Long proximal femoral nails versus sliding hip screw-plate device for the treatment of intertrochanteric hip fractures – A randomized prospective study in 100 elderly patients

M Porecha, D Parmar, H Chawada, S Parmar

INTRODUCTION

The standard treatment for intertrochanteric fractures of the femur is the sliding hip screw and plate. However, mechanical and technical failures continue to occur in as many as 6% to 18% of cases. Because of the magnitude of the problem regarding quality of the life, an improvement in the treatment of intertrochanteric fractures is required.

Theoretically, there is an improved biomechanical environment with an intramedullary device with a shorter lever arm, which provides more load sharing indirect healing and allows less collapse to a stable medial configuration and thus enables early rehabilitation and weight-bearing of the fractured extremity. The insertion by a limited exposure also may offer benefit, because there is less soft tissue trauma, and this could lead to a reduced incidence of infection. A smaller wound also might minimize blood loss because fewer vessels are damaged.

Initial reports showed that the gamma nail to be useful but suggested specific recommendations for insertion. However, randomized controlled trials comparing the dynamic hip screw versus the Gamma nail showed a high incidence of femoral shaft fracture in groups treated with the Gamma nail. On the bases of these studies, a new system of intramedullary nailing with biomechanical modifications compared to existing system is introduced in the form of proximal femoral nail in an attempt to minimize the technical complications. To decrease the high incidence of femoral shaft fracture long proximal femoral nails have been used in our study for trochanteric fractures. The purpose of this randomized prospective observer blinded trial was to compare long proximal femoral nail intramedullary fixation device with sliding hip screw and plate extramedullary device for the treatment of intertrochanteric fractures.

MATERIAL AND METHODS

The randomized prospective trial was performed from January 2005 to July 2008 at Orthopedics Department, M.P.Shah Medical College and Guru Govind Singh Hospital, Jamnagar, Gujarat, India. All patients admitted to the unit with a diagnosis of intertrochanteric fractured femur were considered for the study. A total of 100 patients were randomized. During the study period, an additional 24 patients who had an intertrochanteric fracture were not enrolled in the study, because either the patient declined to participate (13 patients) or bias toward one of the treatment without considering the outcome of the treatment (11 Patients). The fractures were classified according to AO-
OTA classification. The Evans classification as modified by Jensen also describes the fracture configuration such that groupings with stable and unstable fractures are created. The stable fractures are divided into undisplaced (S1) and initially displaced but reducible (S2). The unstable fractures can be displaced with loss of medial support (U1), displaced with loss of medial and lateral support (U2) and reverse obliquity (U3) as shown in Table 1.

**Figure 1**

Table 1: Classification of intertrochanteric fracture according to Evans and AO/OTA and patients distribution according to above classification.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
<th>Long PFN</th>
<th>Sliding Hip Screw-Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evans</td>
<td>S1</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>S2</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>U1</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>U2</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>U3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Sixty five percent of the patients were women; the average patient age was 67 years (range 55-84 years). One patient fell from height and four patients encounter vehicular accident. The rest of the injuries resulted from a low energy fall. Preoperative variables studied included patients’ age, sex, side of the fracture, fracture pattern, premorbid mobility, mode of injury, the American Society of Anesthesiologists rating of operative risk and hemoglobin were recorded.

Pre-operatively as soon as the patient was diagnosed, below knee non-adhesive skin traction with 3 kg weight is applied on Bohler Brown splint. Most of the patients had associated co-morbidities like, Hypertension, Diabetes Mellitus, Ischemic heart Disease, Congestive Cardiac Failure, Chronic Bronchitis, etc. Patients were taken for surgery as soon as fit for anesthesia.

The intra-operative variables studied, included device used, operative time, estimated blood loss, fluoroscopic imaging time (Excluding manipulation before the incision was made), number of the units of the blood transfused and other complications related to implants. Spinal, Epidural or General Anesthesia were used as decided by Consultant Anesthetist. The surgeons were well experienced in the insertion of both implants. IITV anteroposterior (AP) and lateral images were used to evaluate the adequacy of the reduction, insertion of either of implants and the location of the screw within the femoral head. Reduction was classified as Good if alignment was normal or slight valgus on the AP view, less than 20 degree angulated on the lateral view, and had less than 4 mm fracture displacement. It was term Acceptable if either the alignment or displacement criteria were met but not both. The reduction was termed Poor if neither criteria were met.

Screw location within the femoral head was defined by two independent techniques immediately post operative x ray and at each follow up control. One system divided the femoral head into three columns on the AP and lateral views to create nine zones. Another technique, the tip-apex distance summed the distance from the compression screw tip to the apex of the femoral head on the AP and lateral projections (after correcting fro magnification) to generate a single number to define screw position. We noted any change in the position of the implants and the extent of the fracture union. For long proximal femoral nail, the ideal recommended position for the PFN screw is slightly inferior to centre in the femoral head to allow for placement of the hip pin. For extramedullary slide hip screw plate device the ideal placement of the Richard screw is center-center within the femoral head. No displacement osteotomies were performed. Negative suction drainage was put for sliding hip screw-plate extramedullary device; while no suction drainage was put in patients treated with long proximal femoral nail device.

There was no defined postoperative patient protocol, but all patients were given prophylactic preoperative antibiotic and postoperative antibiotics (Third Generation Cephalosporins) for 72 hrs as per the O. T. and Department Protocol. We did
Long proximal femoral nails versus sliding hip screw-plate device for the treatment of intertrochanteric hip fractures – A randomized prospective study in 100 elderly patients

not use DVT prophylaxis drugs as we don’t encounter this problem as frequently as the western world. Rehabilitation protocol was identical for both groups, with patients mobilized out of bed on the second postoperative day, and ambulation with weight bearing as tolerated was begun. The incidence of any postoperative complications and hospital stay were recorded. Wound infections are categorized into none, superficial in cases in which there was cellulitis requiring antibiotic treatment in the early postoperative period, and deep in cases in which there was persisting purulent discharge with positive bacteriology from the wound which delay the healing. A post operative hemoglobin level was taken at day 2. First dressing and removal of negative suction was done after 72 hrs post operatively. 2nd dressing was done at day 5 and patient was discharged from the hospital if there is no evidence of infection. Observer blinded functional assessments were carried out by use of the Harris Hip Score.

RESULTS

Most of the Patients were elderly as mean age about 66-67 year and about to same in both groups. Women were affected almost twice as to men probably because of osteoporosis. Frequencies of stable intertrochanteric fracture were slightly higher than unstable intertrochanteric fracture. Half of the patients on either group were Independent on walking prior to the trauma. Very few patients in either group were chair/bed ridden. Most of the fracture occurs due to low energy fall. Large number of patients had associated co-morbidities according to which they had given ASA rate of operative risk. (Table 2)

Post reduction fluoroscopic IITV image time is about 1 minute higher in Long PFN Group (4 min 14 sec) than Richards’s device Group (3 min 20 sec). Unstable intertrochanteric fractures had required more fluoroscopic time than stable Intertrochanteric group in either group. However, blood loss is clearly more in Richards Device Group (350cc) than Long PFN Group (250cc). The insertion of the long proximal femoral nail was accomplished through a significant shorter incision and with much less dissections, particularly no need to split, cut or reflect the vastus lateralis. This decrease in the surgical trauma certainly explains reduced intra-operative blood loss. Intramedullary device insertion required smaller incision (7.5cm) as compared to Extramedullary Device (15.6cm). Although, surgeons were acquainted with both procedures well, needed more time in insertion of Richard Device (mean 100 min.) than Long PFN (mean 71 min.). And there were very little difference in insertion time for Long PFN group in Unstable and stable fracture. (Table 3)
Three different lengths sliding hip screw sideplates were used, ranging from four to seven holes. All had standard length barrels. The mean diameter of long proximal femoral nail was 10 mm (ranged from 9-12 mm). All long proximal femoral nail were distally locked with one interlocking screw. Open reduction was performed in 6 fractures treated with a sliding hip screw and in three fractures stabilized with an intramedullary hip screw. There were no differences in the quality of the reduction achieved (90% good and acceptable reductions with an intramedullary hip screw versus 95% with the sliding hip screw) or implant position within the femoral head (55% center-center zone and an average tip-apex distance of 22 mm with long proximal femoral nail versus 53% centre-centre zone and an average tip-apex distance of 20 mm with the sliding hip screw).

No intraoperative complications like drill bit breakage, jamming of nail, operative fracture displacement or failure of distal interlocking screw occurred in either group.

Mean duration of hospital stay was clearly higher in Richards Device Group (7.1 days) than Long PGN Group (5.3 days), particularly, more in Unstable Fracture group (9.4 days). There was one infection in Long PFN Group which is of superficial type. While four patients had infection in Richards Device Group, superficial type in each stable and unstable fracture group and deep infection in two patients in Unstable fracture Group. However, there was very little difference in weight bearing between either groups but slightly higher in Richards Device Group.

Three patients died during hospitalization (2 in the sliding hip screw group and 1 in the long proximal femoral nail group). The death rate for all patients it the study was 10% at 3 months and 20% at 12 months follow up. Although the mortality rate consistently was higher for patients who were stabilized with a sliding hip screw (27% versus 13% for long proximal femoral nail at 12 months).

Those patients who died within 3 months of surgery (10 patients) were excluded from the analysis of clinical
outcome. Ninety patients (forty eight treated with long proximal femoral nail and forty two treated with sliding hip screw-plate) were observed for an average of 22 months (range 4-40 months). Fracture healing was occurred with average 6 weeks in long proximal femoral nail and with 7 weeks in sliding hip screw device. The pre-operative X-Ray, immediate post-operative X-ray and X-ray showing radiological union at 6 weeks are shown in figure 1, 2 and 3.

**Figure 6**
Figure 1: X-ray showing pre-operative x-ray of intertrochanteric fracture

**Figure 7**
Figure 2: X-ray showing immediate post-operative fixation with Long PFN of the fracture

**Figure 8**
Figure 3: X-ray showing fracture healing at 6 weeks.

Overall, there were no differences in the rates of functional recovery between the two fixation groups. Harris Hip Score shows no significant difference between the two groups. (Table 6)
3 patients (6.25%) in the long proximal femoral nail and 3 patients (7.14%) in the sliding hip screw-plate device had hip pain at latest follow up. Four major medical complications occur in patients who were stabilized with a sliding hip screw and 1 major medical complication occur in patients who were treated with long proximal femoral nail. Late complications included four lag screws that cut out from the femoral head (2 (4.76%) in sliding hip screw and one (2%) in long proximal femoral nail). One patient treated with sliding hip screw had plate pull-off. One patient with long proximal femoral nail had ‘Z effect’. We did not encounter any periprosthetic femoral shaft fracture as we used long proximal femoral nail unlike other studies. No non-union noticed in either series. Three patients (2 in sliding hip screw group and 1 in long proximal femoral nail group) required hardware removal secondary to hip pain. (Table 7)

Figure 10
Table 7: Pain & Lag screw cut out

<table>
<thead>
<tr>
<th>Pain and lag screw cut out</th>
<th>Long PFN (n=48)</th>
<th>Sliding Hip Screw-Plate (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain in hip (after 3 months):</td>
<td>3 (6.25%)</td>
<td>3 (7.14 %)</td>
</tr>
<tr>
<td>Stable fracture</td>
<td>1 (3.84%)</td>
<td>1 (4.76%)</td>
</tr>
<tr>
<td>Unstable fracture</td>
<td>2 (9.09%)</td>
<td>2 (9.52%)</td>
</tr>
<tr>
<td>Pain in thigh (after 3 months):</td>
<td>6 (12.5%)</td>
<td>6 (14.28%)</td>
</tr>
<tr>
<td>Stable fracture</td>
<td>2 (7.69%)</td>
<td>3 (14.28%)</td>
</tr>
<tr>
<td>Unstable fracture</td>
<td>4 (18.18%)</td>
<td>3 (14.28%)</td>
</tr>
<tr>
<td>Lag screw cut out:</td>
<td>1 (2%)</td>
<td>2 (4.76%)</td>
</tr>
<tr>
<td>Stable fracture</td>
<td>1 (3.84%)</td>
<td>1 (4.76%)</td>
</tr>
<tr>
<td>Unstable fracture</td>
<td>0</td>
<td>1 (4.76%)</td>
</tr>
</tbody>
</table>

DISCUSSION

Early operative treatment of trochanteric fractures reduces both mortality and morbidity giving best chances of early rehabilitation and reduces the risks of prolong bed rest. Fracture intertrochanter is one of those fractures which perhaps we start operating from our days of residency. These fracture carries special attention, although they are frequent and common, because of they are prevalent in elderly population, low energy trauma, weak bones due to osteoporosis, metaphyseal comminution, lack of medial buttress and patients with associated co-morbidities. Because of these problems there is so much controversy among surgeons as to the best method of managing intertrochanteric fractures which occur most frequently and are perhaps the most commonly stabilized fractures in orthopedics. Various modalities of treatment exist till date. Nowadays there is no role of conservative method due to the complications associated with it, leaving only few indications for its use, like an elderly patient whose medical condition carries an excessively high risk of mortality from anesthesia and surgery, or non-ambulatory patient who has minimal discomfort following fracture. Operative management consisting of fracture reduction and stabilization, which permits early patient mobilization and minimizes many of complications of bed rest, has consequently become the treatment of choice for trochanteric fractures.

Numerous implants are available both intramedullary and extramedullary and excellent results have been reported with all. Intramedullary implants have revolutionized the management of fracture trochanter, as they carry all possible advantage over there counterparts, extramedullary implants. They are inserted with minimal soft tissue injury technique, lesser blood loss, lesser limb shortening, lesser decrease in medial offset, so, less abductor lurch while walking, and faster rehabilitation. One of the intramedullary implants used for fixation of trochanteric fractures is long proximal femoral nail. PFN is designed to overcome some of the difficulties encountered with earlier designs of intramedullary implants meant for stabilization of proximal femoral fractures. It provides stable internal fixation with biomechanical advantage of a shorter lever arm, which is more stable under loading. The anti-rotation screw prevents the rotational element of the proximal fracture fragment; fluting the nail tip decreases the stress at the distal end.

In this prospective randomized study, patients with intertrochanteric fractures stabilized with intramedullary
long proximal femoral nail had a shorter operative time, less blood loss, significant shorter incision with much less dissection and lower rate of infection and thus shorter hospital stay than those treated with the sliding hip screw-plate extramedullary device. This results are consistent with the study by T. Morihara et al, Leung and coworkers  

The increased implant complication rate seen with the intramedullary hip screw compared with the sliding hip screw also was described in reports concerning proximal femoral nail can be attributed in part to inexperience with the device; in experienced hands, no intraoperative complications had been encountered in our study. However, postoperative femoral shaft fracture seems to be a problem unique to short intramedullary nails; therefore we prefer to use long proximal femoral nail instead of short proximal femoral nail and had better outcome with the same. The intramedullary long proximal femoral nail has a sliding screw and sleeve geometry that is similar to screw and barrel of a sliding hip screw, such that initial fracture impaction should be equivalent (until the head and neck fragment abuts the intramedullary nail). In the present study, no difference was found between the two devices in the amount of postoperative fracture compression. Intramedullary long proximal femoral nail offer semiperccutaneous fixation of intertrochanteric hip fractures. Unstable fractures can be fixed faster and with less blood loss than when using a sliding hip screw and side plate. For the surgeon who is experienced in the technique of second generation interlocked femoral nailing, the intramedullary long proximal femoral nail ‘has proven to be more efficient’ and thus may be a preferred implant for intertrochanteric fractures.

CORRESPONDENCE TO

Dr. Milind M. Porecha (M.S. Ortho) Assistant professor, Orthopedics department, M.P.Shah Medical College, Guru Govind Singh Hospital, Jamnagar. 361008. Gujarat. India. Residential Address: “Ashutosh” Opp. PW.D. Quarters, Near Ahir Boarding, Amber Cinema Road, Pt. Nehru Marg, Jamnagar. 361008. Gujarat. India. Cell No. 9974705768 (0288) 2671166 E-Mail Address: drmilindmp@yahoo.co.in

References

23. Pillar T, Gaspar E, Poplingher AR, Dickstein R. Operated versus non-operated hip fractures in a geriatric...
Author Information

Milind M. Porecha, M.S. Ortho
Assistant professor, Orthopedics department, M.P.Shah Medical College, Guru Govind Singh Hospital

Deepak S. Parmar, M.S. Ortho
Associate professor, Orthopedics department, M.P.Shah Medical College, Guru Govind Singh Hospital

Hiral R. Chawada, M.D. Anesthesia
Assistant Professor, Anesthesiology Department, M.P.Shah Medical College, Guru Govind Singh Hospital

Shilpa D. Parmar, M.D. Radiology
Assistant Professor, Radiodiagnosis Department, M.P.Shah Medical College, Guru Govind Singh Hospital