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A Prospective Study of Surgical Outcome of Distal Femoral Fractures Treated With Locking Compression Plate

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Abstract
Introduction: *Commonly, distal femoral fractures are related with high velocity road traffic accidents. The incidence of distal femur fractures is approximately 37 per 1,00,000 person-years. In elderly persons distal femur fractures are associated with trivial fall due to osteoporosis and can cause difficulty in fracture fixation.*
Materials and Methods: *This is a prospective study conducted in the Department of Orthopaedics, Dr Lals Hospital, Kadru, Ranchi from January 2019 to December 2019. A total of 50 patients with distal femoral fractures were included in the study as per the inclusion criteria outlined previously. On admission detailed examination of the patients was carried out after hemodynamic stabilization. Then standard Antero-Posterior and Lateral view X-Rays are taken, and the fracture configuration noted. Computerized Tomography is also taken when needed to assess the exact alignment of the fragments. The fracture is classified using the following classification.*
Results: *The total number of patients was 50 with 30 males and 20 females. The youngest age in our study was 19 and the oldest age is 65. Modes of injury were-40 cases due to RTA, 6 cases due to accidental fall and 4 case due to fall of heavy object. The average months of follow up were 10. 6 months with longest of 23 months and shortest of 3 months. Average time to union was 18 weeks with a range from 10 weeks to 36 weeks. Mean range of motion was 0^{0}-106.8^{0}. Using the HSS scoring system, 72% had good to excellent results.*
Conclusion: *In our study, the results are encouraging with 72% of the patients having good to excellent results. Therefore, locking compression plate has a significant advantage with excellent results in treating distal femoral fractures. However, accurate positioning and fixation are required to produce satisfactory results.*
Key Words: RTA, *femoral fractures, hemodynamic stabilization*

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I. Introduction

Commonly, distal femoral fractures are related with high velocity road traffic accidents. The incidence of distal femur fractures is approximately 37 per 1,00,000 person-years. In elderly persons distal femur fractures are associated with trivial fall due to osteoporosis and can cause difficulty in fracture fixation.[1]

The incidence of these fractures in elderly osteoporotic patients and in young patients shows a bimodal distribution. Most of the treating surgeons agree that distal femur fractures need to be treated operatively to have good patient outcomes.[2] There are various options for operative treatment like plating techniques that require compression of the implant to the femoral shaft (blade plate, dynamic Condylar screw, non-locking condylar buttress plate), antegrade nailing, retrograde nailing, sub muscular locked internal fixation and external fixation.[3]

Bilateral plating is advocated but with bilateral plating there is often extensive soft tissue stripping on both sides of the femur, resulting in reduced blood supply and potential non-union and failure of the implants.[4] Most common and frequently used implant are dynamic condylar screw (DCS) system, which is a supracondylar plate combined with a lag screw. This DCS is more forgiving and allows correction in the sagittal plane after the lag screw is inserted.[5]

The LCP is a single beam construct where the strength of its fixation is equal to the sum of all screw-bone interfaces rather than a single screw's axial stiffness.[6] Good functional outcomes are seen when it is fixed via a minimally invasive technique, as it allows for prompt healing, low rates of infection and reduced bone resorption as blood supply is preserved. Internal fixation with locking plates creates a toggle free, fixed angle construct.[7] The study is undertaken to evaluate the outcome of management of distal femoral fractures using LCP which may be helpful to find the solutions for the age-old problems and complications associated with management of these complex fractures.

II. Materials And Methods

This is a prospective study conducted in the Department of Orthopaedics, Dr Lals Hospital, Kadru, Ranchi from January 2019 to December 2019.

Inclusion Criteria

1. Age more than 16 years.
2. Patients with distal femoral fractures which needs to be internally fixed in displaced Muller's type A, type B and type C fractures.
3. Patient who is preoperatively mobile.

Exclusion Criteria

1. Skeletal immaturity with open physis.
2. Undisplaced fracture patterns needing only conservative management.
3. Supracondylar fracture femur associated with other fractures.

Study Protocol

A total of 50 patients with distal femoral fractures were included in the study as per the inclusion criteria outlined previously. On admission detailed examination of the patients was carried out after hemodynamic stabilization. Then standard Antero-Posterior and Lateral view X-Rays are taken, and the fracture configuration noted. Computerized Tomography is also taken when needed to assess the exact alignment of the fragments. The fracture is classified using the following classification.

III. Results

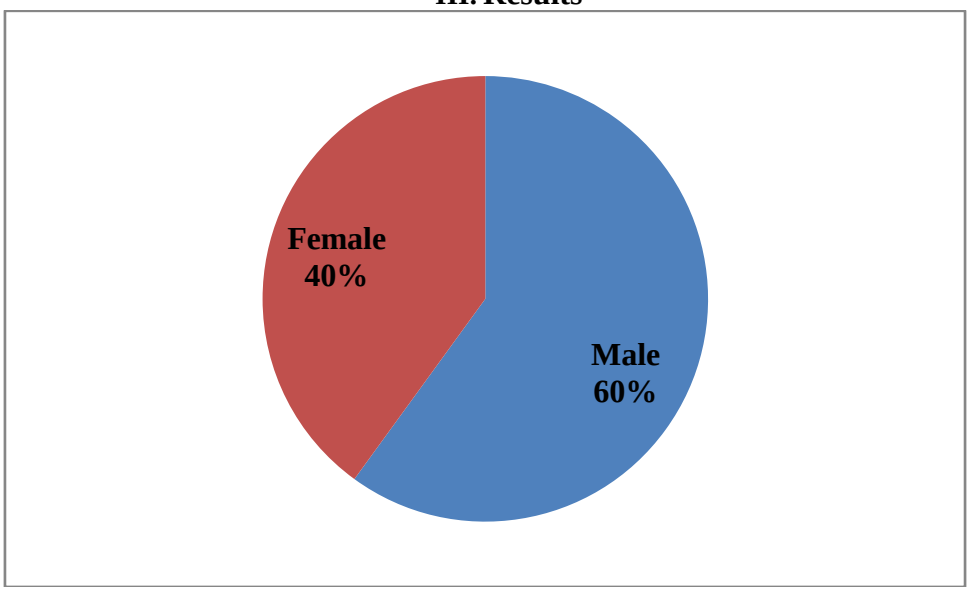

Figure 1: Gender Distribution

	Variables	Score
Pain	Walking (none to severe)	**15-0**
	At rest (none to severe)	**15-0**
Function	Walking (unlimited to unable)	**12-0**
	Stairs (normal to with support)	**5-2**
	Transfer (normal to with support)	**5-2**
	RoM (80°–120°)	**10-15**
	Muscle strength (grade 5–0)	**15-0**
	Flexion deformity (none to >20°)	**10-0**
	Instability (none to >15°)	**5-0**
Subtractions	One cane	**1**
	One crutch	**2**
	Two crutches	**3**
	Extension lag (5°–15°)	**2-5**
	Deformity (every 5°)	**1**

Table 2: HSS (Hospital for Special Surgery) Score

Total score: Excellent = 85 points or more, Good = 70–84 points, Fair = 60–69 points, Poor = less than 60 points.

Type	A1	A2	A3	B1	B2	B3	C1	C2	C3
No	**2**	**4**	**10**	**1**	**1**	**-**	**8**	**15**	**9**

Table 2: ***Muller's Classification Type***

HSS Outcome	No of cases	Percentage
Excellent	**28**	**56%**
Good	**8**	**16%**
Fair	**8**	**16%**
Failure	**6**	**12%**

Table 3: HSS Outcome

Author	No	Age	Followup months	ROM	Deep Infect %	Implant failure %	Removal due to pain %	Excellent and Good results
Kregor et al	66	9	2-103	3	1.7	-	-	-
Schutz et al	99	54	13.7	0-107	7	6	-	-
Markmiller et al	20	57	12	0-110	-	10	-	87.5
Apoatolou et al	19	54.5	16	0-108	5	5	-	81.25
Yeap and Deepak et al	11	44	9.7	1-107.5	-	9	-	72.5
Our study	50	35.1	13.6	0-106.8	4	8	4	72

Table 4: Comparison of Results of Distal Femoral Fractures Treated with LCP Obtained by Other Studies

The following were the observations made in the present study. The total number of patients was 50 with 30 males (60%) and 20 females (40%) (Chart 1). The youngest age in our study was 19 and the oldest age is 65. High incidence is found in 21 to 40 years age group with males are more common due to high velocity injuries. In more than 50 years age group females are predominantly affected mainly due to low velocity injuries.

Mode of injury were 40 cases due to RTA (80%), 6 cases due to accidental fall (12%) and 4 case due to fall of heavy object (8%). The average months of follow up were 10. 6 months with longest of 23 months and shortest of 3 months. Successful fracture union was defined as complete bridging callus in three cortices, together with painless full weight bearing. All patients were able to bear full weight postoperatively except for six patients. Excluding these patients, average time to union was 18 weeks with a range from 10 weeks to 36 weeks. Mean Range of motion was 0^0-106. 8^0. Using the HSS scoring system, there were 28 excellent results, 8 good, 8 fair and 6 failure. Excellent and Good 72%. (Table 3)

Complications

Complications included 4 implant failure of which three needed revision and in the other alignment was maintained and hence union achieved with Above Knee Cast application. There was one case of non-union and one case of deep infection which was treated with wound debridement and appropriate antibiotics and bony union obtained after 18 weeks. One patient had knee pain for which implant exit was done and after which he got relieved of pain.

The comparison with other studies for distal femoral LCP has shown similar results (Table 4). The mean range of motion was 0-106. 8 degrees which is similar to the other studies compared. The incidence of deep infection was 4%, with implant failure of 8% which all are comparable with the various studies. The percentage of patients with excellent and good results was 72% which is comparable and similar to the 72. 7% obtained by Yeap and Deepak et al.

IV. Discussion

Treatment of the Supracondylar fractures of the femur have been a controversial subject over the past two decades. There has been a changing philosophy towards surgical treatment of supracondylar fractures of femur. Close management of these fractures was the treatment of choice until 1970. This was due to non-availability of appropriate implants and lack of proper techniques. Apart from the usual problems of confining elderly patient to bed, conservative methods at any age may be complicated by knee stiffness, mal union and nonunion.[8]

The use of fixed angle devices such as condylar blade plate and the dynamic condylar screw (DCS) require certain amount of bone stock present, which limits their use in some fracture types. This lead to the development of condylar buttress plates for comminuted fractures However with standard buttress plating, these fractures often fall into varus deformity. Biomechanical studies revealed that gross loosening of standard condylar buttress plate and DCS occurred because of the toggle at the screw- plate interface. To address these issues, a first generation locking condylar plate was designed. A locking plate decreases the screw-plate toggle and motion at the bone-screw interface and provides more rigid fixation. Rigid fixation is felt to be one key to the successful treatment of these fractures.[9]

So now with the evolution of locking compression plating for distal femoral fractures especially for the comminuted intra articular fractures many of the older demerits could be addressed which includes the increased stability due to locking compression plating principle, multiple screw options in the distal fragment providing option for fixing the multiple fragments restoring the anatomical congruity and providing stable fixation of the distal fragment with the proximal fragment with resulting increased stability allowing for early mobilization.[1]

Varus malalignment was one of the complications which was encountered during the initial phase of the study. In the later phase of the study Varus malalignment was low due to the technique of maintaining gap between the plate and the proximal fragment and hence the good alignment was maintained. Also using lengthier plates rather than using small plates resulted in reduced rate of this complication in the later part of the study.

In Muller's C2 and C3 fractures due to the multiple screw options multiple fragments can be reduced with improved stability which cannot achieved by using the conventional DCS which uses only one large lag screw. 11 Also revision surgery can be done easily in LCP whereas in DCS if a revision surgery is planned the removal of the lag screw leaves a cavity in the condylar area which renders it difficult for fixation and even if fixation is done chances of failure is more due to poor bone stock.

V. Conclusion

The Distal Femur-Locking Compression Plate is a good implant to use for fractures of the distal femur. However, accurate positioning and fixation are required to produce satisfactory results. Our results are encouraging with 72% of the patients having good to excellent results. Therefore, locking compression plate has a significant advantage with excellent results in treating distal femoral fractures.

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