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Original Research Paper

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# A PROSPECTIVE STUDY OF MANAGEMENT OF CLOSED DISTAL 1/3RD FEMUR SHAFT FRACTURES- ANTEROGRADE NAILING VS RETROGRADE NAILING

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**ABSTRACT** **Objectives:** Comparative analysis of radiological outcome in the management of closed Distal 1/3rd femur shaft fractures (AO – OA TYPE 33A1/ 33A2) by Anterograde Vs Retrograde Nailing by RUST score and postoperative complications. **Materials and Methods:** A retrospective study of 40 patients with closed distal 1/3 femur fractures type AO classification 33A1/A2 who satisfied the inclusion criteria were included in the study which was done over a period of 1 years between January 2021 to January 2023. Patients were followed up postoperatively and were assessed using modified RUST criteria 6 weeks, 6 months and 12 months.

**KEYWORDS :** Distal femur fractures , Anterograde nailing , Retrograde nailing.

## INTRODUCTION

Adult distal femur fractures present in a bimodal distribution, younger male patients generally present secondary to high-energy mechanisms, such as motor vehicle accidents and elderly patients present typically after low-energy mechanisms, such as ground level-falls. Elderly patients often present with significant co-morbidities impacting their operability, recovery, and survival. Distal femur fractures account for less than 1% of all fractures and about 3 to 6% of all femoral fractures. The distal femur is defined as the region from the metaphyseal-diaphyseal junction to the articular surface of the knee, involving approximately the distal 15 cm of the femur. The shaft of the femur is a cylindrical shape and extends into two curved condyles at the distal end. When viewed from the axial plane, the shape of the distal femur is trapezoidal. The lateral cortex slopes at approximately 10 degrees, and the medial cortex slopes approximately 25 degrees. The medial condyle of the distal femur extends more distal than the lateral condyle. The posterior portions of both of these condyles extend more posterior than the posterior cortex of the diaphysis of the femur. The femoral shaft, representing the anatomic axis of the femur, averages about 6 to 7 degrees of valgus to the knee joint. The most common mechanism involves direct trauma to a flexed knee, typically seen in dashboard injuries during motor vehicle accidents. The deforming forces of distal femur fractures depend on the location of the fracture relative to the adductor tubercle. The hamstrings and extensor mechanism causes the fracture to shorten, and the adductor magnus displaces the fracture into varus. The two heads of the gastrocnemius muscle extend the distal fragment, resulting in an apex posterior angulation of the fracture. With intercondylar split fracture patterns, the two heads may also cause the distal condylar fragments to separate and rotate.

The most commonly used fracture classification system used is the Orthopaedic Trauma Association classification.

**The Orthopaedic Trauma Association Classification**

**33A - Extra-articular**

A1 - simple
A2 - metaphyseal wedge
A3 - metaphyseal complex

**33B - Partial articular (a portion of the articular surface remains attached to the proximal shaft)**

B1 - lateral condyle
B2 - medial condyle
B3 - coronal plane (Hoffa fragment)

**33C - Complete articular (articular fragment separated from the shaft)**

C1 – simple articular, simple metaphyseal
C2 – simple articular, metaphyseal comminution
C3 - metaphyseal and intra-articular comminution

Intramedullary nail fixation has the benefit of providing a stable construct with minimal soft tissue and periosteum disruption.(1) Retrograde nailing is a viable option for the treatment of distal femur fractures. The advantages of retrograde nailing include: the intramedullary nail is a load-sharing device compared to plate fixation, the nail may be inserted through smaller incisions causing less soft tissue disruption, and it allows for the treatment of ipsilateral hip and ipsilateral tibia fractures in the polytrauma patient. Potential disadvantages to retrograde nailing include knee sepsis, patellofemoral pain, and synovial metallosis from the nail or screw breakage.

The muscle attachments to the distal femur are responsible for the typical displacement of the distal articular block following a supracondylar fracture, namely shortening with varus and extension deformity. Shortening is due to the pull of the quadriceps and hamstring muscles, while the varus and extension deformity is caused by the unopposed pull of the adductors and gastrocnemius, respectively.

## MATERIALS AND METHODS

### Patient characteristics

After obtaining the institutional ethics committee clearance and written informed consent, the inpatients in the department of Orthopedics fulfilling the inclusion criteria were enrolled in the study. Each patient was given a unique identity number. Demographic data, medical history, concomitant medications, physical examination, clinical examination including recording the vitals, details of surgery and details of the implant are recorded in the study proforma and relevant radiologocal investigations as mentioned in the assessment tools were done at baseline visit. Follow up visits were at 6 weeks ( visit 1) ,at 24 weeks( visit 2) and at 52 weeks(visit 3) from the date of surgery. Radiological evaluation was done in 40 patients with closed distal 1/3femur fractures type AO classification 33A1/A2 for period of 1 year, Outcome was measured using radiographic healing, assessed at 6, 24, and 52 weeks postoperatively using RUST score. Group A included 20 patients operated with anterograde nailing Vs Group B included 20 operated with retrograde nailing. The modified RUST scored each cortex on the AP and lateral radiograph as 1 = no callus, 2 = calluspresent, 3 = bridging callus, 4 = remodeled, fracture not visible. The modified RUST score is the sum of these and therefore has a value from 4 to 16.

### Inclusion Criteria Were

- Age more than 18 years
- Fractures of distal 1/3rd of femur shaft
- All closed fractures
- Fractures under AO classification – AO 33A1 and A2

### Exclusion Criteria:

- Age less than 18 years
- Midshaft femur Fractures and proximal 1/3rd femur shaft fractures
- Open distal 1/3rd femur shaft fractures
- Pathological femur fractures
- Ipsilateral proximal femur/ proximal tibia fractures
- Floating knee
- Femur fractures with vascular injruies
- Polytrauma patients
- Patients not giving consent for study

### Surgical Technique

Pre-operatively, each patient was evaluated clinically and radiologically.

Detailed history, clinical examination and radiological examination was done.

Preoperative roentgenograms included a standing anteroposterior view, a lateral view. Radiological classification as advocated by AO classification. Radiographic evaluation of post-op x-ray was done by RUST score.

Post operatively, at 6 weeks and 12 months were taken. For anterograde nailing.(2)

Under anesthesia, Patient is positioned in supine position with preparations made under traction table. Adduction of leg as much as possible to aid for entry and place the contralateral knee and hip in flexion. Tip of greater trochanter and axis of femur is marked with help of image intensifier and 5cm incision is made 10-15cm proximal to tip of greater trochanter. Entry is made with bone awl after splitting the gluteus muscles. Entry taken at the pyriformis fossa under the image intensifier guidance. Ball tip guide wire is passed. Fracture reduction confirmed and serial reaming done. Exchange tube is passed to replace with the straight guide wire and nail of appropriate length is passed and proximal and distal locking done. The distance of the distal proximal locking screw should be atleast 4cm away from the fracture site. Wound closed in layers sterile dressing was done.

### For retrograde nailing

Under anesthesia, Patient is positioned in supine position with preparations made for knee in 30 degree flexion with sand bag or roll under the thigh. 4cm incision is made along the inferior pole of patella longitudinally. Patella tendon split in line along with skin incision and entry point made with guide at exactly centre of intercondylar notch and in lateral view anterior to blumensaat line.

Bone awl is used for entry and ball tip guide wire inserted. Ball tip guide wire is passed. Fracture reduction confirmed and serial reaming done. Exchange tube is passed to replace with the straight guide wire and nail of appropriate length is passed and proximal and distal locking done.

### Assessment Of Results

Demographic data of age, sex, fracture type classified and the appropriate nailing is done. Patients were asked to follow up at 6weeks, 6 months and 12 months. Radiological outcomes were measured using RUST Score.

### Statistical Analysis

- Chi Square Test was used to compare the gender and laterality distribution between 2 groups.
- Mann Whitney test was used to compare the mean age between 2 groups.
- Independent Student t Test was used to compare the mean modified RUST scores between 2 groups at different time intervals.
- Repeated Measures of ANOVA followed by Bonferroni's post hoc Test was used to compare the mean modified RUST scores between time intervals in each group.
- The level of significance was set at $P<0.05$.

## RESULTS:

The mean modified RUST scores at 6 weeks' period in Group A was 4.20 ± 0.41 and in Group B was 4.20 ± 0.41. During 6 months' period, the mean scores in Group A was 8.25 ± 0.44 and in Group B was 8.15 ± 0.37 and during 1 year post follow-up period, the mean scores in Group A was 12.35 ± 0.49 and in Group B was 12.35 ± 0.49. However, there were no significant differences in the mean modified RUST scores were observed between 2 groups at different time intervals.

The mean modified RUST scores in Group A showed a significant difference between different time intervals at $p<0.001$. Multiple comparison of mean differences b/w time intervals revealed that the mean scores during 1-year follow-up period showed significantly highest scores as compared to 6 months and 6-weeks' period and the mean differences were statistically significant at $p<0.001$.

This was then followed by 6 Months' period which showed significantly higher means scores as compared to 6 weeks' period and the mean difference was statistically significant at $p<0.001$. This infers that the mean modified RUST scores showed significant increase with increase in follow-up period.

Similarly, in Group B the mean modified RUST scores showed a significant difference between different time intervals at $p<0.001$. Multiple comparison of mean differences b/w time intervals revealed that the mean scores during 1-year follow-up period showed significantly highest scores as compared to 6 months and 6-weeks' period and the mean differences were statistically significant at $p<0.001$.

This was then followed by 6 Months' period which showed significantly higher means scores as compared to 6 weeks' period and the mean difference was statistically significant at $p<0.001$. This infers that the mean modified RUST scores showed significant increase with increase in follow-up period

**Figure 1** – Anterograde Nailing with follow up xray

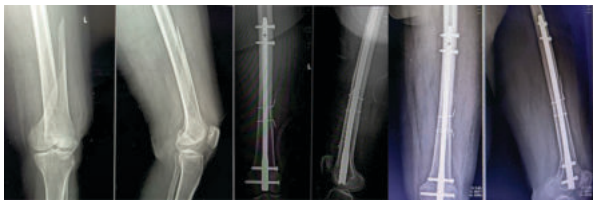

**Figure 2** – retrograde femoral nailing with followup xray

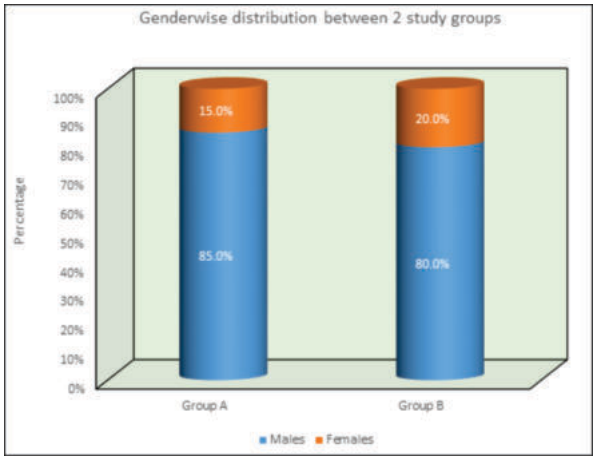


**Figure 3** - Genderwise distribution between 2 study groups

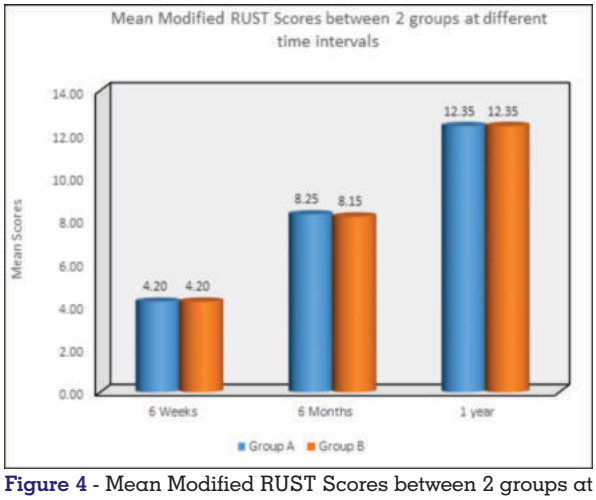


**Figure 4** - Mean Modified RUST Scores between 2 groups at different time intervals

## DISCUSSION :

Ostrum et.al. (3) and Tornetta et. al. (4) reported no significant differences between anterograde and retrograde nailing in terms of blood loss, Ricci et.al (5) found levels of estimated blood loss to be significantly lower in patients treated with retrograde than antegrade nails.

## CONCLUSION:

There was no difference in the union of distal femur shaft fractures operated with either anterograde or retrograde nailing. Complaints of knee pain were more in retrograde nailing than anterograde nailing. The improvement in the clinical and functional scores demonstrate the patients' ability to return to the pre- disease state shows no difference in the outcome between antgerograde and retrograde nailing.

Our study concluded both the patient group showed excellent clinical outcomes at 6 weeks, 6 months and 12 months.

**Table 1**

| Comparison of mean modified RUST scores b/w time intervals in each group using Repeated Measures of ANOVA Test using Bonferroni's post hoc test | | | | | | | |
|---|---|---|---|---|---|---|---|
| Procedure | Time | N | Mean | SD | p-value[a] | Sig. Diff | p-value[b] |
| Group A | 6 Weeks | 20 | 4.20 | 0.41 | <0.001* | 6W vs 6M | <0.001* |
| | 6 Months | 20 | 8.25 | 0.44 | | 6W vs 1Y | <0.001* |
| | 1 year | 20 | 12.35 | 0.49 | | 6M vs 1Y | <0.001* |
| Group B | 6 Weeks | 20 | 4.20 | 0.41 | <0.001* | 6W vs 6M | <0.001* |
| | 6 Months | 20 | 8.15 | 0.37 | | 6W vs 1Y | <0.001* |
| | 1 year | 20 | 12.35 | 0.49 | | 6M vs 1Y | <0.001* |

**Table 2**

| "Age and gender distribution between 2 groups | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Category | Group A | | Group B | | p-value |
| | | Mean | SD | Mean | SD | |
| Age | Mean | 32.45 | 12.03 | 37.95 | 14.68 | 0.23[a] |
| | Range | 14 - 51 | | 18 - 73 | | |
| | | n | % | n | % | |
| Sex | Males | 17 | 85.0% | 16 | 80.0% | 0.68[b] |
| | Females | 3 | 15.0% | 4 | 20.0% | |

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