures are difficult to treat. Unstable and comminuted type of distal end of femur fractures may occur in high energy trauma and elderly patients. Because of proximity of these fractures to the knee joint, regaining of the full knee motion and function may be difficult¹.

Distal femur fractures occur at approximately one tenth the rate of proximal femur fractures and make up 6% of all femur fractures. There is a bimodal distribution of fractures based on age and gender. Most high-energy distal femur fractures occur in males between 15 and 50 years, while most low-energy fractures occur in osteoporotic women >50 years.¹ The most common high energy mechanism of injury is a traffic accident (53%) and the most common low energy mechanism is a fall at home (33%)².

These potentially serious injuries result in various degrees of permanent disability and continue to pose a therapeutic challenge to the modern orthopaedic surgeons even today in achieving successful outcome.

Therapeutics challenges posed by distal femoral fractures are due to following peculiarities:-

- Osteoporotic fractures
- Open fractures
- Fractures with short articular segments⁵.

Before the development of techniques and implants to provide stable fixation, most distal femur fractures were treated with skeletal traction¹. Disappointments with closed treatment were in terms of prolonged hospitalization³, knee stiffness, deep vein thrombosis, urinary tract & pulmonary tract infection, non-union, malunion, pin tract infection⁵. Recent literature thus supports surgical intervention in non ambulatory patients to avoid such complications².

Many fracture fixation implants are now available each having its own merits and demerits. Anatomic reduction of the articular surface, restoration of limb alignment, and early mobilization has been shown to be effective ways of managing most distal femoral fractures.

Despite the advances in techniques and the improvements in surgical implants, treatment of distal femoral fractures remains a challenge in many situations¹. Hence a study is carried out to evaluate the results of distal femur fractures treated with different modalities so that it helps in careful selection of patients and implants and determine its outcomes.

2. Methods and materials

A detailed study of distal femur fractures was carried out on 39 patients from May-2009 to November-2011 in a tertiary care centre in a rural area. All the presenting patients were thoroughly examined and evaluated. Depending upon the fracture configuration (classified by AO classification) and the clinical condition, they were treated with different modalities. They were followed to an average of approximately 6 months and the outcomes were analyzed based on knee society score.

3. Observation and results

According to sex distribution majority of patients 30(76.92%) were male while 9(23.04%) were female and almost 41% patients were from productive age group of 20-40 years. As in our study there is high preponderance of males even as observed by Siliski *et al*². The male preponderance has been attributed to a reason of more outgoing personality and thus high rate of incidence of road traffic accidents amongst them. Most common cause of injury in our study was road traffic accident (88.24%) which could be probably due to high number of two wheelers

in our country which commonly leads to associated ipsilateral limb injuries. Siliski *et al.* observed that 76% patients had road traffic accidents, 26 patients out of 30 patients who had multiple injuries were caused by road traffic accidents., 17/ 39 patients had open fractures.

Fractures were classified based on AO classification as shown in **table 1**. A.O type C3 fracture which is comminuted and due to high velocity trauma is more commonly open IIIb type fracture (11 out of 17). According to literature type C3 seen in approx 58% of open fracture cases and in approx 27% of all cases⁹. According to Gwathmey *et al* Open fracture occurs in 5% to 10% of supracondylar fractures⁸. The ratio of open injury is higher in our study because most of them are due to road traffic accidents. The patients also sustained associated injuries as shown in **table 2**. It has also been observed in our study that due to good awareness and good transport facilities (particularly of ambulance services) most of the patients (31 out of 39 patients) could reach hospital within 24 hours, while 7 patients presented late to our hospital after taking primary treatment elsewhere. However one of the patients presented to us after more than 8 weeks of injury (undiagnosed), who was later diagnosed and treated at our centre. All patients in our study underwent operative intervention. 9 patients were submitted for primary debridement & fracture stabilisation within 24 hours of admission, while remaining patients were taken for surgery once they became fit for anaesthesia & surgery (local skin condition). In majority of cases (31 out of 39) fracture reduction & fixation was achieved by open reduction and internal fixation. The choice of implant was dependent on the type of fracture & operating surgeon as shown in **table 3** Unicondylar fractures were treated by cancellous cannulated screws. Open injuries were treated with external fixator & one patient of comminuted type A2 was treated with Ilizarov fixator. In 13 patients distal femoral locking plates were used. In 6 patients condylar buttress plates were used & in remaining of cases simple L.C.P, I.M.S.C nail and Anterograde nail were used (depending upon fracture type and surgeon's choice).

Table 1: Open/Close Type

Type of fractures	Close	Open				Total	Total %
		I	II	IIIA	IIIB		
A2	2	0	2	0	0	4	10.3
B2	2	0	0	0	0	2	5.1
B3	0	0	1	0	0	1	2.6
C1	7	0	0	0	0	7	17.9
C2	5	0	0	0	2	7	17.9
C3	6	0	0	1	11	18	46.2
Subtotal	22	0	3	1	13	39	100

Table 2: Associated Injuries

Associated Injuries	No. of patients	Total No.	Percentage
Ipsilateral side			
Ankle injury	1	11	28.0
Tibia fracture*	7		
Neck femur**	1		
Segmental femur fracture***	1		
Radius fracture	1		
Contralateral side			
Olecrenon fracture	1	3	7.8
Tibia fracture	2		
Open gr.-III upper 1/3rd radius & olecrenon	1	1	2.6
open book type of Pelvis injury	1	1	2.6
Total	16	16	100

*= 2 patients had tibia fracture with 2nd metatarsal fracture, 3 patients had tibia shaft fracture, 1 patient had femur segmental fracture
 ** = patient also had ipsilateral patella fracture
 ***= patient also had ipsilateral patella fracture

Table 3: Implant used

Implant	Type of fracture						Total
	A2	B2	B3	C1	C2	C3	
CC screw	0	2	0	2	0	2	6
Condylar buttress plate	0	0	0	0	1	5	6
Distal femoral lock plate	2	0	1	1	6	3	13
Ex fix.	0	0	0	0	0	7	7
IM nail	1	0	0	3	0	0	4
Ilizarov	1	0	0	0	0	0	1
IMSC	0	0	0	1	0	0	1
LCP	0	0	0	0	0	1	1
Total	4	2	1	7	7	18	39

CC SCREW- cannulated cancellous screw; EX FIX- external fixator; IM NAIL-intramedullary nail;
 LCP- locking compression plate; IMSC-intramedullary supracondylar

Majority of patients were given immobilisation either with slab or cast as advised by operating surgeon. In our study duration of immobilisation was decided by operative surgeon based on stability of fracture fixation. Majority of these fractures are result of the high velocity trauma & old osteoporotic bone. In comminuted and open fractures there are high chances of delayed union, non-union, osteomyelitis and implant failure 3, 4, 5. All these conditions require secondary procedure in the form of bone grafting, debridement, exchange of implant and refixation of the fracture. Often these conditions may require combination of the secondary procedures or repetition of the procedures. In our study one secondary procedure was done in 4 patients, 2 secondary procedures were required in 7 patients, in 1 patient of C3 type fracture 3 secondary procedures had to be done. 5 patients underwent bone grafting following which 3 patients had union while 2 patients still had non-union because of resorption of grafts due to infection.

All close fracture united within 25-36 weeks whereas majority of open fractures united after 32 weeks or more. In open fractures there are high chances of delayed union. Kanabar *et al.* observed in his study that closed fracture takes 10-36 weeks to unite.⁶ One of the most common

complications observed in our study was infection. Several factors play an important role in the development of infection like extensive approach, contused soft tissues and open comminuted injury. 3 Open fractures are more likely to develop osteomyelitis than closed fractures. 33 patients in our study had early post operative infection and all 3 had open injuries at the time of presentation. Similar results were also seen in study of Hierholzer *et al*⁷. In our study we had 3 patients of osteomyelitis at the final follow up, out of which 2 patients had open IIIB C3 fracture while 1 patient had closed C3 fracture, was operated outside with Condylar buttress plate and had developed infection. All three patients had poor results. According to a study by Chee *et al* there are up to 20% chances of late infection in open fracture⁴.

When patients are having intra articular fracture involvement & /or quadriceps mechanism tear there are high chances of loss of knee range of movement⁴. In most of the C3 type fractures and open fractures having comminution either at intercondylar region or articular margin leads to loss of range of motion/ knee stiffness. In our study majority of distal femur fracture other than C3 had more than 80* flexion however majority of patients with open C3 had range of movement less than 80*. This group of patients also has more chances of extensor leg and fixed flexion deformity. These results are comparable to the study done by Hakeem *et al* in Peshawar.⁵We had used knee society score given by Insall *et al* to analyse outcome results & functional results.¹²According to this scoring system majority of A2 (2 of 4), B2 (1 of 1), C1 (5 out of 5), C2 (3 of 4) type of fractures had good to excellent results, while majority of C3 type fractures (7 out of 9) had poor outcome because of fracture comminution. Similar results were observed by Chee *et al* in his study.⁴ One study reported that the outcome after ORIF of high-grade type C fractures only 56%(5 of 9) had a satisfactory result.¹¹Patients with simple fracture patterns tend to do well with surgical treatment, and more complex fractures (type C3) are associated with a higher risk of complication and poor outcome¹¹.

According to implant result of knee score is good to excellent in C.C. Screw (one patient each of B2, B3), IMSC (One patient of C1), Simple L.C.P. (One patient of C3) and IM Nail, poor in Condylar buttress plate, Ilizarov (one patient of A2), external fixator (3 out of 4 had poor results-all had open C3 injury) and equivocal in distal femoral lock plate. We had poor result in Ilizarov due to associated injuries (ipsilateral neck femur & patella). According to functional score majority of patients of A2(2 of 4),B2(1 of 1),C1(4 out of 5),C2(3 out of 4) patients had excellent functional outcome and majority of C3 type fracture (5 out of 9) had poor outcome.

Patients of type C3 fractures took long time for healing and outcome of these fractures are also not satisfactory so they take long time to return to their occupation. There are some patients who were not able to do their work after trauma so they had to change their occupation or forcefully retire from pre injury occupation. In our study one patient had changed his occupation (electrician to clerk) and 4 patients had retired after trauma due to poor outcome. Patients with simple fracture patterns tend to do well with surgical treatment, and more complex fractures (type C3) are associated with a higher risk of complication and poor outcome¹¹.

4. Summary

In our study, 39 distal femoral fractures were studied out of which 32(82.0%) patients were associated with road traffic accidents. Male female ratio was 10:3 Majority of affected patients (41%) were from 20-40 year age group. The male preponderance and young patients having fracture can be due to more outgoing personality and thus high rate of incidence of road traffic accidents amongst them.

Also due to higher velocity of traumatic injury in road traffic accidents, 17/39 patients had compound fractures whereas 18/39 had C3 fractures. Based on fracture configuration and soft tissue condition, various operative procedures were selected. However the results as compared by knee society score were worse in the fractures having more intra articular comminution and open fractures. Fractures with intra articular comminution usually occur following high velocity trauma due to which patients can have significant soft tissue injury as well. These patients have higher chances of quadriceps function disruption thereby resulting into knee stiffness. Similarly open fractures have increased chances of infection thereby worsening the functional outcome of the patient. Thus Patients with simple fracture patterns tend to do well with surgical treatment but more complex fractures are associated with a higher risk of complication and poor outcome inspite of adequate treatment.

5. Conclusion

From our study we came to following conclusions;

- Distal femur fractures are most commonly seen in males & most common cause is road traffic accident.
- Distal femoral locking plate gives good results then condylar buttress plate.
- Close fractures unite earlier then open fractures irrespective of type of the fracture.
- Most common complications in patients treated operatively are infection, non union & knee stiffness.
- Type C3 fracture with open grade IIIB usually gives poor result.
- Change of occupation and retirement is commonly seen in open grade IIIB fractures.

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