

Surgical Results of Intercondylar Fractures of the Adult Femur

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Abstract

Introduction: Although surgical treatment of intercondylar fractures of the adult femur gives satisfactory results in the majority of cases, there are complications reported with operative management. We aim to analyse the surgical results of these cases performed in our institution and compare them to other reported series. **Materials and Methods:** A total of 16 patients with intercondylar fractures of the femur were operatively treated from 1989 to 1997. The ages of these patients ranged from 24 to 77 years, with a mean age of 42 years. Average length of follow-up was 28 months. The fractures were classified according to AO classification. Twenty-five per cent of the fractures were significantly comminuted. They were internally fixed with various implants such as cancellous screw fixation, dynamic condylar screw plate, condylar blade plate and condylar buttress plate. **Results:** Average time to full weight bearing was 12 weeks. Results of treatment were assessed according to the criteria described by Shelbourne. Eighty-three per cent of minimally comminuted fractures had a good result, but only 50% of significantly comminuted fractures did well. **Conclusions:** We recommend the use of anterior midline approach and condylar buttress plate for very comminuted fractures. Infection, if detected early and treated aggressively could avoid a poor outcome. Elderly patients should benefit from internal fixation and earlier mobilisation.

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Key words: Anterior approach, AO classification, Comminution, Condylar buttress plate, Shelbourne criteria

Introduction

Fractures of the intercondylar region of the femur often resulted from high velocity accidents. This would lead to increased comminution and involvement of the articular surfaces, making them a complex group of injuries to treat.

Traditionally, they were treated by closed methods which involved traction and subsequent mobilisation in cast braces. Some authors^{1,2} showed that closed methods gave better results than open methods. However, problems such as knee stiffness, prolonged bed rest and the inability to control displaced intra-articular fragments remained unsolved with closed methods.

There has been an increasing trend towards surgical treatment and this is largely due to improvements in surgical techniques and implant materials. Several authors³⁻⁷ reported good results with open reduction and internal fixation of these fractures. However, numerous complications with operative treatment were also reported.⁸

In the midst of this controversy, we aim to analyse our results of operative treatment of intercondylar fractures of the femur, including the complications.

Materials and Methods

A retrospective analysis was performed on 22 consecutive cases of isolated fractures involving the intercondylar region of the femur treated in this hospital from 1989 to 1997. Multiple fractures and associated ipsilateral tibial plateau fractures were excluded from the study. Six patients were lost to follow-up, leaving 16 patients for analysis. There were 6 females and 10 males in this series. The ages of the patients ranged from 24 to 77 years, with a mean of 42 years. The length of follow-up ranged from 12 months to 114 months, with a mean of 28 months.

The mechanisms of injury included road traffic accidents (10 cases), falls (4 cases) and assault (2 cases). Twelve cases had no significant comminution and 4 fractures had severe comminution. Eleven of the 16 fractures (69%) were closed and the remaining 5 (31%) were open. Of the 5 open fractures, 3 were of grade 1 severity, 1 of grade 2 severity and 1 of grade 3a severity, according to the classification by Gustilo. None of the patients had any neuro-vascular deficit. One patient (AO type C3) also presented with ipsilateral tears of both the anterior and

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posterior cruciate ligaments.

The AO/ASIF classification was used to categorise the fractures. It also distinguished between fractures involving one or both condyles and those involving the articular surfaces (Fig. 1). Ten cases were classified as type B1/2; 2 cases as type C1; 2 cases as type C2; and 2 cases as type C3. Twelve of our cases that had no significant comminution were AO types B and C1. Four cases that had significant comminution were AO types C2 and C3.

Operative treatment of all patients was performed within 48 hours. Prophylactic antibiotics (cephazolin) were used in all closed fractures for 2 days. For open fractures, a combination of amoxicillin, cloxacillin, gentamicin and metronidazole was used. Anterior approach (similar to the approach used in total knee arthroplasty) was used in 6 cases and lateral approach (curving towards the anterior) was used in the remaining 10 cases. For open fractures, the wounds were thoroughly debrided and cleansed with pulsatile lavage. The fractures were internally stabilised with various methods. Dynamic condylar screw plate, condylar blade plate and condylar buttress plate (Fig. 2) were used in 15 cases. All intercondylar fractures were

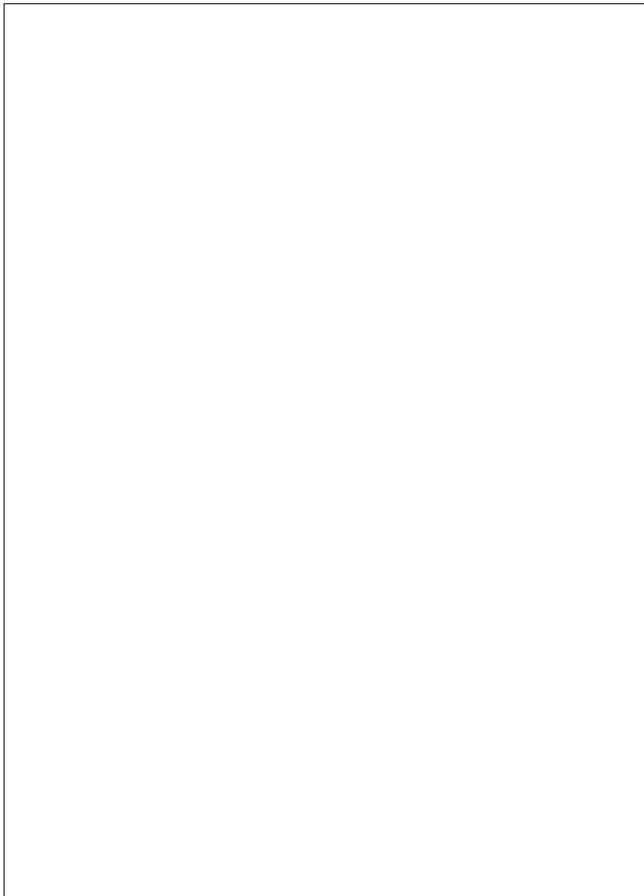


Fig. 1. AO classification of supracondylar and intercondylar fractures of the femur.

initially reduced and fixed with a 6.5-mm cancellous lag screw before applying the plate. One patient who had closed non-comminuted fracture had stable fixation with two 6.5-mm cancellous lag screws. For cases that were operated using the anterior approach, initial reduction and fixation of the articular fragments were done, followed by placement of the fixation device on the lateral aspect of the distal femur in the submuscular plane.

Based on the AO/ASIF classification, type B fractures were internally fixed with cancellous screws (1 case), condylar buttress plate (1 case), condylar blade plates (4 cases) and dynamic condylar screw plates (4 cases). The type C1 and C2 fractures were fixed with condylar buttress plates (2 cases), condylar blade plate (1 case) and dynamic condylar screw plate (1 case). Type C3 fractures were stabilised with condylar buttress plates. One had additional placement of external fixator across the knee for 3 weeks because of presence of associated tears of the anterior and posterior cruciate ligaments leading to subluxation of the knee. Both type C3 patients had supplemental kirschner wires inserted for stabilisation of smaller articular fragments.

All except 1 patient had primary closure of the wounds at the end of surgery. This patient had open grade 3a fracture. Daily dressings were performed and split skin grafting was done on the sixth postoperative day. None of our cases required any major pedicled or free flap coverage.

Postoperatively, the patients had their injured limbs elevated and immobilised, until the suction drains were removed. Subsequently, they were ambulated non-weight bearing on the injured limb with the aid of crutches. Range of motion exercises of the knee was also started.

The patients were assessed postoperatively in terms of length of hospitalisation stay, time to full weight bearing, time to fracture union and any need for bone grafting,

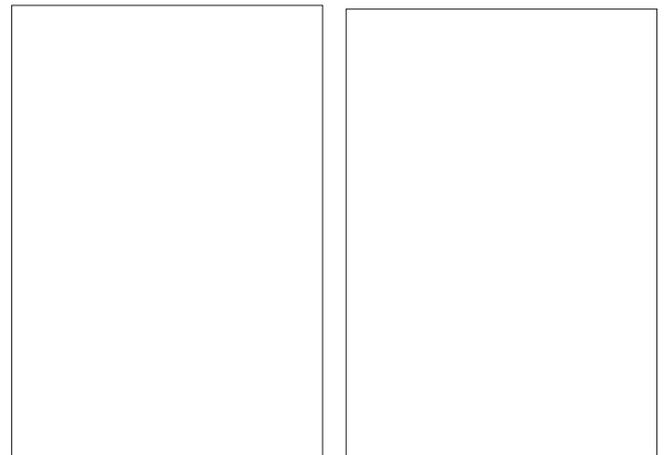


Fig. 2a. Radiograph of a type C comminuted intercondylar fracture of the femur.
Fig. 2b. Radiograph of the same fracture treated with a condylar buttress plate.

TABLE I: RATING SYSTEM BASED ON SHELBOURNE FOR GRADING RESULTS OF OPERATIVE TREATMENT OF INTERCONDYLAR FRACTURES OF THE FEMUR

| Rating | Motion (degrees) | Angulation (degrees) | Pain | Shortening (cm) |
|--------------|---------------------------------------|----------------------|--|-----------------|
| Excellent | Full extension; flexion >120 | None | None | None |
| Good | Full extension; flexion 90-120 | <5 | Minimum or with weather changes; no medications | <2.5 |
| Fair | Loss of extension, <10; flexion 70-90 | 5-10 | Minimum; not requiring regular anti-inflammatory medications | 2.5-5 |
| Failure/poor | Total <60 | >10 | Requiring daily analgesics or further surgery | >5 |

postoperative complications, as well as the functional outcome. The functional outcome was graded according to the criteria proposed by Shelbourne⁶ (Table I). Four categories were assessed in this system: amount of knee motion, degree of angulation at the fracture site, presence of pain and amount of shortening.

Results

The average hospitalisation stay was 19 days, with a range of 7 to 30 days. The mean time to full weight bearing was 12 weeks. The average time to union of fracture was 14 weeks. Two cases required bone grafting as a secondary procedure for delayed and non-union. They were both of high grade open fractures (grades 2 and 3a) and had severe comminution. One had good surgical outcome on evaluation, whilst the other had poor result.

There were no systemic complications reported in our series. Major complications related to the fractures were encountered in 3 cases. The first case involved an open grade 3a fracture (AO type B2) in which coagulase negative staphylococcal septic arthritis developed postoperatively. The patient required an arthrotomy. He subsequently had intravenous antibiotics for 3 weeks and then oral antibiotics for 3 weeks. He eventually had a fair outcome based on Shelbourne's criteria.⁶ The other 2 patients had severely comminuted AO type C3 fractures which led in 1 case to knee stiffness requiring arthrolysis and quadriceps release and in the other case avascular necrosis of the lateral femoral condyle. Both patients eventually had severe restriction of knee motion and had poor outcome on evaluation. None of our patients required above knee amputation, arthrodesis of the knee or total knee arthroplasty at follow-up.

Based on the rating system by Shelbourne,⁶ 50% of the fractures had excellent results and 25% had good results. A fair rating was reported in 12.25% of the fractures, and in 12.25% of the fractures the outcome was considered poor. Of the 2 patients with fair results, 1 had excessive pain and the other had extension lag of 10°. Both fractures were closed and did not have any significant comminution. Two

patients who had poor results had severely comminuted (AO type C3) fractures.

The degree of comminution of the fractures did affect the functional outcome (Table II). There were 12 fractures without significant comminution (AO types B and C1) and of these, 83% had good to excellent outcome. Only 50% of the patients with significantly comminuted fractures (AO types C2 and C3) had good to excellent results.

Time to full weight bearing was also influenced by the type of fracture. It ranged from 5 to 16 weeks for AO type B1, 6 to 16 weeks for AO type B2, 12 to 19 weeks for AO type C1, 16 to 20 weeks for AO type C2, and 10 to 20 weeks for AO type C3. There was a trend towards an increasing time to weight bear as the fracture type progressed from the less comminuted to the very comminuted.

Age did not play a significant influence on the surgical outcome. In our study, 3 patients were 60 years old and above. All had type B fractures. One patient had excellent, 1 had good and 1 had fair result.

Discussion

Intercondylar fractures of the femur are complex injuries often associated with various lesions⁷ around the knee, e.g. knee ligamentous injuries, meniscal tears, tibia plateau fractures and patellar fractures. These are difficult injuries to treat.⁶ Traction, traction followed by cast bracing, and open reduction and internal fixation are the treatment modalities available.⁶

Many different systems of classifications have been

TABLE II: BREAKDOWN OF THE SURGICAL RESULTS ACCORDING TO AO/ASIF CLASSIFICATION USING SHELBOURNE'S CRITERIA

| AO type | Number | Surgical result | | | |
|---------|--------|-----------------|------|------|------|
| | | Excellent | Good | Fair | Poor |
| B1/2 | 10 | 6 | 2 | 2 | 0 |
| C1 | 2 | 1 | 1 | 0 | 0 |
| C2 | 2 | 1 | 1 | 0 | 0 |
| C3 | 2 | 0 | 0 | 0 | 2 |

used.^{1,2,9} The lack of a common system made comparison between reported series difficult. Other factors that made comparisons between different series difficult were the varying severity of the intra-articular fractures and the treatment modalities used.

In our study, we used the AO/ASIF classification (Fig. 1) as it is easy to use and is accurate in predicting final outcome. It correlates well with the degree of comminution of fractures and with the type of operative techniques needed for stabilisation.

The standard lateral approach might not be suitable for all intercondylar fractures of the femur, especially the very comminuted. Visualisation and reduction of all intra-articular fragments is difficult. The use of a Y-shaped incision,⁵ through which the entire extensor mechanism is elevated with a block of bone from the tibial tuberosity, leads to high incidence of wound breakdown and infection. Others reported using an extensile approach⁴ like a large lateral J-shaped incision combined with tibial tubercle osteotomy to overcome the wound problems encountered with Y-shaped incisions. In our series, we used the standard midline anterior approach for the more comminuted fractures. This approach allowed adequate exposure of all intra-articular fragments. The problem of union of the tibial tuberosity was also avoided. The anterior approach would allow the use of the same incision should the patient need total knee arthroplasty later.

We feel that condylar buttress plate is probably the best implant, especially in the presence of severe comminution. Surgical errors with dynamic condylar screw and condylar blade plate⁹ can lead to placing the screw or blade plate too long, irritating the medial soft tissues. Sometimes the screw or blade plate is inserted too proximal for fear of breaching the knee joint. By doing so, adequate fixation of distal fragments is often not possible. These potential technical problems can be avoided by using the condylar buttress plate. Multiple 6.5-mm cancellous screws (full or half-threaded) placed in various directions can provide good fixation of multiple fragments. It is easy to use, an advantage especially for the relatively less experienced surgeons. We have used this implant increasingly more often now for the fixation of intercondylar fractures of the femur.

In our study, the average duration of hospitalisation of 19 days compares well with other reported series.¹⁻³

The rating system for grading functional outcome (Table I) devised by Shelbourne⁶ was used. This system emphasised the importance of obtaining full knee extension rather than full knee flexion. Based on this grading system, we obtained results comparable to other reported series on surgical as well as conservative treatment. The benefits of surgical stabilisation are earlier mobilisation and return to work,

and the avoidance of complications related to prolonged bed rest. In our series, none of the patients developed pressure sores, urinary tract infection, pneumonia or deep vein thrombosis of the leg. Because of this, we believe that elderly patients, unless medically unfit, should not be denied operative intervention. In our series, age did not negatively affect the surgical outcome. Partly due to their age, the main mechanism of injury was fall from a height, and not road traffic accident. The injuries were low to medium velocity, and the fractures were of the less comminuted type (AO type B). Impaction of comminuted metaphyseal fragments⁷ was done in these patients. The final outcome was relatively good, and compares favourably with that of the general population. We believe that the main factor affecting the final outcome is the degree of fracture comminution (Table II), which is very well classified by the AO/ASIF classification.

We reported 12.5% rate of delayed union (union occurring after more than 6 months) and non-union. This finding is in agreement with several previous reports.^{1-3,9} Absence of infection and stable anatomic two-plane fixation³ using interfragmentary and axial compression reduces the incidence of delayed union and non-union. We did not use primary autogenous bone grafting to fill bony defects, as has been reported by some authors.^{3,7}

The risk of infection is one of the main concerns in the operative treatment of these fractures.^{1-3,5,7} Open injuries with contamination, extensile approach, extensive dissection of the fractured fragments leading to devitalisation, presence of contused soft tissue envelope over the fractured fragments, and long operating time are the factors leading to infection. Infection accounted for 3 out of 4 poor results in one series.⁷ In our series, we had 1 case of serious infection that required arthrotomy, debridement, and lavage, besides antibiotics. He eventually had a fair outcome. Our infection rate of 6.25% compares well with other series. We believe that infection should be detected and treated early and aggressively to avoid poor outcome.

Conclusion

Seventy-five per cent of intercondylar fractures of the femur in this series had good or excellent results with surgery. This compares favourably with other reported studies. Management remains difficult despite advances in surgical techniques and implant materials. However, surgical management is advocated in view of the satisfactory results obtained. Benefits of early mobilisation imply that surgery should not be withheld from elderly patients. Anterior midline approach and condylar buttress plate fixation are better suited for very comminuted fractures. Infection must be detected and treated aggressively to avoid a poor outcome.

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