Original Research Article

Subtrochanteric fracture of femur treated with proximal femoral nails – its functional outcome

K G Kandasamy1,*, R Shankar2

1Dept. of Orthopaedics, Vinayaka Missions Kirupananda Variyar Medical College and Hospital, Salem, Tamil Nadu, India
2Dept. of PSM, Vinayaka Missions Kirupananda Variyar Medical College and Hospital, Salem, Tamil Nadu, India

ABSTRACT

Background: Using proximal femoral nailing for sub-trochanteric fractures of femur by orthopedicains showed a mixed response in terms of functional outcome such as stability and anchoring and long term studies had also showed that it helps in preventing the recurrence of fractures.

Aim: To assess the operational outcome of subtrochanteric hip fractures those are treated with proximal femoral nails in terms of function.

Methodology: A prospective study was conducted for a period of one year among patients with subtrochanteric hip fracture and a total of 62 patients were included as our study subjects. Proximal femoral nail was inserted through the tip of greater trochanter exactly at the midway between its anterior and posterior extent. Based on the type of fracture distal interlocking was done either statically or dynamically to fix the fracture and the fracture fixation was confirmed through C-arm. Post-operatively all patients were followed up for a period of one year at an interval of 3 months and during each follow-up visit for the functional outcome was assessed in the form of walking, squatting, sitting and rising from chair.

Results: Function outcome was almost 100% at the end of 12 months and for walking for 15 meters nearly 98% was able to perform even at 6 months and 92% performed in 6 weeks post-operatively, whereas for raising from chair and squatting 55-60% of the patients were able to perform at the end of 6 months and for squatting and raising from chair it was 20% and 45% respectively at the end of 6 weeks.

Conclusion: Proximal Femoral Nailing is a good implant technique for patients with subtrochanteric fracture of the femur as it is almost like a closed technique with better stability and early mobilisation.

1. Introduction

Proximal femur fracture is a common type of fracture frequently reported in the department of orthopedics and among them fracture neck of femur and inter-trochanteric fractures are routinely dealt with by the orthopedicians.1 One of the most important area in the proximal part of femur is the subtrochanteric region which is located within 5 cms below the lesser trochanter usually experiences high level of stress and if not managed properly results in poor outcome. The overall incidence of this type of fractures as shown by previous studies was 15 – 20/100,000 population and females aged more than 50 years are most commonly affected.2,3 Other added risk factors for subtrochanteric fractures were diabetes mellitus, reduced bone mineral density and patients who were using bisphosphonates as the treatment for osteoporosis for more than 5 years.4,5 The subtrochanter region is where the multiple muscular attachments such as lateral hip abductors, medial hip adductors, the iliopsoas, and short external rotators takes place making it to increase the stress around the hip and proximal femur.6 In clinical examination of subtrochanteric fractures the classical deformity that occurs is proximal segment abduction, external rotation, and flexion that is due to the pull caused by gluteus medius, gluteus minimus, iliopsoas, gracilis and adductor muscle groups.7 The most
common mode of injury in these type of fractures are either
due to injuries resulting from high energy, falling from
height or a low mechanism injury such as an accidental fall
that commonly occurs in elderly. Diagnosis is confirmed
by the x-ray picture that reveals atypical subtrochanteric
fractures that include a transverse fracture patterns with
a minimal comminution, lateral cortical thinking, and a
posteromedial spike. There is no role of non-operative
management in sub-trochanteric fractures as is leads
to increased morbidity and mortality and the definitive
management is early surgical intervention. Over the past
two to three decades subtrochanteric fractures are mainly
treated with plates and screws such as dynamic hip screws,
condylar screws or cephalo-medullary nails. Proximal
femoral nailing is a newer technique introduced in the year
1997 by an Orthopedic association and after its introduction
few studies were conducted to assess its efficacy in terms
of stability, anchoring, dynamic locking and option for
secondary locking that helps in the prevention of later
fractures. Another added advantage of this procedure is,
it is a weight sharing implant rather than weight bearing
and very few complications such as malunion or non-
union were reported. Though few studies have been
conducted in assessing the efficacy of proximal femoral
nailing but not much had been done in South India and so
the present study was conducted to assess the operational
outcome of proximal femoral nailing among patients with
subtrocahnteric fractures.

2. Methodology

A prospective longitudinal study was conducted for a period
of one year at a tertiary care hospital in Salem district.
The study was started after getting approval from the
institutional ethics committee. Patients with subtrochanteric
hip fracture admitted in our hospital were included as
our study subjects. Patients with open fractures were
excluded from the study and a total of 62 patients were
taken as our study sample. Proper informed consent was
taken from all patients involved in the study. A semi-
structured questionnaire was designed to collect the socio-
demographic details and the clinical history from all the
patients with subtrochanteric fractures. For all patients
the operative procedure was done under spinal/epidural
anaesthesia. After placing the patient on the fracture table,
using longitudinal traction technique the fracture is reduced
and the affected limb is slightly adducted in such a way
it helps in facilitating the proximal femoral nail insertion
through greater trochanter.

A lateral incision of 4-6 cm was made proximally then
the gluteus maximus muscle was dissected along with the
line of its fibers which paved the way for the entry of
proximal femoral nail at the tip of the greater trochanter.
After fixing the appropriate sized nail on the insertion device
the nail was then slowly introduced manually into the shaft
of femur with a help of guide wire using C-arm. The hip
pin was initially introduced just about 25 mm medial to the
fracture line, and then the neck screw was inserted according
to the size required. Depending on the type of fracture, distal
interlocking was done. The stability of the procedure was
assessed and wounds were closed in layers after placing
a negative suction drain. Post-operatively patients were
reated with analgesics and antibiotics and proper wound
dressing was applied. Transfusion requirements, adverse
events and length of hospital stay were recorded for each
patient.

Post-operatively the operated limb was kept in an
elevated position in order to reduce swelling and facilitate
drainage. Mobilization was initiated based on the patients
fracture pattern, in non-comminuted fractures weight
bearing was initiated early whereas in comminuted fractures
it was delayed till the formation of callus. All the patients
were followed up at an interval of three months for a
period of one year and in each follow-up visit the functional
outcome was assessed in the form of walking, squatting,
sitting and rising from chair. Any complication if occurred
was also recorded.

All the data were entered and analysed using SPSS
version 24. Mean and standard deviation was derived for
all parametric variables and percentage was calculated for
all frequency variables, chi-square test was used to derive
the statistical inference considering p<.05 as statistically
significant.

3. Results

Most of the study subjects in our study were in the age
group between 50 and 70 years with mean age was 56.4
years. Males were slightly more in number than the females
with the male: female ratio of 1.23: 1 (Table 1). There
was almost equal distribution on the side of injury between
left and right. Almost 60% of the patients acquired the
fracture through road traffic accidents and the remaining had
history of accidental fall. The subtrochanteric femur fracture
based on the radiological findings was classified according
to Seinsheimer Classification. Based on this classification
majority of the patients fell under type 3A (27.4%) fractures
followed by type 2C (22.5%) and 2B (20.9%) and only one
patients had type 4 fracture (Table 2). The most common
comorbid condition reported among our study subjects were
either diabetes or hypertension. In majority (64.5%) of the
patients the surgery was done in less than 7 days after
acquiring the injury and the mean duration between the
onset of fracture and the surgery was 5.8 days. Only for
two patients the surgery was performed after 2 weeks that
is for stabilizing the patient as they had type 4 and type 3B
fractures (Table 3). Among the surgeries performed 93% of
the patients underwent open reduction and the remaining
7% had a closed reduction and regarding the size of the
proximal femoral nail out of 62 patients for 58 patients 9
mm PFN was used and for the remaining 4 patients 10 mm PFN was used. The mean operating time from skin to skin was 90 mins. In our study 70% of the patients had complete fracture union by 14 – 16 weeks and the remaining showed complete union by 12 – 14 weeks with a mean of 14.5 weeks (Table 4). Out of 62 patients 4 patients were lost follow up and so the follow up analysis for functional outcome was made for only 58 patients. The operational outcome was assessed in terms of the patients able to perform the functions like squatting, walking for 15 meters and raising from chair. Three follow-up visits were made at 6 weeks, 6 months and 12 months respectively. It was shown from table 5 that all the patients who had come for regular follow-up was able to perform all the functions at the end of 12 months and for walking for 15 meters nearly 96.5% was able to perform even at 6 months and 93% performed in 6 weeks post-operatively, whereas for raising from chair and squatting 55-60% of the patients were able to perform at the end of 6 months and for squatting and raising from chair it was 22.4% and 43% respectively at the end of 6 weeks (Table 5). Type of fracture does not show a significant association with the functional outcome (Table 6) and similarly age, gender, size of PFN and mode of injury did not show statistical significant association with the outcome. Among the complications reported 2 patients had superficial wound infection which were treated with intravenous antibiotics and wound dressing and two more patients had anesthetic related complications which were managed adequately in the recovery room of anesthesia. Other than that no other serious complications such as malunion, limb length discrepancy or implant related complications were reported. X-ray pictures taken in pre-operative and post-operative period are shown in Figures 1, 2 and 3.

4. Discussion
In Subtrochanteric fractures of femur the commonest mode of injury is because of high energy trauma and due to its complex stress configuration these fractures commonly occurs in the area of least resistance in the proximal femur. Further the unstable fractures occurring at this region impose a significant challenge to the operating surgeon as fixing these fractures becomes technically difficult and improper technique might lead on to primary fixation failure. As quoted in the previous studies the best treatment for these fractures is fixing the fractures with dynamic hip screws (DHS) but still the failure rate was shown as upto 20%. Fracture instability, presence of osteoporosis, lack of anatomic reduction, implant failure, and placing the lag screw in an incorrect position in femoral head were found to be the most common causes for fixation failure. The most common preference among orthopedicians is intramedullary fixation because of its advantages like minimal soft tissue injury and wound complications. Among the various procedures in intramedullary fixation introducing a proximal femoral nail is a newer technique in which the nail tip is specially shaped to reduce the stress and further it prevents low energy fracture at the tip of the implant, along with this it also reduces the lever arm distance at the time of reactionary forces generated in the hip joint movements. Knowing these advantages the present study was done to assess the operational outcome of patients treated with proximal femoral nails for fractures in the subtrochanteric region of femur.

In the present study the mean age of the patients operated for subtrochanteric fractures was 56 years and it is almost similar to the study done by Sandeep Sharma etal, where he quoted the mean age as 53 years and few other studies done by C.Bouldinet al, I.C.Schipper etal and T.Pavelka et al had mentioned the mean age as more than 70 years and as quoted by previous studies males are more in number than females. In our study the commonest mode of injury was road traffic accidents followed by accidental fall and all the earlier studies had also quoted these two as the major mode of injury with slight variations in the percentage.

In the current study Seinsheimer classification was followed for classifying the subtrochanteric fractures and under this classification type III A was found to be the most common type and a similar results was also shown in the studies done by Sandeep Sharma et al and Seinsheimer et al. In our study the time interval between the onset of injury and the surgery performed was 5.8 days and it is almost in par with he studies done by I.B.Schipper, C.Bouldin and D.M.Rahme. The average time taken for the surgery was 90 mins and most of the previously done studies had shown the average time of the procedure varied between 60 and 90 mins as it depends on the skill of the surgeon and certain factors related to patients. In the current study the complete union of the fracture was seen in 14.5 weeks, whereas the study done by VivekPradhan etal had shown the mean weeks for complete union as 13.88 weeks and most of the other studies also ranged between 13.5 and 14.5 weeks. In our study no serious postoperative complications line malunion or union were reported only superficial wound infection and anesthesia related complications had occurred, whereas a study done by Sandeepetalhad shown non-union in 3.5% of the patients and few studies done by D.M.Rahme et al and W.M.Gadegone et al it was 12% and 13% respectively. In the present study excellent outcome results was achieved by 12 months in 100% of the patients who had come for follow-up and the outcome was based on their ability to squat, walk for 15 meters and rising up chair, in most of the previously done studies the results was shown that excellent outcome was achieved in almost 90% of the patients in 8 to 12 months.
Fig. 1: A: Pre-operative X-ray; B: Immediate Post-operative X-ray; C: X-ray taken at 2 months post-operatively; D: Functional outcome at end of 2 month

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>4 (11.7%)</td>
<td>3 (10.7%)</td>
<td>7 (11.2%)</td>
</tr>
<tr>
<td>30 – 50</td>
<td>11 (32.3%)</td>
<td>7 (25%)</td>
<td>18 (29%)</td>
</tr>
<tr>
<td>50 – 70</td>
<td>13 (38.2%)</td>
<td>9 (32.1%)</td>
<td>19 (30.6%)</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>6 (17.6%)</td>
<td>9 (32.1%)</td>
<td>14 (22.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>34 (100%)</td>
<td>28 (100%)</td>
<td>62 (100%)</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>53.7 ± 7.2</td>
<td>58.5 ± 7.8</td>
<td>56.4 ± 7.4</td>
</tr>
</tbody>
</table>
Fig. 2: A: Pre-operative X-ray; B: Post-operative X-ray

Fig. 3: A: Pre-operative X-ray; B: Post-operative X-ray; C: Functional assessment post-operatively at 2 months

Table 2: Distribution of the study subjects based on type of fracture according to Seinsheimer Classification

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-part transverse fractures (II-A)</td>
<td>10</td>
<td>16.1%</td>
</tr>
<tr>
<td>Two-part spiral fractures with lesser trochanter attached to the proximal fragment (II-B)</td>
<td>13</td>
<td>20.9%</td>
</tr>
<tr>
<td>Two-part spiral fractures with lesser trochanter not attached to the proximal fragment (II-C)</td>
<td>14</td>
<td>22.5%</td>
</tr>
<tr>
<td>Three-part spiral fractures in which the lesser trochanter is part of the third fragment (III-A)</td>
<td>17</td>
<td>27.4%</td>
</tr>
<tr>
<td>Three-part spiral fractures of the proximal third of the femur (III-B)</td>
<td>7</td>
<td>11.2%</td>
</tr>
<tr>
<td>Comminuted fractures (IV)</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: Distribution of the study subjects based on the time interval between fracture and surgery

<table>
<thead>
<tr>
<th>Time to surgery</th>
<th>No. of cases</th>
<th>Percentage</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 7 days</td>
<td>40</td>
<td>64.5%</td>
<td></td>
</tr>
<tr>
<td>1 – 2 weeks</td>
<td>20</td>
<td>32.2%</td>
<td>5.8 ± 4.2</td>
</tr>
<tr>
<td>&gt; 2 weeks</td>
<td>2</td>
<td>3.2%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Distribution of the study subjects based on the duration for fracture union

<table>
<thead>
<tr>
<th>Time for union</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 – 14 weeks</td>
<td>21</td>
<td>33.8%</td>
<td></td>
</tr>
<tr>
<td>14 – 16 weeks</td>
<td>41</td>
<td>66.1%</td>
<td>14.5 ± 0.88</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Various functional outcome measured among the study subjects

<table>
<thead>
<tr>
<th>Functional outcome</th>
<th>6 weeks</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squatting (%)</td>
<td>13 (22.4%)</td>
<td>37 (63.7%)</td>
<td>58 (100%)</td>
</tr>
<tr>
<td>Walking 15 metres (%)</td>
<td>54 (93.1%)</td>
<td>56 (96.5%)</td>
<td>58 (100%)</td>
</tr>
<tr>
<td>Rising from chair (%)</td>
<td>25 (43.1%)</td>
<td>33 (56.8%)</td>
<td>58 (100%)</td>
</tr>
</tbody>
</table>

Table 6: Distribution of the study subjects based on the type of fracture and the functional outcome

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Functional outcome</th>
<th>6 weeks</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2A (n=10)</td>
<td>Squatting</td>
<td>3 (30%)</td>
<td>6 (60%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td></td>
<td>Walking 15 metres</td>
<td>6 (60%)</td>
<td>8 (80%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td></td>
<td>Rising from chair</td>
<td>4 (40%)</td>
<td>7 (70%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td></td>
<td>Squatting</td>
<td>5 (38.4%)</td>
<td>8 (61.5%)</td>
<td>13 (100%)</td>
</tr>
<tr>
<td>Type 2B (n=13)</td>
<td>Walking 15 metres</td>
<td>10 (76.9%)</td>
<td>12 (92.3%)</td>
<td>13 (100%)</td>
</tr>
<tr>
<td></td>
<td>Rising from chair</td>
<td>7 (53.8%)</td>
<td>9 (69.2%)</td>
<td>13 (100%)</td>
</tr>
<tr>
<td></td>
<td>Squatting</td>
<td>5 (38.4%)</td>
<td>9 (69.2%)</td>
<td>13 (100%)</td>
</tr>
<tr>
<td>Type 2C (n=14)</td>
<td>Squatting</td>
<td>5 (33.3%)</td>
<td>10 (66.6%)</td>
<td>15 (100%)</td>
</tr>
<tr>
<td></td>
<td>Walking 15 metres</td>
<td>8 (53.3%)</td>
<td>14 (93.3%)</td>
<td>15 (100%)</td>
</tr>
<tr>
<td></td>
<td>Rising from chair</td>
<td>6 (40%)</td>
<td>10 (66.6%)</td>
<td>15 (100%)</td>
</tr>
<tr>
<td></td>
<td>Squatting</td>
<td>3 (50%)</td>
<td>4 (66.6%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>Type 3A (n=17)</td>
<td>Squatting</td>
<td>5 (83.3%)</td>
<td>6 (100%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td></td>
<td>Rising from chair</td>
<td>4 (66.6%)</td>
<td>5 (83.3%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td></td>
<td>Squatting</td>
<td>0</td>
<td>1 (100%)</td>
<td>1(100%)</td>
</tr>
<tr>
<td>Type 3B (n=7)</td>
<td>Squatting</td>
<td>0.591</td>
<td>0.784</td>
<td>0.614</td>
</tr>
<tr>
<td></td>
<td>Rising from chair</td>
<td>0.784</td>
<td>0.614</td>
<td></td>
</tr>
</tbody>
</table>

5. Conclusion

Fracture union was observed in almost all the cases with a very good postoperative functional outcome for patients who had regular follow-up. Proximal Femoral Nailing is a good implant technique for patients with subtrochanteric fracture of the femur as it is almost like a closed technique with better stability and early mobilisation. The operation being technically demanding if the operating surgeons are adequately trained it is considered as a truly minimal invasive procedure.

6. Source of Funding

None.

7. Conflict of Interest

None.

References


Author biography

K G Kandasamy Associate Professor

R Shankar Professor