Comparative study between Dynamic Condylar Screw and Locking Plate Fixation in fractures of distal femur in adults – A study of 30 cases

Gururaj N.G[1,*], Vinaya G[2], Riyaz Ahmad[3]

[1]Assistant Professor, Dept. of Orthopaedics, [2]Assistant Professor, Dept. of Obstetrics, [3]Assistant Professor, Dept. of Community Medicine, KIMS, Karnataka

***Corresponding Author:**
Email: vinigururajnayak@gmail.com

Abstract

Background: The aim of treatment of the distal femoral fractures has been a balance between the goal of anatomical alignment and need for early function of limb.

Objective: 1. To compare the rigidity of fixation achieved.
2. To compare the restoration of anatomical joint surface.

Methodology: 30 patients of distal femoral fractures admitted to Department of Orthopaedics, at Government Medical College, Rajindra Hospital, Patiala. Only those cases were selected where ORIF is indicated like in patients with displaced intra-articular fractures, multiple injuries, severe ipsilateral limb injuries, displaced extra-articular supracondylar fractures, pathological fractures and most open fractures.

Results: Among 30 patients, 16 cases (54%) sustained A type and 14 cases (46%) suffered type C supracondylar fracture as per AO classification. In DCS group, most (80%) of the patients had A type of fracture. In LCP group, most (75%) of the patients had C type of fractures. Bone grafting was done in 8 (24%) cases at the time of primary fixation of fractures. In DCS group bone grafting was done in two cases and in LCP group in 6 cases. In the DCS group, we had 2 cases (6%) in which only one inter fragmentary screw and 1 case in which 2 inter fragmentary screws were fixed in the distal fragment along with DCS lag screw and plate to give additional support.

Conclusion: LCP is the implant of choice in comminuted fractures of distal end of femur and in elderly patients DCS can be used in distal femur fractures only when there is an uncomminuted bone stock of atleast 4 cm above the intercondylar notch.

Key Words: Supracondylar, Intercondylar, Inter fragmentary screws, Bone grafting

Access this article online	
Quick Response Code:	**Website:** www.innovativepublication.com
	DOI: 10.5958/2395-1362.2016.00028.1

Introduction

Trauma is the greatest health hazard in modern era. High velocity vehicular traffic in this rapidly advancing modern age has resulted in broken bones in different patterns. Fractures of the shaft of femur are a major cause of morbidity and mortality in patients with lower extremity fractures. Fractures of the distal part of the femur are difficult to treat and present considerable challenges in management. Severe soft tissue damage, commination, extension of fracture into knee joint and injury to the extensor mechanism lead to unsatisfactory results in many cases whether treated surgically or non surgically.[1]

Distal femoral fracture occurs at approximately one tenth the rate of proximal femoral fracture and make up 6% of all femur fractures. There is a bimodal distribution of fracture based on age and gender. Most high energy Distal femoral fractures occur in males between 15 and 50 years of age while most low energy fractures occur in osteoporotic women >50 years. The most common high energy mechanism of injury is traffic accident (53%) and the most common low energy mechanism is fall at home (33%). (Brett et al, 2008)

As with all fractures understanding the deforming forces involved is critical for successful operative management. Shortening of the fracture with varus and extension deformities are due to the unopposed pull of the hip adductors and gastrocnemius muscles respectively.[1]

Diagnosis of distal femoral fractures is mainly dependent on complete clinical examination of the patient. The presence of other injuries of the same extremity needs to be ruled out, with particular attention to the hip and the leg below the fracture site. The vascular supply to the limb should be assessed by examining for the presence of the pulse at the popliteal, dorsalis pedis and posterior tibial arteries. Motor and sensory functions of the leg and foot must be assessed.

Adequate radiographic evaluations of distal femoral fractures include plain radiographs of entire length of the femur to avoid missing ipsilateral femoral neck or shaft fractures. Good quality knee radiographs are required to screen for intra articular extension of fracture lines. Computed Tomography scan may be required in intra articular and comminuted fractures.[2]

Successful treatment of intra articular fracture especially in weight bearing joint requires restoration and maintenance of the congruity of the two articular surfaces. The present study was undertaken to study the comparison between Dynamic Condylar Screw and Locking Plate Fixation in the treatment of distal femoral fractures with following aims and objectives:

- To compare the rigidity of fixation achieved and to compare the restoration of anatomical joint surface.

Materials and Methods

The present study was including the patients of distal femoral fractures admitted to Department of Orthopaedics, at Government Medical College, Rajindra Hospital, Patiala.

Only those cases were selected where ORIF is indicated like in patients with displaced intra-articular fractures, multiple injuries, severe ipsilateral limb injuries, displaced extra-articular supracondylar fractures, pathological fractures and most open fractures.

Patients were evaluated in the emergency with attention to ABC of trauma care i.e. Airway, Breathing and Circulation. Primary survey of the patient will be conducted regarding the presence of other associated injuries and complications.

Primary treatment was given in the form of splintage, antiseptic dressing, antibiotics, analgesics, anti-inflammatory drugs and intravenous fluids.

Complete biodata of the patients were recorded and detailed history was taken. Routine investigations were done and initial radiographs taken in anteroposterior and lateral directions.

Tibial pin traction was given in the emergency, till the patient is fit for surgery after complete medical and cardiology checkup.

After giving pre-anaesthetic medication, patient was given general, spinal or epidural anaesthesia. Under all aseptic conditions, under tourniquet control, fracture site was exposed through lateral or anterolateral approach and internal fixation was done with either dynamic condylar screw or locking plate Fixation. Dynamic condylar screw was inserted proximal to joint line at junction of anterior one-third and posterior two-third taking into account the 25-degree inclination of medial wall of medial condyle. Guide wire was inserted initially from lateral femoral condyle to medial femoral condyle making it sure that it does not protrude medially. Dynamic condylar screw reamer was sat at 10 mm less than the measured length from guide wire and reaming done over guide wire. Dynamic condylar screw of appropriate size will then be inserted after tapping 5 mm less than the length of screw. Dynamic condylar screw was inserted and additional 5-mm to increase purchase into the condyles. Appropriate dynamic condylar screw plate was gently seated with impactor. After closing the wound, compression bandage was applied.

Locking Compression Plate

Locking plates are fracture fixation devices with threaded screw holes, which allows screws to thread to the plate and function as one construct. These plates may have a mixture of holes that allow placement of locking and traditional non locking screws (so called combi holes. Any plate that allows the insertion of fixed angle/angular stable screw or pegs can be used as a locking plate. The main biomechanical difference of locking plates from conventional plates is the fact that the latter require compression of plate to the bone plate interface. With increasing axial loading cycles, the screws can begin to toggle, which decreases the friction force and leads to plate loosening. If this occurs prematurely, fracture instability will occur leading to implant failure.

This biomechanical prerequisite of conventional plates is associated with biological pitfalls due to compression of periosteal blood supply and compromise of the vascularity of the fracture. Thus conventional plate osteosynthesis with rigid fixation (example inter fragmentary compression and lag screws) has been associated with a substantial complication rate, including infection, hardware failure, delayed union and non-union.

Results

In our study of 30 cases, we have two peaks at 41-50 years and more than 61 years with age range 21-60 years. In DCS group, most of our patients were in age group 41-60 years with 46% of patients in 41-50 years age group and 40% in 51-60 years age group. In LCP group, 40% of the patients were in age group more than 61 years. Out of 30 cases, there were 25 males and 5 were females (5;1). Most of the patients in both the DCS group (80%) and LCP group (87%) were males, which can be attributed to more outdoor activity of males. Most of the patients in DCS group (67%) and LCP group (60%) were of lower middle socioeconomic status. In our study of 30 cases, 71% cases were literate and 29% were illiterates and they were evenly distributed in both the groups. In our case series of 30 patients, 16 cases (54%) sustained A type and 14 cases (46%) suffered type C supracondylar fracture as per AO classification. In DCS group, most (80%) of the patients had A type of fracture. Among A type of fractures, 8 patients were in A1 subtype and 2 patients in each A2 and A3. and the rest 3 cases were of C type of fractures and all the fractures were of C1 subtype. In LCP group, most (75%) of the patients had C type of fractures. Among the C type of fractures 4 cases were of C3 subtype, 5 cases were of C2 subtype and 1 case was of C1 subtype the rest 4 cases had A type of fractures. Out of 4 patients, 2 cases were of A2 subtype and 1 case was in each A1 and A3 respectively Table 1.

Table 1: AO classification of fractures

Type of fracture	Number of patients DCS Group	Number of patients LCP Group
A1	8(54%)	1(7)
A2	2(13%)	2(13)
A3	2(13%)	1(7)
C1	3(21%)	2(13)
C2	-	5(34)
C3	-	4(26)
Total	15	15

Table 2: Associated fractures in DCS and LCP group

Associated Fractures	No of patients DCS Group	No of patients LCP group
Supracondylar fracture with Fracture proximal femur	1	-
Supracondylar fracture both bones leg fracture	-	2
supracondylar fracture with colles fracture	3	2
supracondylar fracture not associated with other fracture	11	11
Total	15	15

In DCS group, 1 patient had intertrochanteric fracture femur on same side and 3 patients (21%) had colles fracture, 1 on the same side and 2 on the opposite side. 73% patients had only supracondylar fracture. In LCP group, 2 patients (13%) had fracture upper end of tibia on same side and 2 patients (13%) had colles fracture the same side. 74% of patients had only supracondylar fracture.

In our study of 30 cases, bone grafting was done in 8 (24%) cases at the time of primary fixation of fractures. In DCS group bone grafting was done in two cases and in LCP group bone grafting was done in 6 cases Table 2.

Table 3: Bone grafting

Bone grafting	No of patients DCS	LCP Group
Bone grafting done	2	6
Bone grafting not done	13	9
Total	15	15

In the DCS group, we had 2 cases (6%) in which only one inter fragmentary screw and 1 case in which 2 inter fragmentary screws were fixed in the distal fragment along with DCS lag screw and plate to give additional support. In LCP group, we had 2 cases (13%) in which three inter fragmentary screws, 7 cases in which two additional inter fragmentary screws and 2 cases in which one additional inter fragmentary screw was fixed in the distal fragment to give additional support and lag effect Table 4.

Table 4: Inter fragmentory screws in distal fragment

Inter fragmentory screws in distal fragment	DCS	LCP
3 screws	-	2
2 screw	1	7
1 screw	2	2
	12(Only DCS lag screw)	4(Only LCP plate)
Total	15	15

In DCS group, 60% patients had sufficient callus formation and rest had callus present in follow up x-rays. Three patients had insufficient callus formation. In LCP group, 66% patients had sufficient callus

formation and 34% had callus present but not all around.

Discussion

Fractures in the distal femur had posed considerable therapeutic challenges throughout the history of fracture treatment. Most of these surgical failures were due to inadequate fixation of the fracture fragments.[3] The prognostic factors for supracondylar fracture included age, intra- articular involvement and timing of joint motion.[4] The use of plates and screws in the fixation of fractures has the inherent drawback of producing a load-shielding device.

The present study does show a biphasic age distribution of the patient population. Age distribution in two groups is statistically significant (p 0.039**).

Most of the patients in both DCS group (80%) and LCP group (87%) were males which was similar to Muller and Algower, 1995.

Most of the patients in DCS group (67%) and LCP group (60%) were of lower middle socioeconomic status. Both groups were not statistically significant (p> 0.5).

In DCS group, 87% of the fractures were of simple type and 13% were compound type while in LCP group, 60% of the injuries were of simple type and rest 40% were compound type. Most (80%) of the fractures in DCS group were classified as A type and the rest 20% were classified as C type of fractures as per A0 classification. In LCP group, majority of the fractures were classified as C type (73%) and the rest were classified as A type of fractures. Among the C type of fractures 24% were of subtype C3 subtype, 32% were of C2 subtype and 13% were of C1. AO classification intergroup comparison is statistically highly significant (p 0.010).

This discrepancy in distribution in both groups can be explained as LCP is useful for fixation of supracondylar fracture with intraarticular extension and with comminution, hence more useful in C type of supracondylar fractures.[6]

The DCS makes accurate reduction and fixation. The lag screw holds well, and was easy to place in good position over a guide wire inserted. But it needs 4 cm of intact uncomminuted bone stock in the distal fragment. So it is more useful in fixation of A type of fractures.

Bone grafting was mainly done to fill the structural bone defect and to construct the articular surface and to promote osteosynthesis. Two cases in DCS were compound fractures with bone loss. Among six patients in LCP group, 4 patients were of C3 type of fractures and 2 patients were compound fractures with bone loss. Both groups were statistically significant (p< 0.05).[7]

Additional screws were used in the distal fragment to compress the fracture fragments together to hold a plate against bone. The screw being an elementary machine, converts a small torque to a large axial force and creates this requisite elastic force in the bone. In our study series, in DCS group, distal fragment was fixed with 2 inter fragmentary screws in 1 patient and 1 inter fragmentary screw in 2 patients. In LCP group, distal fragment was fixed with 3 inter fragmentary screws in 2 patients, 2 inter framentary screws in 7 patients and 1 inter fragmentary screw in 2 patients. Both groups were found to be statistically significant (p<.05).

Conclusion

It was concluded that in DCS group, 12 patients belong to A type and 3 patients belong to type C supracondylar fractures. In LCP group, there were 4 patients with type A fractures and 11 patients had C type of supracondylar fractures. Bone grafting was done in 40% of patients compared to 13% of patients in DCS group. Bone grafting was mainly done to correct the articular defects in LCP group. Inter fragmentary screws were used in distal fragment for additional support and lag effect. These screws were used in 11 patients in LCP as compared to 3 patients in DCS group.

References

1. Donald AW. Supracondylar and intercondylar fractures of the femur. The Rockwood CA Jr and Green D. 4th ed. Philadelphia: JB Lippincot, Mosby; 1996.1973-95.
2. Brett D, Crist MD; Gregorg J, Pellia Rocea, MD, Ph D. Treatment of acute distal femur fractures.July,2008;31(7):681.
3. Mize RD, Bucholz RW, Grogan DP. Surgical treatment of displaced, comminuted fractures of the distal end of the femur. J Bone Joint Surg Am 1982;64:871-9.
4. Neer CS II, Grantham SA and Shelton ML. Supracondylar fracture of the adult femur: A study of one hundred and ten cases. J Bone Joint Surg 1967;49:591-613.
5. Muller ME, Allgower M, Schneider R. Manual of internal fixation. New York: Springer Verlag;1979.
6. Grieve RM et al, 2007 demonstration of advantages of locking compression plate technique over traditional plating.
7. Campbell's operative orthopaedics. 11th edn. St. Louis: Mosby Year Book; 1998.1994-2035.
8. Halpenny J, Roarbeck CH. Supracondylar fractures of the femur: Result of treatment in 61 patients. Can J Surg 1984;27:606-9.