

Management of Distal Femur Fracture with Dual Plating using Anterolateral and Medial Approach: A Case Series

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ABSTRACT

Dual plating of distal femoral fractures is indicated in a supracondylar bone loss, trans-bi-condylar fractures, Hoffa fracture, periprosthetic femur fractures, non union after failed fixation using single plating, osteoporotic bone quality, and AO type C3 comminuted distal femur fractures. Ten patients (7 males and 3 females) came to the emergency department with a history of a roadside accident. Based on clinical history and radiographic evaluation, a diagnosis of AO type C3 distal femoral fracture was made. All were treated using dual plating via anterolateral and medial approaches. Mean operative time was 200±40 minutes. Overall, the patient outcome was favourable. The majority of patients (70%) had a good range of motion (>90°). Dual plating allows for better exposure, easy manipulation, and biomechanical stability, as well as congruous reduction of the fracture.

Keywords: Biomechanical stability, Comminuted, Infection, Non union, Reduction

INTRODUCTION

Distal femur fractures are one of the variants of complex trauma caused by high-energy forces, like roadside accidents and falling accidents. As per the literature, incidences of distal femur fractures are 8.7/100,000/year with a bimodal distribution [1]. Depending upon the force of trauma, distal femur fractures present as excruciating pain, swelling, along deformity of the distal thigh. Conservative management includes closed reduction and immobilisation. However, non operative treatment is rare but can be relatively advised for a frail patient, non ambulatory status, stable fracture, and a non constructible fracture [2]. Surgical management comprises retrograde femoral nailing and the lateral locking plate. With the availability of various techniques, the lateral locking plate is most commonly used and popular for the management of distal femur fractures. Dual plating is indicated for the management of complex intra-articular fractures, supracondylar fractures of the femur, non unions, and periprosthetic fractures [3,4].

CASE SERIES

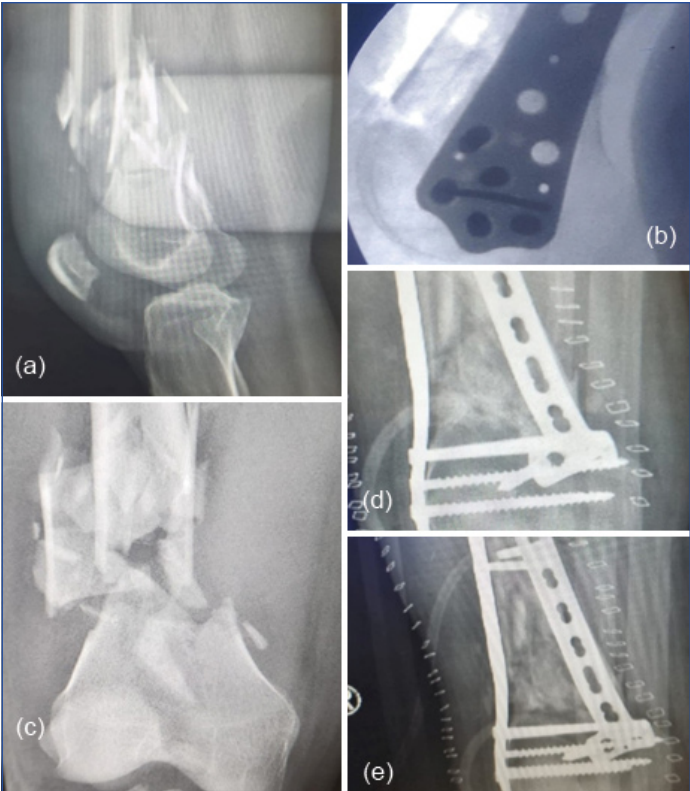
A case series of ten patients (seven males, three females) who underwent surgery for fixation of distal femur fracture (Type C3, AO classification) [5] using dual plating was enrolled as described in [Table/Fig-1]. The mean age of the patients was 40.7±6.53 years. The mechanism of injury was mainly a roadside accident among eight patients, whereas two had a history of falling from a height. Diagnosis of complex articular and metaphyseal fracture of the distal femur (AO type C2/3) was made after thorough clinical examination and radiological evaluation (plain anteroposterior and lateral X-rays view) as shown in [Table/Fig-2]. An operative plan was formulated with fixation of distal femur fractures using dual plating under anaesthesia.

SURGICAL APPROACH

The patient was lying in a supine position with knee flexion of 30°. The lateral parapatellar approach was used for fixation of the lateral plate.

S. No.	Age (in years)/ Gender	Mechanism of injury/side	AO/OTA classification	Co-morbidities	Time to surgery (in days)	Type of plating used	Duration of follow-up (in months)	Functional outcome (Lysholm score)	Complications
1	30/F	RTA/ left	C3	-	Day 1	T- type DFLCP	4.5	90	-
2	42/M	RTA/right	C2	Smoker	Day2	DFLCP 3.5 LCP	6	84	-
3	45/M	FALL/right	C3	Smoker/ Alcoholic	Day 2	DFLCP 3.5 LCP	9	81	
4	50/M	RTA/right	C3	HTN	Day 4	T- type DFLCP	10	77	Knee stiffness
5	34/F	RTA/left	C2	-	Day1	DFLCP 3.5 LCP	6	90	-
6	41/M	RTA/left	C3	Smoker/HTN	Day 3	DFLCP 3.5 LCP	9	86	-
7	48/F	FALL/right	C2	Diabetes mellitus	Day 4	T- type DFLCP	9	77	Superficial infection, Impingement of plate
8	39/M	RTA/left	C3	-	Day 1	DFLCP 3.5 LCP	6	86	-
9	32/M	RTA/right	C3	Smoker	Day 1	DFLCP 3.5 LCP	4.5	86	-
10	46/M	RTA/left	C3	Smoker/ Alcoholic	Day 2	T- type DFLCP	12	79	Knee stiffness

[Table/Fig-1]: Demographic characteristics.
DFLCP: Distal femoral locking compression plate; RTA: Road traffic accident; HTN: Hypertension; OTA: Orthopaedic trauma association; AO: Arbeitsgemeinschaft für osteosynthesefragen



[Table/Fig-2]: Radiographs showing comminuted distal femur fracture showing preoperative, (a and c)and postoperative(b,d, and e).

Functional outcome was assessed with the help of the Lysholm score. Radiological and surgical outcome were also assessed, as shown in [Table/Fig-4,5].

S. No.	Pre-op displacement (mm)	Post-op displacement (mm)	Deformity valgus/varus	Type of union
1.	10-12; intra-articular step-off 5-7	<2	Neutral	Radiologically union
2.	~18; intra-articular step-off 8	<2; intra-articular step-off 1-2mm	Neutral	Radiologically union
3.	8-10; intra-articular step-off 8-10	<2	Neutral	Radiologically union
4.	10-12; intra-articular step-off 4-6	<2	Neutral	Radiologically union
5.	12-15; intra-articular step-off 10-12	<2	Neutral	Radiologically union
6.	20-25; intra-articular step-off 3-5	<2; intra-articular step-off 1-2	Neutral	Radiologically union
7.	15-18; intra-articular step-off 8-10	<2	Neutral	Delayed union
8.	10-15; intra-articular step-off 4-6	<2	Neutral	Radiologically union
9.	~15; intra-articular step-off 5-7	<2	Neutral	Radiologically union
10.	13-15; intra-articular step off 7-9	<2	Neutral	Delayed union

[Table/Fig-4]: Radiological outcome after dual plating.

S. No.	Range of Motion (ROM)	Deformity valgus/varus	Type of union
1.	0-120°	-	Radiologically union
2.	0-100°	-	Radiologically union
3.	0-90°	-	Radiologically union
4.	0-100°	-	Radiologically union
5.	0-110°	-	Radiologically union
6.	0-90°	-	Radiologically union
7.	0-90°	-	Delayed union
8.	0-100°	-	Radiologically union
9.	0-100°	-	Radiologically union
10.	0-90°	-	Delayed union

[Table/Fig-5]: Surgical outcome after dual plating.

Postoperative Care

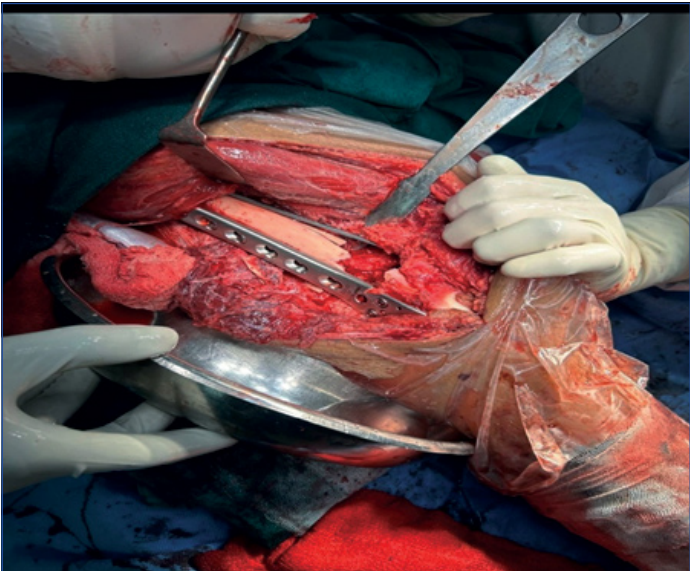
To allow early range of motion, quadriceps, hamstrings, and calf muscles strengthening exercises were advised. Active and passive movements of the hip and knee were started as early as day 1 postoperatively for early mobilisation and rehabilitation.

Weight Bearing

Touch-down weight bearing was started on postoperative day 1 with the help of a walker. Partial weight bearing was started after 2-3 weeks. Full weight bearing was allowed after 8 weeks.

Follow-up

Patient was planned for discharge after the third postoperative day following dressing of the surgical site. Follow-up was advised in routine Outpatient Department (OPD) after 2 weeks for radiographic evaluation and suture removal. Subsequently, visits at 1 month, 3 months and 6 months of the postoperative day were done to see the stability and healing of fracture site. One patient had superficial infection for which escalation of antibiotics and local site debridement was done. Patients having knee stiffness were motivated to undergo active physiotherapy to improve the range of motion.



[Table/Fig-3]: Image showing comminuted distal femur fracture intraoperatively.

DISCUSSION

Despite innovations in the field of implants and techniques, the fixation of intra-articular distal femur fractures remains challenging for the operating surgeon. Patients with marked comminution and extensive damage to articular cartilage can result in long-term disability. Fracture shortening and varus deformities of the distal articular surface are one of the common presentations. During the reduction of distal femur fractures, various problems like articular penetration, excessive penetration of the medial cortex, and anteromedial displacement with external rotation of the condylar part of the femur can occur [3].

Various approaches are available for the management of the distal femur fractures depending upon the type of fracture and the surgeon's preference. Intramedullary Nail (IMN) is a minimally invasive approach that uses indirect reduction for metaphyseal fractures. This technique is associated with fewer wound complications and decreased infection; however, anatomical reduction is not fully achieved with nails. In case of complex fractures, nailing cannot stabilise the fracture because of intra-articular extension, resulting in poor outcome, instability, and mal-reduction [4]. Dual plating aims at anatomical restoration of the articular surface, biomechanical stability, and prevention of varus deformity. Indications of dual plating are supracondylar bone loss, trans-bi-condylar fractures, Hoffa fracture, periprosthetic femur fractures, non union after failed fixation using single plating, osteoporotic bone quality, and AO type C3 comminuted distal femur fractures [3]. Biomechanical studies showed that dual plating results in increased stiffness and construct strength [6]. Keeping in mind the complexity of fractures, the outcomes of dual plating are very promising. Non union rates of dual plating range from 0-12.5%, lower than lateral locking plates, which are reported as 18-20% [7].

In present cases, authors used dual plating via anterolateral and medial approaches, which provides better visualisation and congruous reduction with rigid fixation. Dual plating also reduces the risk of failure of fixation. In complex fractures like extensive metaphyseal comminution, osteopenic bone, or open fractures, additional medial plating will help to provide better stability and decrease failure rates. Literature has suggested that in cases of medial bone loss more than 2 cm, medial plating along with bone grafting will provide additional stability [3,8]. In cases of high comminuted symptomatic knee, a more appropriate option can be primary arthroplasty [9].

Problems faced with dual plating are increased surgical duration, more blood loss, and periosteal stripping, which increase the duration of union. Metallic implants can also result in skin irritation and prominence at the local site. Infection rates were found to more with dual plating (0-16.7%) compared to lateral plating alone (3.6-8.5%) [10]. External fixation with internal fixation faces several problems, like septic arthritis, pin site infections, and osteomyelitis, in treating type-C femur fractures. Risk of inadequate reduction, non union, or delayed union can also be seen [11-12].

Zarin BH et al., used the anterior approach for dual plating. They suggested that the distal femur can be stabilised with dual plating using a single anterior approach, as it provides minimal medial dissection with excellent exposure [13]. Zhang ZM et al., also assessed the efficacy and feasibility of double plating, using the anterior/middle approach in managing distal femur fractures (type 3). The overall result of all patients was good [14]. Sanders R et al., showed that with single lateral plating, the achieved stabilisation was inadequate. For extra stabilisation, a medial plate with bone grafting was needed [15].

Pai Manjeswar M et al., conducted a study to assess the clinical results and functional outcome of fifty patients with distal femur fractures treated with dual plating. About 84% of patients did not

have Fixed Flexion Deformity (FFD) and walked normally by the 12th week postoperatively. 16% of cases had a residual displacement of more than 1.6 cm [16]. Similarly, in current study, despite variability in preoperative displacement, postoperative displacement was found to be less than 2 cm. Kale S et al., conducted a case series of seven patients with a 6 months follow-up to assess the outcomes of combined distal femur plating and retrograde femur nailing in comminuted femur fractures. It was shown that the range of movement improved significantly, and the fracture was united by the end of 6 months. The average Lysholm knee scoring scale was found to be good (65.17) [17]. The present study study also had similar findings, and the Lysholm knee scoring scale was 83.6, suggestive of a good functional outcome.

CONCLUSION(S)

Dual plating prevents malreduction of the fracture after meticulous placement and contouring of the lateral and medial plates. Adjunctive use also prevents varus collapse, especially in comminuted fractures and bone loss. Increased stability and strengthening result in good functional outcomes. Hence, authors concluded that functional outcomes were better with fractures managed with dual plating, probably due to superior fixation and early mobilisation.

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