

Original Research Article

Association of aL DFA with functional outcome of distal femur fracture treated with locking plate

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ABSTRACT

Background: Distal femoral fracture is one of the common presentations in orthopaedic emergency. Stable fixation and early mobilization is necessary to avoid knee stiffness with maximum functional outcome. We have done a retrospective analysis of Type 33A (supracondylar) and type 33C (supraintercondylar) fracture with distal femoral locking plate. Close observation done by aL DFA for varus collapse and functional outcome.

Methods: 61 patients of Type 33A (supracondylar) and Type 33C (supraintercondylar) treated from January 2011 to august 2016 selected for the study. Functional and radiological outcome of fracture assed by mize criteria and aL DFA respectively. Most of the cases of Type 33C shows some amount of varus collapse specially type 33C3.

Results: 6 out of 8 patients treated with type 33C3 treated with isolated distal femoral locking plate showed varus collapse more than 10 associated with implant failure and non union.

Conclusions: Type 33C3 subset required a special consideration like dual plating or cortical strut graft on first go. aL DFA is strong predictor of for functional and radiological outcome.

Keywords: Type 33A, Type 33C, Varus collapse, aL DFA, Distal femoral locking plate

INTRODUCTION

In contrast to hip fracture distal femur fracture account to 4-7% of all femur fracture.¹ Incidence of distal femur is bi modal in presentation one group is adolescent boys and men of age group 16 to 30, other is woman aged above 65.² Distal femur fracture usually associated with intra-articular extension, soft tissue injury, injury to the quadriceps mechanism and severe comminution poses the extra challenge in the treatment. In addition to it a wide medullary canal and poor bone quality add more challenge. There are multiple surgical option available for the patients that includes blade plate, dynamic condylar screw, non- locking buttress plate, retrograde nailing and distal femoral locking plate.³ Before addition of locking

plate in the orthopaedics armories use of single lateral plate associated with higher rate of nonunion and malunion with varus collapse but addition of medial plate associated with more of soft tissue injury.^{4,5} Because of different biomechanical functions LCP used as internal splinting rather than compression result in flexibility in fixation and induction of callus formation.⁶ Fixed angle construct of LCP in which implant offer fixed angle contact between plate and screw, theoretically avoid varus collapse.⁷ Up to 90% of union rate associated with locking plate even in supraintercondylar AO/OTA 33C.⁸ Aim of our study is to observe the association between aL DFA and functional outcome of distal femur, both supracondylar (AO/OTA 33A) and supraintercondylar (AO/OTA 33C).

METHODS

During January 2011 to August 2016, we operated 72 patients of distal femur fracture including 33 A, B and C. Minimum follow up for all patients was 12 months. Classification of fracture was done with AO/OTA; in our study 32 patients were 33A, 29 patients were 33C and 11 patients were 33B out of which 5 were Hoffa's fracture. All 11 patients with 33B fracture treated with either cannulated cancellous screw or cannulated cancellous screw with anti glide plating. Out of 72 patients only 61 patients were included in the study. It was a retrospective analysis of type 33A and Type 33C fracture treated with distal femoral locking plate.

Inclusion criteria

Inclusion criteria were all adult distal fracture with AO/OTA type 33A and 33C.

Exclusion criteria

Exclusion criteria were pediatric distal femur fracture; fracture with AO/OTA type 33B; open fractures; fracture with distal neurovascular deficit.

All patients were stabilized in the emergency department, and temporary stabilization of the fracture done by the splinting of the fracture. Average duration of fracture fixation was 3 to 5 days. All patients were approached through lateral incision and fixed with distal femoral LCP. Post operative depending upon the patient's pain tolerance quadriceps drill, calf pump and active range of motion exercise was started. All patients were encouraged to use of axillary crutches for ambulation without weight bearing. First OPD visit were in the end of two weeks to remove the sutures and subsequent follow up were performed 4 to 6 weeks of duration.

Follow up x-ray were done to evaluate the union and bony alignment of the fracture. AP and Lateral view were taken, for union callus formation and trabecular pattern was observed and for bony alignment aLDFA (anatomical lateral distal femoral angle) were assessed. We measured aLDFA by intersection between anatomical axis and horizontal line tangential to subchondral surface of femoral condyle. Definition of varus deformity, if aLDFA 5 above the upper limit of normal 81 ± 2 .⁹ Medial compartment of the knee share more load in comparison to the lateral as stated by Andriacchi and colleagues and Zhao and colleagues.^{10,11} That's why knee joint is more prone for the varus deformity post fixation. On follow up visit we assessed the patients with clinically, functionally and radiologically. It was a comparative observational study. We evaluated patients with criteria suggested by Schtzker and Lambert which was modified by Mize (Table 1).^{12,13}

Table 1: Modification of Mize-modified criteria (original criteria suggested by Schatzker and Lambert).

Grading	Description
Excellent	All of the following: loss of flexion. $< 10^\circ$; full extension; no varus, valgus, or rotator deformity; no pain; perfect joint congruency ^a
Good	No more than any 1 of the following; loss of flexion, $>20^\circ$; loss of extension, $>10^\circ$; varus deformity, $>5^\circ$ valgus deformity, $>10^\circ$; minimum pain
Fair	Any 2 of the criteria listed in previous category
Failure	Any of the following: flexion, $<90^\circ$; varus deformity: $>10^\circ$; valgus deformity, $>15^\circ$; joint incongruency: disability pain, irrespective of radiographic appearance

Alignment was determined by measuring the anatomic lateral distal femoral angle (normal range = 79° - 83°).

RESULTS

In 33A (supracondylar group) out of 32, 23 were male and 9 were female. Among 32, 12 were A1, 16 were A2 and 4 were A3. In supracondylar group (33A) 30 patients united well with average duration of union was 4.6 months. Union rate was 96.66% in supracondylar group. One patient develops varus deformity that was 33A3 according to AO/OTA classification, but the patient's functional score was good according to the mize criteria (Figure 1).

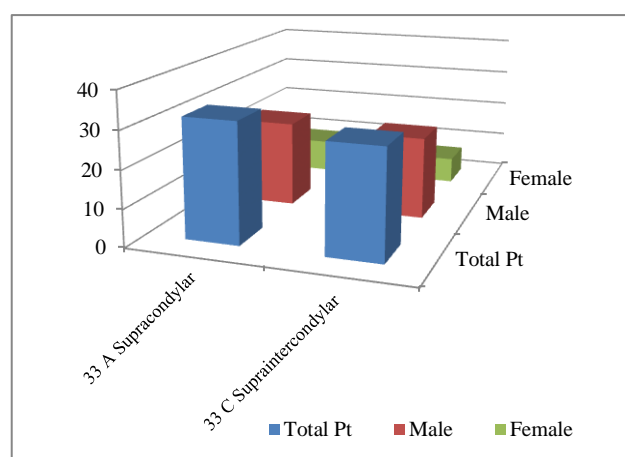
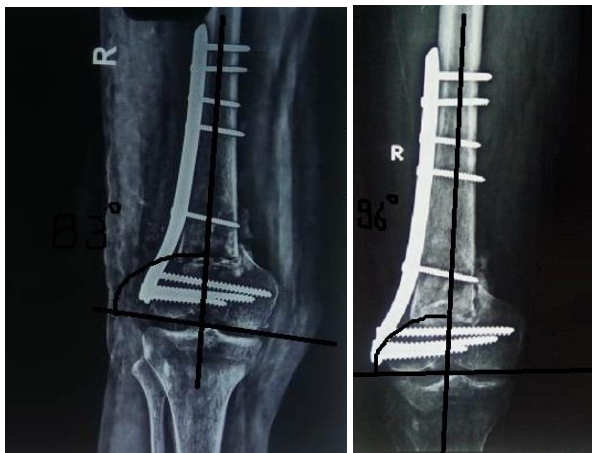


Figure 1: Patients and sex distribution of type 33A and type 33C.

In 33C (supraintercondylar group) out of 29, 22 were male and 7 were female. Among 29, 11 were C1, 10 were C2 and 8 were C3. In supraintercondylar group (33C) 24 patients united well with average duration of union was 6.3 months. Union rate was 82.75% in supraintercondylar group. 5 patients were developed varus deformity that

was 33C3 according to AO/OTA classification, and functional score were failure according to mize criteria (x-ray 1, 2).



**Figure 2: X-ray-1 immediate post OP with 83° aLDFA
x-ray-2 at 3 months with 96° aLDFA.**

Table 2: Comparative result between two groups.

Group	Union rate (%)	Duration of union in months	Varus deformity
Supracondylar 33A	93.75	4.6	1
Supraintercondylar 33C	82.75	6.3	5

If we compare these two groups, treatment is more challenging for the supraintercondylar group particular in 33C3. 6 out of 8 patients develop varus deformity in 33C3 group. 5 patients who had varus deformity more than 10 degree develop failure in the form of nonunion, implant backout and breakage of implant, which intended to think about other surgical option in first go like dual plating and bone grafting on first go. With the above result we can keep close eye on aLDFA for aggressive second surgical option like bone grating prior to failure.

DISCUSSION

Distal femur fracture is around 6% of all femur fracture. As wide medullary canal and thin cortex sufficient mechanical stability required for the fixation. Due to the presence of DF-LP (distal femoral locking plate) all other implant are veining in the past like CBP, Dynamic condylar screw and retrograde nailing.

Theoretically and practically DF-LP provide fixed angular construct and create toggle free fixation for periarticular fractures. As we are analyzing our result for all distal femur fracture we have to take precaution in cases where extensive comminution, bone loss as in type 33C.

The concept of biological fixation with bridge plating is one of the best methods to preserve the vascular attachment to the fractured bony fragment and soft tissue sparing. With same concept result of the distal femur with locking plate is very promising and enhances fracture healing characteristics.^{14,15} Study quoted that with the correct application of biological fixation leads to early callus formation and avoidance of bone grafting.^{16,17} But concept of biological fixation does not always hold for periarticular fracture with intraarticular extension, where the restoration of joint congruency is utmost priority. Same goes with majority of 33C3 fracture where metaphyseal–diaphyseal comminution, crushing of metaphysis, bone void and articular fragment malrotation, make it difficult for indirect reduction. Though it holds good for type A fractures.

Leunig et al recommended primary bone grafting for the large metaphyseal defect and segmental bone loss.¹⁸ Though the question of primary or secondary bone grafting is depend upon the institutional protocol but large metaphyseal defect required a bone grating for loss of articular reduction and malalignment.

We found that aLDFA is strong predictor for implant failure as in majority of our case who develop varus deformity more than 10 degree had failure. There were 6 cases where varus deformity was between 5 to 10 functional outcome was good and long follow is needed to keep a check on secondary osteoarthritis.

CONCLUSION

Distal femoral locking plate is one best solution for periarticular fracture femur till date. Majority of weight transfer through medial compartment joint, so we have observed a varus collapse and it was more marked in Type 33C3. Extensive comminution and bone loss make these fractures to deal with dual plating or cortical strut graft on first attempt. We can keep a close follow-up on varus collapse with aLDFA.

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