Fixation with cancellous screws and fibular strut grafts for neglected femoral neck fractures

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ABSTRACT

Purpose. To review the outcomes of fixation with cancellous screws and fibular strut grafts for neglected femoral neck fractures.

Methods. 44 men and 28 women aged 17 to 50 years with neglected femoral neck fractures of the subcapital (n=12), transcervical (n=57), or basal (n=3) types underwent closed (n=39) or open (n=33) reduction and fixation with a single cancellous screw with double fibular strut grafts (n=24) or fixation with double cancellous screws with a single fibular strut graft (n=48). The mean time from injury to surgery was 10 weeks; the delay was 22 to 35 days in 43 patients and >35 days in 29 patients. Double fibular strut grafts were used for 18 patients with longer delay and resorption of the femoral neck, and 18 patients with posterior comminution of the femoral neck. The outcome was assessed using the Harris hip score.

Results. Patients were followed up for a mean of 3 years. The time to bone union was 3 to 4 months in 48 patients, 4 to 5 months in 15, and 5 to 6 months in 5; nonunion was noted in 4 patients. In 18 patients with resorption of the femoral neck, bone union took a longer time. The Harris hip score was excellent (90–100) in 30 patients, good (80–89) in 20, fair (70–79) in 15, and poor (<70) in 7. Of the latter, 4 had nonunion and 3 developed avascular necrosis of the femoral head; they had persistent pain and restriction of hip joint movement.

Conclusion. Fixation with cancellous screws and fibular strut grafts for neglected femoral neck fractures is cost-effective and technically less demanding, and associated with good outcomes.

Key words: bone screws; bone transplantation; femoral neck fractures

INTRODUCTION

Neglected femoral neck fractures after severe trauma in patients with normal bone is a challenge, owing to the precarious blood supply of the femoral head, difficulty in reducing and maintaining reduction,
strong muscle forces, flow of synovial fluid, and osteoporosis. The choice of treatment depends on the patient age, duration of injury, activity level, extent of displacement, and extent of osteoporosis. The treatment goals are anatomic reduction, stable fixation, preservation of blood supply to the bone fragments, and early active mobilisation to prevent stiffness. Treatment options include valgus osteotomy and osteosynthesis with or without bone grafting (muscle pedicle, free vascularised, or non-vascularised fibula), hemiarthroplasty, and total hip arthroplasty. Nonunion and avascular necrosis are common complications. Closed reduction and internal fixation is usually not feasible after 3 weeks, as the femoral neck begins to resorb causing avascular necrosis and nonunion. Osteotomy results in a shorter limb and mechanically unsound hip. Fixation with cancellous screws and fibular strut grafts provides good stability. The grafts prevent the subchondral collapse and act as a biological implant and a channel for revascularisation. This study reviewed the outcomes of 72 patients who underwent fixation with cancellous screws and fibular strut grafts for neglected femoral neck fractures.

MATERIALS AND METHODS

Between July 2004 and June 2007, 44 men and 28 women aged 17 to 50 years with neglected femoral neck fractures of the subcapital (n=12), transcervical (n=57), and basal (n=3) types underwent fixation with double cancellous screws with a single fibular strut graft (n=48) [Fig. 1] or fixation with a single cancellous screw with double fibular strut grafts (n=24) [Fig. 2].

Most patients were aged 41 to 50 years (n=30), followed by those aged 31 to 40 years (n=21), 21 to 30 years (n=14), and 17 to 20 years (n=7). According to the Garden classification, 50 fractures were type III and 22 type IV. According to the Pauwels classification, 10 fractures were type I, 43 type II, and 19 type III. The

Figure 1  (a) Preoperative, (b) postoperative, (c) 5-month, and (d) 4-year radiographs showing fixation with 2 compression hip screws and a single fibular graft.
The mean time from injury to surgery was 10 weeks; the delay was 22 to 35 days in 43 patients and >35 days in 29 patients.

In 39 patients, closed reduction was performed under image intensification using gentle traction in 45° flexion and slight abduction; the hip was then extended and internally rotated to 30° to 45° and brought parallel to the trunk. A Garden alignment index of 160° to 180° on the anteroposterior view and 0° to 20° on the lateral view were considered acceptable. In 33 patients, closed reduction failed and open reduction was performed through the anterolateral approach. A T-shaped incision was made over the middle of the anterior capsule from the acetabular margin to 1 cm proximal of the intertrochanteric line to preserve the arterial arcade at the base of the femoral neck.

The fracture was transfixed with 3 parallel guide wires under image guidance. Appropriate size cannulated cancellous screw(s) (7 mm in diameter) was/were then inserted and tightened over the guide wires. About 8 cm or 16 cm of the fibula were harvested for single or double fibular grafting, respectively. The proximal 4 cm and distal 6 cm of the fibula were left untouched. Multiple holes were drilled at regular intervals on 2 surfaces of the harvested fibula, and the interosseous border was left intact. Multiple drill holes increase the chances of bony ingrowths in the femoral head and neck. The remaining guide wire(s) was/were reamed with a dynamic condylar screw reamer for insertion of the fibular graft(s) by hammering. Double fibular strut grafts were used for 24 patients with longer delay and resorption of the femoral neck and/or posterior comminution of
the femoral neck. Wounds were closed in layers and a suction drain was used. The limb was kept in 15° flexion and 20° abduction with the aid of a pillow. The operating time was 60 to 90 minutes in 52 patients and >90 minutes in 20.

Postoperatively, isometric quadriceps exercises were started on day 1 as soon as pain was tolerated. Knee bending exercises were started on day 2 or 3. Patients were followed up at a 4-week interval. Clinical assessment included pain, hip joint movement, limb-length discrepancy, muscle power around the hip and ankle, and stability of hip joint. Radiological bone union was defined as obliteration of the fracture site with trabecular bridging within 12 months. Position of screws, loosening of screws, advancement of grafts or screws, change in the Pauwels angle, resorption and avascular necrosis of the femoral neck were noted.

Partial weight bearing was allowed after 8 to 12 weeks in 46 patients, 12 to 17 weeks in 19, and >17 weeks in 7. Full weight bearing was allowed after 12 to 16 weeks in 46 patients, 16 to 21 weeks in 19, and 21 to 26 weeks in 7.

Outcome was assessed using the Harris hip score, for which the maximum score is 100, which included pain (44 points), function (47 points), range of motion (5 points), and deformity (4 points). Function is subdivided into activities of daily living (14 points) and gait (33 points).

RESULTS

Patients were followed up for a mean of 3 years. The time to bone union was 3 to 4 months in 48 patients, 4 to 5 months in 15, and 5 to 6 months in 5; non-union was noted in 4 patients. In 18 patients with resorption of the femoral neck, bone union took a longer time. The Harris hip score was excellent (90–100) in 30 patients, good (80–89) in 20, fair (70–79) in 15, and poor (<70) in 7. Of the latter, 4 had nonunion and 3 developed avascular necrosis of the femoral head; they had persistent pain and restriction of hip joint movement.

DISCUSSION

In underdeveloped countries, delayed presentation or improper treatment of femoral neck fractures is not uncommon because of poverty, lack of facilities, and ignorance. The prognosis is usually poor and the rates of avascular necrosis and nonunion are high. The rate of nonunion increases dramatically when surgery is delayed for >6 days. In our patients, outcomes were similar for neglected femoral neck fractures treated after 22 to 60 days.

In one study of 40 neglected femoral neck fractures (mean delay, 5.1 months) treated with open reduction and internal fixation with compression screws and a fibular graft, 38 patients achieved bone union. However, after a mean of 58.8 months, there were collapse of the femoral head (n=5), coxa vara (n=11), fibular graft fracture (n=4), screw penetration (n=6), and graft penetration (n=3). Hip function was excellent in 7 patients, good in 21, fair in 7, and poor in 5.

In our study, closed or open reduction and internal fixation with cannulated cancellous screws and fibular grafts achieved good outcome. The cancellous screws provide rigid fixation, whereas the fibular grafts provide additional stability and facilitate bone regeneration owing to the osteoinductive potential. The trephine shape of the fibula provides additional rotational stability. Drill holes in the fibula facilitate incorporation of grafts and act as a channel for revascularisation at the

<table>
<thead>
<tr>
<th>Fracture type</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<tr>
<td><strong>Anatomic location</strong></td>
<td></td>
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<tr>
<td>Subcapital (n=12)</td>
<td>5 (42)</td>
<td>3 (25)</td>
<td>2 (17)</td>
<td>2 (17)</td>
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<tr>
<td>Transcervical (n=57)</td>
<td>24 (42)</td>
<td>15 (26)</td>
<td>13 (23)</td>
<td>5 (9)</td>
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<tr>
<td>Basal (n=3)</td>
<td>1 (33)</td>
<td>2 (67)</td>
<td>0 (0)</td>
<td>0 (0)</td>
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<tr>
<td><strong>Garden classification</strong></td>
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<tr>
<td>Type III (n=50)</td>
<td>25 (50)</td>
<td>14 (28)</td>
<td>10 (20)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Type IV (n=22)</td>
<td>5 (23)</td>
<td>6 (27)</td>
<td>5 (23)</td>
<td>6 (27)</td>
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<tr>
<td><strong>Pauwels classification</strong></td>
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<tr>
<td>Type I (n=10)</td>
<td>5 (50)</td>
<td>2 (20)</td>
<td>2 (20)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>Type II (n=43)</td>
<td>21 (49)</td>
<td>12 (28)</td>
<td>9 (21)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Type III (n=19)</td>
<td>4 (21)</td>
<td>6 (32)</td>
<td>4 (21)</td>
<td>5 (26)</td>
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</tbody>
</table>
fracture site. Subchondral placement of fibular grafts in avascular and/or osteopenic femoral heads may minimise structural collapse until revascularisation occurs. Bone chips from drilling can act as internal bone grafts.

CONCLUSION

Fixation with cancellous screws and fibular strut grafts for neglected femoral neck fractures is cost-effective and technically less demanding and associated with good outcomes. The femoral head is preserved; this can be converted to bipolar or total hip replacement if needed in future.

DISCLOSURE

No conflicts of interest were declared by the authors.

REFERENCES