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Research Article

Functional Outcome of Surgical Management of AO Type-C Fractures of Distal Femur Treated with Distal Femoral Locking Plates using Swashbuckler Approach

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Abstract

Background: Orthopaedic injuries near a joint are often disabling with residual deficits. Distal femur fractures are one of such challenging injuries for orthopedic surgeons, due to their high complication rate. Use of swashbuckler approach while fixing such fractures with Distal Femoral Locking Plate (DFLP) bestows better outcome with lesser complications.

Materials and Methods: 30 patients with AO Type C fractures of distal femur were treated with DFLP using Swashbuckler Approach. Cases were followed for up to 12 months post operatively and evaluated by the NEER'S knee Score.

Results: Mean time of fracture union was 17.35 weeks (range 12-20 weeks). Average duration of surgery was 88.4 minutes and mean Neer's score was 80.76.

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Conclusion: Swashbuckler approach is a good alternative to other classical approaches. Use of DFLP in type C distal femur fractures with swashbuckler approach may provide excellent results.

Keywords

AO Type C Distal Femur Fracture; Distal Femur Locking Plate; NEER Knee Score; Swashbuckler Approach; Complications

Introduction

Distal femur fractures are difficult to treat injuries [1]. Low energy cases may occur in osteoporotic women >50 years age, while high energy injuries occur in road traffic accidents [2,3]. Various implants and a plethora of approaches have been used for such disabling injuries. As such fractures may have both intra articular as well as extra articular segments to deal with; hence some approaches like Para patellar approach may not be sufficient enough for all cases as proximal exposure is difficult with that approach. The advent of Distal Femoral Locking Plate (DFLP) has promised excellent results in the management of such complex injuries. Starr, et al., have described their preferred “Swashbuckler” approach to the distal femur. Because this extensile approach utilizes an anterior incision at the knee, the authors argue that it does not compromise future skin incisions necessary for total knee arthroplasty [4]. Extensile approaches to the distal femur, particularly those which expose the metadiaphysis, have previously been associated with an increased incidence of infection and need for autogenous bone grafting [5]. Hence under the light of above data, we planned this study to report the results in a prospective study of patients with distal femur fractures, operated using Swashbuckler approach.

Aims and Objectives

The study was done for the management of intra articular fracture of distal femur with DFLP and aimed at

- Anatomical reduction
- Adequate femur alignment and length
- Stable internal fixation and rapid movement
- Early rehabilitation of knee
- To assess the union time clinically and radiologically

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Material and Method

This study was done for the patients of intraarticular distal femoral fractures admitted to Department of Orthopaedics, at Government Medical College, Rajindra Hospital, Patiala. 30 cases of either sex having intraarticular fracture of distal femur (AO Type C) coming to Orthopaedics department were taken up for the study, treated with DFLP using Swashbuckler approach (Fig. 1 and Fig. 2).

Inclusion Criteria: Inclusion criteria for study were closed intraarticular fractures of distal femur (AO Type C), patients more than 18 years of age, patients giving informed written consent patients who were preoperatively mobile and patients medically fit for surgery.

Exclusion Criteria: Patients with AO type A and B fractures, open fractures, patients not medically fit for surgery, fractures in patients less than 18 years of age and pathological fractures were excluded from study.

Statistical analysis: The sample size was calculated by using formula $n = Z(1-\alpha/2)^2 \cdot SD^2 / (d)^2$, with 95% confidence $Z = 1.96$, SD is standard deviation, d is error rate and n is minimum sample size. With $SD = 14$ and $d = 5$, minimum sample size according to this formula came out to be 30.1. Student t-test was used for statistical analysis in our study considering $p < .05$ as statistically significant. Statistical analysis was performed using IBM SPSS statistics version 22.0 for Windows.

Figure 1: Pre-operative X-ray showing comminute intra articular fracture distal femur.

Figure 2: Intraoperative photographs (Swashbuckler approach).

Results

To evaluate efficacy of technique used, functional outcome was compared on the basis of Neer criteria and results tabulated accordingly [6]. Eighty percents of the cases operated with this approach were males. Mean of our evaluation criteria (Neer score) was 80.76 and 56.6% cases achieved excellent results (Table 1-5) (Fig. 3 and 4).

Gender	Number of patients/total cases	Proportion	Percentage
Males	24/30	4/5	80%
Females	6/30	1/5	20%
P-value	0.001		

Table 1: Gender-wise distribution (proportion) of cases treated with Swashbuckler approach technique.

Duration of Surgery	Number of Patients	Percentage of Patients
60 to 90 minutes	22	73.33%
90 to 120 minutes	6	20%

More than 120 minutes	2	6.66%
Total	30	100
P-value	<0.001	
Most of surgeries (73.33%) were done with in duration of surgery period being 60 to 90 minutes.		

Table 2: Duration of surgery in study cases.

Duration of Healing (wks)	Cases (n)	Proportion (in %)
9 weeks	2	6.67%
9-12 weeks	7	23.33%
12-24 weeks	21	70%
Total	30	100
P-value	<0.001	
Most of the fractures (70%) had bony union time as 12 to 24 weeks. 23.33% cases united in 9 to 12 weeks and 6.67% cases in 9 weeks.		

Table 3: Duration of bone healing in study cases.

Complications	No. of Patients	Percentage of Patients
Non-Union	1	3.33%
Mal-Union	2	6.66%
Superficial Infection	2	6.66%
Joint Contractures	1	3.33%
Knee Instability	1	3.33%
Post-Traumatic Arthritis	2	6.66%
Total Complications	9	30 %
No Complications	21	70%
P-value	0.027	

While 21 cases had no complications, 9 cases had some kind of bony or soft tissue complication.

Table 4: Complications after surgery in study cases.

Neer Functional Score	Number of Patients	Percentage of Patients
Excellent	17	56.6%
Good	10	33.33%
Fair	3	10%
P Value	0.003	

Table 5: Neer's Score result in study cases.

Figure 3: a- Post operative X-ray image with DFLP; b-knee range of motion.

Figure 4: Knee range of motion at 6 months follow up.

Discussion

Distal femur fractures are difficult to treat. Ultimate outcome of treatment including knee range of motion, callus formation, time to clinical and radiological union and weight bearing depend upon treatment method used. Armory of treatment of these fractures varies from conservative management with traction, casting, or both. Limitation of reduction and difficulty of maintaining reduction ultimately leading to a large number of complications are major obstacles with non operative methods [7-10]. The AO principle in the operative treatment of intra-articular fractures involves anatomical reduction of the articular surface of the fracture, rigid fixation and early mobilization. The advent of Distal Femoral Locking Plate (DFLP) has promised excellent results in the management of these challenging fractures [11]. Direct exposure of the articular surface ensures anatomic reduction, reduces time of surgery and subsequent lesser number of complications. Many approaches to the distal femur have been described including medial parapatellar approach lateral parapatellar (anterolateral) approach, tibial tubercle osteotomy, combined medial and lateral approaches [12-15]. A new approach termed the swashbuckler approach is used nowadays and has gained a lot of credit than other older approaches [5]. This approach helps in obtaining a better clinical outcome and radiological bony union in a comparatively lesser time. We achieved 70 % excellent results at one year follow up and bony union in all cases within 24 weeks. In our study, radiological union was seen at an average of 17.35 weeks which is comparable to study of distal femur fractures by polyaxial plating by Pascarella, et al., and J B Erhardt, et al., [16,17].

A study was done by Zhang ZM, et al., for treatment of type C3 distal femoral fractures with double-plating fixation via anteriomedial approach, the study showed very large amount of time (from 110 to 160 min, with an average of 135 min) with an average union time of 21 weeks as compared to 88.4 minutes and 17.35 weeks of our study respectively [18].

Gautier, et al., described guidelines about locking compression plate in distal femur fractures and advised to put plate as a bridging plate, for comminuted fractures the plate length being 2 to 3 times longer than fracture length and 3 or more empty holes around fracture site while Stoffel, et al., suggested that screws should be as close to fracture site as possible [19,20].

In a study by Gupta S, et al., for treatment of supra condylar and inter condylar fractures of femur with swashbuckler approach and distal femur plating, excellent results were obtained in 70 % of cases while good results in 20 % while determining clinical outcome at one year follow up using knee society score [21].

Anuj A, et al., in their study about modified swashbuckler approach for complex distal femoral fractures were of the opinion that a standardized and validated outcome scoring system needs to be developed to allow comparability across studies [22]. They attribute the good knee flexion obtained in their series to anatomical articular reduction, rigid fixation of articular fracture lines

and early mobilization. Concomitant addressal of ligament injuries, as was done in their series, is important for early rehabilitation as patients are apprehensive to move unstable joints.

In another study by Siddharth Agrawal, et al., for functional outcome following swashbuckler (modified anterior approach) versus lateral approach for management of complex distal femur fractures, they found better Neer's score and very less amount of complications with swashbuckler approach and concluded it was better than lateral one especially in C3 fractures while they obtained similar results with both approaches in C2 fractures [23]. We obtained excellent results in 17 out of 30 cases with no complications in 21 out of 30 cases. Rajendra A, et al., achieved a mean NEER's score of 81.83 with swashbuckler (modified anterior approach) versus 76.96 with lateral approach though complications were similar in both groups [24]. Mean NEER's score in our study was 80.76 with swashbuckler (modified anterior approach).

Conclusion

Results of swashbuckler approach especially in complex AO type C3 fractures are encouraging. In comparison to other standard approaches like lateral approach, good clinical outcome and bony union can be achieved in a majority of patients in a lesser time with swashbuckler approach. We could achieve excellent results as per NEER's functional criteria in more than fifty percent of our patients and hence recommend this approach in carefully selected cases.

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