European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 06, 2022

Original Research Article

Distal femur fractures: Functional outcome with single lateral anatomical locking plate

[1]Dr. Shivakumar Kerakkanavar, [2]Dr. Amith S Kallanagoudar, [3]Dr. Shashidhara H, [4]Dr. Druva V

[1,3]Associate Professor, Department of Orthopedics, SS Institute of Medical Sciences & Research Centre, Davangere, Karnataka, India
[2,4]Assistant Professor, Department of Orthopedics, SS Institute of Medical sciences & Research Centre, Davangere, Karnataka, India

Corresponding Author:
Dr. Druva V

Abstract

Introduction: Distal femur fractures account for 3-6% of all femoral fractures, which pose many clinical challenges to orthopaedic surgeons. A variety of surgical methods are available for definitive fixation. Since single lateral locked plating has been one of the best methods till recently, we want to study the functional outcome of distal femur intra-articular fractures fixed with single Lateral plating at our institution. *Objective:* To study functional out come of distal femur intraarticular fractures surgically treated with lateral anatomical locking plates *Materials And Methods:* This was a prospective follow up study conducted in department of Orthopaedics, S. S. Institute of Medical Sciences & Research Centre,Davanagere. Total 30 cases with closed distal femur fracture of Orthopaedic trauma association (AO/OTA) classification type 33C1, 33C2 & 33C3 with minimum of 1 year follow up at our institute were considered. Out of 30 cases one periprosthetic distal femur fracture, three open fractures and two AO type A fractures were excluded from the study. Remaining 24 patients were assessed for functional outcome with Knee Society Score recorded at 1 year follow up. *Results:* In three patients (12.5%) primary bone grafting with fibular strut was done at the time of index surgery. In another three patients (12.5%) cortico-cancellous grafting was done as a secondary procedure at 6-8 weeks following index surgery. Seventeen patients (70.8%) had no complications at the end of 1 year. Deep infection was noted in one patient (4.1%) who was treated with debridement and parenteral antibiotics. *Conclusion:* Although dual plating is the preferred method in treating distal femur fractures in young patients with good bone stock better results can be achieved even with single plating with due attention to medial cortical defect.

Keywords: Distal femur fractures, functional outcome, single lateral anatomical locking plate

Introduction

The fractures of the distal femur are severe injuries which pose many clinical challenges to orthopaedic surgeons. Distal femur fractures account for 3-6% of all femoral fractures and are going to increase in number due to aging population [1]. Intra articular distal femur fractures are complex injuries which are prone for long term disabilities. They include malunion, non-union, delayed union, implant failure, knee stiffness, post traumatic arthritis of knee joint and

the need for secondary procedures reflecting complications of healing [2, 3].
Historically results of conservative management of distal femur with traction, casting or a combination of both were disappointing [4, 5].
A variety of surgical methods are available for definitive fixation. Selection is based on the characteristics of the fracture and patient status. Implants have evolved from fixed angle devises like Fixed-angle side plates, including blade plates to condylar plates with a sliding barrel, locking plates and less invasive stabilization system (LISS). Locking plates provide greater versatility in managing intraarticular and osteoporotic fractures [6, 7].
More recently along with locked plating techniques, double plating methods have been advocated in complex intra articular fractures. The double plating method requires extensive soft tissue stripping on both sides of femur and has the risk of knee stiffness although this method gives better mechanical stability [8, 9].
Since single lateral locked plating has been one of the best methods till recently, we want to study the functional outcome of distal femur intra-articular fractures fixed with single plating at our institution.

Material and Methods

This was a prospective follow up study conducted in department of Orthopaedics, S. S. Institute of Medical Sciences & Research Centre,Davanagere. A total of 30 cases operated for distal femur fractures with single plate fixation were considered for this study. The clearance from institutional ethical committee was obtained before the study was started. Cases with closed distal femur fracture of Orthopaedic trauma association (AO/OTA) classification type 33C1, 33C2 & 33C3 with minimum of 1 year follow up at our institute, age 18 years and above of either gender, with co-morbid disease like controlled diabetes mellitus, hypertension, asthma, and other medical condition were included in the study. Children with intra articular distal femur fractures in whom growth plate is still open, compound fracture of distal femur, patients with ipsilateral tibia/proximal femur fractures, intra articular distal femur fractures with neurovascular compromise and periprosthetic fracture were excluded from the study.
Demographic information, medical comorbidities, smoking status, type of surgical fixation, complications, and knee range of motion were recorded from the medical charts for review. Out of 30 cases one periprosthetic distal femur fracture, three open fractures and two AO type A fractures were excluded from the study. Remaining 24 patients were assessed for functional outcome with knee society score recorded at 1 year follow up.
The data thus obtained was collected using pre designed proforma and analyzed using appropriate statistical tests.

Results

Table 1: Distribution of the study subjects according to demographic and clinical characteristics

Characteristics		Frequency	Percent
Age group	Less than 40 years	13	54.1
	More than 40 years	11	45.8
Sex	Male	18	75
	Female	6	25
Associated comorbidity	Nil	17	70.83
	Diabetes	4	16.6
	Hypertension	3	12.5
Mechanism of injury	Fall	6	25
	RTA	18	75

ISSN 2515-8260 Volume 09, Issue 06, 2022

Side affected	Left	8	33.3
	Right	16	66.6

Time interval between injury and surgery	Less than 3 days	11	45.83
	3 to 6 days	10	41.6
	More than 6 days	3	12.5
Type of injury	33C1	5	20.9
	33C2	9	37.5
	33C3	10	41.6

In our analysis of 24 patients we found majority of the patients with distal femoral fracture were aged less than 40 years. Males were higher than the females. About 16.6% of the study subjects had diabetes mellitus and 12.5% had hypertension as comorbidities. Road traffic accident was the main cause of injury. Most of the patients were affected on right side and underwent surgery within 3 days. About 40% of the patients had AO type 33C3 injuries.

Table 2: Outcome of the surgery

Characteristics		Frequency	Percent
Bone grafting	Nil	18	75
	Primary bone grafting	3	12.5
	Secondary bone grafting	3	12.5
Complications	Infection	1	4.1
	Mal alignment	4	16.6
	Non union	2	8.3
	Nil	17	70.8
Range of movements	80-90 degree	3	12.5
	90-120 degree	16	66.6
	More than 120 degrees	5	20.8
KSS	Poor	1	4.1
	Fair	6	25
	Good	11	45.8
	Excellent	6	25

In three patients (12.5%) primary bone grafting with fibular strut was done at the time of index surgery. In another three patients (12.5%) cortico-cancellous grafting was done as a secondary procedure at 6-8 weeks following index surgery.

Seventeen patients (70.8%) had no complications at the end of 1 year. Deep infection was noted in one patient (4.1%) who was treated with debridement and parenteral antibiotics. Mal union was commonest complication with varus angulation in 4 (16.6%) patients. Two patients (8.3%) were diagnosed as non-union, among them one had implant failure also. The details of further treatment of non-united fractures are not recorded as it is out of the context of the study. Even with non-union these patients had fair function with minimal pain and assisted walking. All patients were started with knee mobilisation as early as possible. Almost 66.6% of the patients had good range of movements between 90-120 degrees. About 45.8% of the patients had good function according to Knee society scoring and 25% had excellent scores.

Table 3: Distribution of the study group according to type of fracture and clinical characteristics

Mean ± SD	Type of fracture			P value, Sig
	C1	C2	C3	
Age in years	40.43 ± 13.57	40.45 ± 13.36	38.67 ± 8.77	0.921, NS
Time to union (months)	3.43 ± 0.53	3.45 ± 1.03	3.9 ± 0.57	0.352, NS
Range of motion (Degrees)	111.43 ± 16.0	103.64 ± 16.6	97.08 ± 8.65	0.107, NS
KSS	80.0 ± 7.79	76.18 ± 10.52	73.17 ± 11.06	0.382, NS

ISSN 2515-8260 Volume 09, Issue 06, 2022

Younger age group patients had complex injury like AO type 33 C3 than the older age group which was not statistically significant. The time to union of AO type C3 fractures was higher than the other types of injuries. The range of motion was higher in AO type C1 fractures compared to C3 fracture which was also not statistically significant. The Knee society score was higher in C1 and C2 type of fractures than C3 fractures but it was not statistically significant.

Fig 1: Preoperative radiograph-31 years female patient with AO 33C2.3 type fracture

Fig 2: Immediate post of radiograph of Fig. 1 patient

Fig 3: Follow up radiograph-12 months of Fig. 1 patient

Fig 4: Follow up photo at 12 months-knee range of motion of Fig.1 patient.

Discussion

This retrospective analytical study was undertaken to study the outcome of internal fixation of intra articular fracture of the distal femur by single lateral locking plate.

Distal femur fractures are known to have bimodal age presentation with younger patients sustaining these injuries due to road traffic accidents and elderly individuals due to low energy trauma. Best method of fixing intra articular distal femur fractures is of concern for the last two decades [10, 11, 12, 13].

This study has shown that, most of the patients with distal femoral fracture were aged less than 40 years and males outnumbered females. In a study *et al*. by Kim *et al*. [14], the mean age of the patients was 59.6 years which is higher than this study. In a study by Jalili *et al*.

ISSN 2515-8260 Volume 09, Issue 06, 2022

[15], the mean age of the patients was 37.4 years among the locking plate and 40.0 years among the non-locking plate group. Diabetes mellitus and hypertension were the comorbidities encountered in this study.

Most patients underwent surgery within 3 days. Kiran Kumar *et al*. [16] have reported road traffic accidents in more than half of the patients. A study by Kiran Patil *et al*. [17] have also noticed that the distal femur fractures were higher due to high speed road traffic accidents and also noticed that the intra-articular distal femur fractures were higher on right side compared to left side.

Comminuted intra articular distal femur fracture with metaphysical comminution, AO type 33 C3 was common in our study. This can be explained as our study had younger age group patients sustaining these injuries due to high velocity injuries. In a study by Supanich *et al*. [18], 23 fractures of distal femur were of C1 type, 52 were of C2 type and 11 were of C3 type. Whereas Pogiatzis K *et al*. studied only 33 C1 and 33 C2 fractures in which about 63% of the patients had type C1 fractures and 37% of the patients had type C2 fractures [19].

Primary and secondary bone grafting was used in 3 (12.5%) patients each. Primary bone grafting with fibular strut was used to support the medial cortex as only lateral plating was done for fixation of fractures. In 3 patients who were having bone gap/defect secondary bone grafting was contemplated after 6-8 weeks of index surgery to prevent non-union. Gwathmey *et al*. [6] suggested techniques to prevent collapse and malunion include bicortical proximal screw fixation, medial augmentation with primary bone grafting or plating for large metaphyseal defects, protected weight bearing and early surgical intervention with bone grafting for delayed union. Infection (4.1%), Malalignment (16.6%) and non-union (8.3%) were the complications encountered in this study. Near to 30 per cent of study subjects having complications is a large number. Many authors in the literature evaluated the effectiveness of lateral locked plates in managing distal femoral fractures with good union rates ranging from 81% to 95% but with many complications related to the single-plate use such as loss of reduction, malunion, rotational malpositioning and breakage leading to revision surgeries in a rate of 19% to 23% [20]. However majority of the patients had range of movements of 90-120 degrees.

The time to union of AO type C3 injuries was longer than the other types of injuries. The range of motion was higher in C1 injuries compared to C3 injuries, which was not statistically significant. The Knee society score was higher in type C1 and C2 fractures than C3 injuries but it was not statistically significant.

Petsatodis [21] reported that about 55% of the distal femoral fractures treated with Condylar buttress plate, fixed angle condylar blade plate and dynamic condylar screw had excellent results, 32% were good and 8% were moderate. They also reported that the outcomes in patients treated by the dynamic condylar screw were significantly superior to those treated with condylar buttress plate or fixed angle blade plate. In a study by Khalil AE *et al*. [22] of C3 fractures, two cases had excellent results, five cases had good results, three cases had fair results and two cases had poor results. Although there are very few studies in recent literature in favour of single lateral plating for distal femur fractures, this was the method of choice until recently. Double plating with or without bone grafting is the preferred method now. Briffa *et al*. [23] has demonstrated biomechanical superiority of dual plating of distal femur fractures compared to single plating in a controlled Sawbones model. none the less this method has its disadvantages like excessive soft tissue stripping, non-union due to more rigid fixation of fracture and knee stiffness [8]. Good functional score in our patients can be explained as most of the patients in our study were younger with good bone stock.

Conclusion

The study had shown good to excellent results in most of the patients. The locking plates

have shown to result in high range of motion in most of the patients. Although dual plating is the preferred method in treating distal femur fractures, in young patients with good bone stock better results can be achieved even with single plating with due attention to medial cortical defect.

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