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Anterior midline approach to distal femur fractures requiring dual plate fixation: A study of forty cases

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Abstract

Distal femur fractures usually require fixation on both medial and lateral surfaces. Various approaches have been used for fixation of such fractures but morbidity associated with commonly used approaches involving two incisions is high. The aim of this study was to assess the ease of exposure, feasibility of fixing the individual condyles and postoperative outcome using a single midline approach to the distal femur. A prospective study of 40 adult patients with fracture pattern 33A & C (AO system) operated through a single midline anterior incision was carried out during the period from May 2013 to April 2015. The patella was retracted either laterally or medially depending on the side of arthrotomy which was based on an articular comminution. Each condyle and its corresponding supracondylar ridge were fixed with an individual locking plate. Observations included intra-operative blood loss, surgical time and post-operative evaluation of wound healing & functional outcome. Results were favorable in terms of wound healing, functional outcome and feasibility to perform joint replacement through the same incision without any complications. Using a single midline incision with appropriate arthrotomy fixation on both lateral and medial surfaces of distal femur is possible in properly indicated fractures of distal femur.

Keywords: distal femur, approach, arthrotomy, dual plate fixation

Introduction

Distal femur fractures are high velocity ^[1, 2] injuries commonly resulting in comminution of both metaphyseal as well as articular surfaces. These fractures need to be addressed globally targeting both medial and lateral condyles as well as to the coronal plane injuries. Routinely available implants for such fractures address to a single condyle and hence adequate exposure is required to access both the condyles which require independent fixation. Various approaches have been used for fixation of distal femur fractures which include direct lateral approach with or without arthrotomy, medial approach and the anterior midline approach. The direct lateral approach is the most commonly used exposure for open reduction and fixation of the distal femur. The Swashbuckler approach with lateral arthrotomy allows exposure of entire articular surface of distal femur sparing quadriceps but falls short in exposure of medial supracondylar comminution. Although a tibial tubercle osteotomy can be performed to allow for reflection of the extensor mechanism for a wide articular exposure ^[3], it is less favorable among the surgeons due to poor outcome. Hence, in cases requiring fixation of medial condyle, a separate medial approach becomes a necessity. Morbidity related to such extensive approach is however high requiring a prolonged post-operative care and rehabilitation. The aim of this study was to assess the ease of exposure, feasibility of fixing the individual condyle and postoperative outcome using a single midline approach to the distal femur.

Methods

A prospective study of 40 adult patients with unilateral distal femur fractures was carried out during the period from May 2013 to April 2015. Patients with type 33A & C (AO system) fractures with or without coronal fractures of condyles requiring dual plate fixation were included in this study.

All patients were operated through an anterior midline incision of around 12-17 cm extending equally on either side of patella. Tourniquets were not used in this procedure.

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Depending upon the comminution either an anterolateral or an anteromedial arthrotomy was performed. Arthrotomy was performed towards the side with greater comminution. However in cases which were equivocal, the standard anterolateral arthrotomy as described for distal femur fractures was performed. The quadriceps tendon was split in line of incision and arthrotomy continued along either the lateral or medial border of patella keeping adequate tissue margin with the patella for resuturing. High velocity injuries usually resulted in a medial metaphyseal spike herniating through a rent in the vastus medialis obliquus. Such rents were included in the arthrotomy incisions. The patella was retracted either laterally or medially according to the arthrotomy and articular comminution, intercondylar fractures, coronal split fractures and proximal extension of the fracture were addressed. After accurate reduction, fractures were provisionally fixed with Kirschner's wires. Both medial and lateral surfaces were fixed with an individual locking plate. Proximal fixation of lateral plate was done with stab incisions through the mid coronal plane of the proximal femur. Blood loss and duration of surgery were noted in each case.

Post operatively wounds were evaluated on 3rd and 10th day if otherwise clean. Assisted quadriceps exercises were initiated from 3rd post operative day as per pain tolerance. Quadriceps strength was assessed on the 10th post operative day and at every follow up. Weakness of quadriceps muscle was assessed comparing the opposite normal limb. Patients were called for follow up 4 weekly for minimum of 6 months. Weight bearing was started according to the union status of individual patient. During follow up clinical assessment of wounds, knee movements, thigh girth comparison in relation to opposite normal limb and radiological assessment was done. Final assessment was done either at the end of 6 months

or fracture union whichever was earlier. At final follow up scar condition, knee movements and union status were assessed.

Observations and Result

This is a study of 40 patients (33M, 7F) with type 33A & C fractures of distal femur where midline anterior approach was used for fixation. The mean age was 39.8 years (Range: 18-75years). The average incision size was 15.3cm (Range: 13-19cm). Table No.1 shows distribution of patients according to the classification and arthrotomy performed.

Table 1: Types of fractures and arthrotomy

| Arthrotomy | No of patients | Type of fracture (no of patients) | | | |
|---------------|----------------|-----------------------------------|----|----|----|
| | | A2 | A3 | C2 | C3 |
| Anterolateral | 29 | 8 | 6 | 7 | 8 |
| Anteromedial | 11 | 0 | 3 | 5 | 3 |
| Total | 40 | 8 | 9 | 12 | 11 |

With an anterolateral arthrotomy (Figure 1), full exposure of the lateral condyle up to posterolateral corner was possible. Anterior and lateral surface of lateral condyle and trochlear groove were exposed excellently. Retracting patella medially in full flexion of the knee anterior articular surface, intercondylar area and anterior most part of medial condyle could be accessed comfortably. Access to the medial epicondyle, medial surface of medial condyle and metaphyseal part of medial condyle was limited due to retracted patella. Access to posterior part of medial condyle was not possible. Lateral plating of distal femur did not require much effort, however medial fixation required mobilization of soft tissue.



Fig 1: Anterolateral arthrotomy and fixation

When anteromedial arthrotomy was done (Figure 2), in addition to the medial structures visualized in anterolateral arthrotomy, metaphyseal junction of medial condyle, coronal plane fractures of medial condyle and intercondylar area up to attachment of femoral part of posterior cruciate ligament was visible. However posterior part of medial condyle and its posterior articular surface were not visible in this arthrotomy either. After lateral patellar retraction, anterior and lateral part

of lateral condyle and corresponding articular area, trochlear groove and metaphyseal area was exposed. With full knee flexion intercondylar area and coronal split fractures of lateral condyle were comfortably visualized. Access to the posterior most part of lateral condyle was limited but lateral side plating through a tunnel made from periosteal elevation using MIPO like technique was quite comfortable.



Fig 2: Anteromedial arthroscopy and fixation

Average surgical duration in anteromedial arthroscopy was 102 minutes and 85 minutes for anterolateral arthroscopy. Wound healing was not hampered in most patients. One patient required secondary suturing due to dehiscence following marginal necrosis. Another patient who developed early post-operative wound infection progressed to secondary healing causing an adherent and unpleasant scar formation. This patient also developed knee stiffness which persisted till

the last follow up. Patients improved on all parameters at final assessment as compared to the follow up period (Table No. 2). However non union with knee stiffness was observed in a total of four patients. Two patients who developed early post traumatic arthritis required a total knee replacement which was comfortably performed through the healed scar of previous incision without any postoperative wound problems.

Table 2: Frequency of observations apropos the issues of interest and concern to an orthopaedic surgeon in this study. (All patients other than those stated in each column had an uneventful outcome with respect to the complication stated.)

| Arthroscopy | Avg. Sur. Duration (Min) | Avg. Blood Loss (ML) | Problems In Wound Healing | | | Follow Up Issues | | | | Final Assessment | | |
|--------------------|--------------------------|----------------------|---------------------------|----------|----------|------------------|---------------------|---------------------------|---------------------|------------------|---------------|-----------|
| | | | Delayed | Infected | Necrosis | Wasting | Quadriceps Weakness | Delayed Progress Of Union | Secondary Procedure | Knee Stiffness | Scar Problems | Non Union |
| Anterolateral N=29 | 85 | 350 | 2 | 0 | 1 | 4 | 7 | 4 | 1 | 3 | 0 | 3 |
| Anteromedial N=11 | 102 | 400 | 1 | 1 | 0 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Total N=40 | 93.5 | 375 | 3 | 1 | 1 | 6 | 9 | 6 | 2 | 4 | 1 | 4 |

Discussion

Many traditional surgical approaches are currently used for fixation of distal femur fractures. However, each approach has its anatomic inadequacies. In the lateral approach fascia lata is incised, perforators need to be ligated and vastus lateralis requires to be reflected anteriorly [4, 5]. Although the lateral approach can reduce damage to the extensor mechanism of the knee, it damages the iliotibial band and insufficiently exposes the medial compartment of the knee [6]. Medial approach to the knee provides excellent visualization of medial condylar fractures but access to the lateral condylar fractures is limited. The posterolateral approach described by Marcy [7] provides poor access to the intercondylar notch and medial compartment of the knee. Moreover this approach may damage the sciatic nerve [8, 9]. Therefore a utilitarian approach which addresses to all components of distal femur fractures was perceived.

The anterior midline incision with medial/lateral arthroscopy has routinely been used for joint replacement surgeries. We studied to understand if the same approach could be used for distal femur fractures as well. The anterior midline approach is a versatile surgical approach that can be adopted to different fracture configurations of the distal femur. Using a single midline anterior incision with appropriate arthroscopy

intra-articular fractures of both condyles are better visualised and fixation on both medial and lateral surfaces of distal femur is possible. Lateralization of femur which is often seen after isolated fixation of lateral condyle is avoided. Medial parapatellar approach which is used for total knee replacement surgeries provides excellent exposure of the joint, medial collateral ligament, intercondylar notch area and the entire medial surface upto the posteromedial corner of the medial condyle. Coronal plane fracture which is a part of comminuted fractures of distal femur can be better visualized with this arthroscopy. Anterolateral arthroscopy approach provides adequate access to the articular surfaces and can be extended proximally into quadriceps mechanism as an extensile anterolateral approach to include the femoral shaft [10].

Wider exposure of fracture with minimal soft tissue stripping is possible without compromising on surgical duration, blood loss or fixation using this approach. Total surgical time was less than 90 minutes in most of the cases. Fluoroscopy exposure can also be reduced in comparison to conventional lateral and medial approaches for fixation of comminuted distal femur fractures. However arthroscopy and splitting of quadriceps tendon results in scarring and weakness of its muscle power. In our study 22.5% of patients had knee

stiffness during follow up which eventually reduced to 10% at final assessment.

Contemplating arthritis to ensue in some highly comminuted fractures even after the best reduction and fixation, the same incision can be explored for a future joint replacement surgery if required. We had two patients who underwent knee arthroplasty through the same incision without any wound complications. A possible problem with an arthrotomy would be damage to the infrapatellar branch of the saphenous nerve resulting in numbness in the anteromedial infrapatellar region of the knee and/or a painful neuroma^[11, 12]. However we did not encounter any such complication in our patients.

With increasing vehicular movement and infrastructure that permits high speed of travel, high velocity injuries are common presentations now-a-days. Distal femur fractures have borne the brunt of these advancements as well. However, outcome of such injuries are highly dependent on surgical exposures, skills and available armamentaria. The midline anterior approach was used by us to evaluate the ease of exposure, comfort in fixation of distal femur fractures and complications related to it. Trauma and joint replacement surgeons are quite familiar with this approach and it does not seem technically demanding. Our results have been quite favourable for its use in the indicated fractures of the distal femur.

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