Supracondylar nailing of distal femoral fractures after total Knee Arthroplasty

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Abstract
We present results of supracondylar nailing in six patients who suffered distal femoral fractures above total knee arthroplasty. The average age of patients was 68 (42-92) years. All six fractures healed in a satisfactory alignment in an average duration of 14.6 weeks. There were no wound infection, loss of reduction or implant failure. All patients had regained their previous range of movement of the knee joint at an average follow up of 20 months. Supracondylar nailing is a good method of treatment of a displaced periprosthetic fractures proximal to total knee arthroplasty.
Introduction
Fracture of the distal femur proximal to knee arthroplasty is a difficult orthopaedic problem. Various factors like osteoporosis, rheumatoid arthritis, notching of anterior cortex, neurological disease and revision arthroplasty have been implicated as predisposing factors [9]. Both conservative and surgical methods have been suggested to treat this fracture. Conservative treatment usually involves immobilisation in a cast brace with or without a period of skeletal traction [5,9]. Surgical options include open reduction and internal fixation [7,12], external fixation [1], revision arthroplasty [3], primary arthrodesis [6] and retrograde supracondylar nailing [8,10,11,13]. We are presenting our experience of using retrograde supracondylar nailing for periprosthetic fractures of the distal femur.

Material and Methods
Between October 1997 and November 1999 six displaced periprosthetic fractures of the distal femur in six female patients were treated by a titanium supracondylar nail (Depuy ACE) The mean age of patients was 68 (42-92 years). Low velocity trauma by minor fall was the cause of fracture in all patients. Six fractures were equally divided between right and left side. All fractures were classified as type II according to the classification proposed by Chen et al [2]. Pre-existing disabilities, associated medical conditions and the type of knee implant in situ are shown in table 1. None of the patients was reported to have notching of the anterior cortex at the time of total knee replacement. The knee implants were in place for an average period of 36 months (range 3 weeks to 48 months).
Table 1 – *Profile of all patients in this series*

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Age</th>
<th>Sex</th>
<th>Side</th>
<th>Prosthesis type</th>
<th>Time since TKR</th>
<th>Associated disabilities</th>
<th>Union (weeks)</th>
<th>Follow-up (months)</th>
<th>ROM degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75</td>
<td>F</td>
<td>R</td>
<td>PFC</td>
<td>2 yr</td>
<td>-</td>
<td>12</td>
<td>22</td>
<td>0-90</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>F</td>
<td>L</td>
<td>IB-II</td>
<td>3 yr</td>
<td>MS, RA,</td>
<td>18</td>
<td>36</td>
<td>10-90</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>F</td>
<td>R</td>
<td>IB-II</td>
<td>3 yr</td>
<td>RA, DM, B/L THR &amp; TKR</td>
<td>12</td>
<td>24</td>
<td>0-70</td>
</tr>
<tr>
<td>4</td>
<td>92</td>
<td>F</td>
<td>L</td>
<td>IB-II</td>
<td>4 yr</td>
<td>-</td>
<td>16</td>
<td>6</td>
<td>10-90</td>
</tr>
<tr>
<td>5</td>
<td>78</td>
<td>F</td>
<td>L</td>
<td>IB-II</td>
<td>3 yr</td>
<td>RA, B/L THR</td>
<td>16</td>
<td>20</td>
<td>10-110</td>
</tr>
<tr>
<td>6</td>
<td>70</td>
<td>F</td>
<td>R</td>
<td>IB-II</td>
<td>3 wks</td>
<td>RA</td>
<td>16</td>
<td>24</td>
<td>10-110</td>
</tr>
</tbody>
</table>

RA- Rheumatoid arthritis; DM- Diabetes Mellitus; MS- Multiple sclerosis

A midline incision with medial parapatellar approach was used to access the intercondylar notch. Under radiographic control, the fracture reduction was achieved by closed method and the nail was inserted across the fracture site. After the nail was countersunk to avoid impingement, interlocking screws were inserted distally and proximally. The AIM titanium supracondylar nail is available in two diameters of 10 and 12 mm and four lengths of 150, 200, 250 and 300 mm. Both proximal and distal interlocking can be carried out using a single jig except for the longest nail, when free hand technique is used for proximal locking.
All except one patient were immobilized in a cast brace for 6-8 weeks. Active and passive knee mobilisation was started as soon as possible. Partial weightbearing was allowed for first six weeks gradually progressing to full weightbearing. All patients were followed in clinic with radiological examination. Radiographs were assessed for fracture healing, alignment at the fracture site and sign of loosening of prostheses. The average follow up was 20 (range 6-36 months).

Results

All six fractures healed (Fig 1) in an average period of 14.6 weeks (12-18 weeks). One patient suffered another fall two months after nailing and sustained a fracture of the shaft of the femur above the proximal end of the nail. This was treated by exchange nailing using a longer supracondylar nail. Both fractures healed in a satisfactory alignment in 18 weeks time. The alignment in the remaining cases was also satisfactory and none of the fractures healed in angulation of more than 10 degrees in any plane. All patients regained their previous range of movement of the knee joint. The average range of movement was 86.6 degrees. There were no postoperative complications like infection, deep vein thrombosis and pulmonary embolism. There were no cases of loss of reduction or implant failure. One 92-year old patient died six months after surgery due to unrelated causes but the fracture had healed at 16 weeks follow up. None of the five surviving patients showed any signs of loosening of knee prostheses at latest follow up and two patients had undergone total knee replacement on the contralateral side.
Figure 1

A: AP & Lateral view of a low periprosthetic fracture of the distal femur with total hip replacement on the same side. B: AP & Lat view at 12 weeks after supracondylar nailing showing fracture union in good alignment.

Discussion

The aim of treatment in fractures of the distal femur proximal to total knee arthroplasty is to achieve a painless and stable knee without significant residual malalignment. Conservative treatment of this injury has been reported with satisfactory outcomes [5]. However, this may be associated with difficulty in maintaining reduction, prolonged period of immobilisation, reduced knee functions, malunion and nonunion. Merkell and Johnson recommended conservative treatment in their study although nine out of 26 patients (35%) required revision arthroplasty because of nonunion, malunion, loosening of components and extensor lag [9].
Culp et al discouraged the use of closed methods as conservative treatment was followed by
nonunion in 20 percent cases and malunion in 23 percent patients in their series [4]. To
overcome these problems some authors have recommended open reduction and internal
fixation of these fractures [7,12] but this method is also not without its complications and
could be technically demanding in osteopenic and comminuted bones. Figgie et al reported
their results of open reduction and internal fixation in 10 cases. Only five fractures healed and
other five needed further surgical procedures. They also noted that eight out of 10 cases
developed varus alignment despite satisfactory intraoperative alignment due to metaphyseal
comminution. This was found to be associated with progressive radiolucent lines around the
prostheses. Chen et al in a meta-analysis showed that results were similar for both conservative
and surgical treatment of a displaced periprosthetic fractures of the distal femur. The
operative group mainly included patients who underwent open reduction and internal fixation
using plate and screws. There were only two patients who were treated by a supracondylar
nail and both had satisfactory outcome [2]. However, since then many studies have shown
high success rate with the use of supracondylar nail in management of the periprosthetic
fractures of the distal femur [8,10,11,13]. Because of a low incidence of this injury there not
many large series reported from one institution. But, our experience and available literature
suggests that supracondylar nailing is a simple and minimally invasive procedure. This
technique uses the previous incision and no soft tissue dissection is required at the fracture
site. It allows early mobilisation and range of motion exercises of the knee joint and maintains
the overall alignment. However in osteoporotic bones fixation needs to be protected in a cast
brace until bone healing is evident on radiographs. Although most of the modern knee
prostheses would allow supracondylar nailing, it is important to determine the type of the
knee implant and the width of the intercondylar notch before embarking on surgery.
In our small series, all six patients were females and four of these patients suffered from rheumatoid arthritis. None of the patients were reported to have anterior notching of the anterior cortex and it appears that osteopenia was the most common predisposing factor for periprosthetic fracture in this series. Interestingly five out of six patients had IB-II implants in situ but probably this finding is a reflection of local practice regarding the use of type of knee prostheses.

In conclusion, we have found supracondylar nailing a satisfactory procedure for the management of a displaced distal femoral fracture above a well-fixed total knee arthroplasty.

References


