Neglected femoral neck fractures in adults

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ABSTRACT

Purpose. To assess treatment outcomes in adults with neglected femoral neck fractures, and propose a treatment protocol based on bone quality measured by the Singh index.

Methods. 16 men and 6 women aged 18 to 48 (mean, 33) years presented with neglected (>3 weeks old) femoral neck fractures. Those with good bone quality (Singh index, >3) underwent closed reduction and valgus osteotomy and fixation with 120° double angle blade plates (group 1, n=8), whereas those with poor bone quality (Singh index, <3) and/or comminution of the posterior femoral neck underwent fibular grafting and internal fixation with one or two 7-mm cannulated cancellous screws (group 2, n=14). Functional outcome was assessed at the 6-month follow-up, according to modified Askin and Bryan criteria.

Results. The mean delay in surgery was 12 (range, 4–21) weeks. Patients were followed up for a mean of 19 (range, 12–24) months. The mean time to union was 20 (range, 12–52) weeks. The mean time to full weight bearing was 18 (range, 12–40) weeks. All patients achieved bone union except one in group 1 who had non-union and breakage of the blade plate at week 20 and underwent total hip arthroplasty. Other complications included slippage of fibular graft (n=1), delayed union (n=1), avascular necrosis of the femoral head (n=2, Fig. 6), limb length discrepancy (n=3), and superficial infection (n=1). Functional outcome was excellent in 2 patients, good in 17, and poor in 3.

Conclusion. Valgus osteotomy and double angle blade plate fixation, and fibular grafting and cancellous screw fixation appeared to be appropriate treatments for neglected femoral neck fractures in adults.

Key words: bone plates; bone screws; bone transplantation; femoral neck fractures; fibula; osteotomy
INTRODUCTION

Total hip arthroplasty is a standard treatment for older adults with femoral neck fractures. The treatment protocol for younger adults (<60 years old) with neglected femoral neck fractures remains controversial. Neglected fractures often lead to osteopenia, resorption and avascular necrosis of the femoral neck, difficulty in reduction, and severe comminution. These problems prolong future surgery and increase the risks of implant failure and non-union. We aimed to assess treatment outcomes in adults with neglected femoral neck fractures, and propose a treatment protocol based on bone quality measured by the Singh index.

MATERIALS AND METHODS

From April 2004 to December 2005, 16 men and 6 women aged 18 to 48 (mean, 33) years presented with neglected (>3 weeks) femoral neck fractures (Fig. 1). Those with good bone quality (Singh index, >3) underwent closed reduction and valgus osteotomy and fixation with 120° double angle blade plates (group 1, n=8), whereas those with poor bone quality (Singh index, <3) and/or comminution of the posterior femoral neck (Fig. 2) underwent fibular grafting and internal fixation with one or two 7-mm cannulated cancellous screws (group 2, n=14).

Resorption and comminution of the posterior femoral necks of both hips were assessed using anteroposterior and lateral radiographs. Magnetic resonance imaging was not performed for detection of avascular necrosis of the femoral head, which was not contraindicated for either procedure.

Patients were operated on via the lateral approach under regional anaesthesia and under C-arm image intensifier control; the fracture site was not exposed. In group 1, a wedge of bone was removed and used as a graft, and the angle of fracture was made close to 30° horizontally to bring the fracture under compression (Fig. 3). In group 2, a fibular graft was taken from the opposite side. A slot for the graft was created with a dynamic hip screw reamer after a guide wire for the screw was placed. The graft was placed below the cannulated cancellous screw (Fig. 4).

Postoperatively, group 1 patients were allowed to mobilise on the unaffected side with a walker as soon as pain decreased and they felt confident to stand with support. Group 2 patients were kept non-weight bearing and immobilised in a Thomas splint for at least 6 weeks, as they had poor bone quality. In both groups, partial weight bearing was allowed on the affected side after 6 weeks, and full weight bearing was allowed only after bone union was achieved.

Patients were followed up at weeks 2 and 6 and month 3, and then 2 monthly until month 6. Bone union was assessed, as were clinical (range of motion, degree of associated pain, and ability to bear weight with or without assistance) and radiological (presence of bridging trabeculae and implant migration) outcomes. Functional outcome was assessed at the 6-month follow-up, according to modified Askin and Bryan criteria.

RESULTS

The mean delay in surgery was 12 (range, 4–21) weeks. No patient had signs of avascular necrosis of the femoral head on radiographs. Patients were followed up for a mean of 19 (range, 12–24) months. The mean time to union was 20 (range, 12–52) weeks. The mean time to full weight bearing was 18 (range, 12–40) weeks. All patients achieved bone union except one in group 1 who had non-union and breakage of the blade plate (Fig. 5) at week 20 and underwent total hip arthroplasty. Other complications included slippage of fibular graft (n=1), delayed union (n=1), avascular necrosis of the femoral head (n=2, Fig. 6), limb length discrepancy (n=3), and superficial...
infection (n=1) [Table]. Based on modified Askin and Bryan criteria, the functional outcome was excellent in 2 patients, good in 17, and poor in 3.

DISCUSSION

Healing of the femoral neck and head is the best outcome after any treatment for femoral neck fractures.7 Salvaging the femoral head for younger adults (<60 years of age) with neglected femoral neck fractures is challenging.8 Total hip arthroplasty is recommended for those older than 60 years, although the appropriate treatment should depend not only on patient age, but also medical status, viability of the femoral head, size of the remnant femoral neck, extent of osteoporosis, duration of the disease, and the state of the joint space.9

Osteosynthesis such as valgus osteotomy,10–13

Figure 2  Severe comminution of the femoral neck.

Figure 3  Valgus osteotomy and fixation with a double angle blade plate.

Figure 4  Fibular grafting and fixation with 2 cancellous screws.

Figure 5  A broken blade plate and persistent non-union.
fibular grafting with internal fixation,\textsuperscript{14} vascularised bone grafting,\textsuperscript{15-17} muscle pedicle bone grafting,\textsuperscript{18} McMurray displacement osteotomy\textsuperscript{19} have been advocated for neglected femoral neck fractures. Nonetheless, there is no guideline for choosing one over another for a particular fracture.\textsuperscript{20} Unlike muscle pedicle grafting, valgus osteotomy and fibular grafting with internal fixation can be performed even in patients with resorption and pre-collapse avascular necrosis of the femoral neck. These procedures can achieve a painless stable hip, unlike excision arthroplasty that results in an unstable hip. Vascularised bone grafting is technically demanding and not feasible in some patients.

Two of our previous patients who were operated on for neglected femoral neck fractures had blade plate cutting out through bone during surgery and 3 weeks after surgery. They had severely osteopenic bone (Singh index, <3). Thereafter, for such patients we performed fibular grafting and internal fixation with cannulated cancellous screws.

Two of our patients developed avascular necrosis of the femoral head, which might have existed preoperatively rather than being a postoperative complication, because following injury it takes one to 6 months before avascular necrosis of the femoral head becomes detectable,\textsuperscript{21} and in our patients the mean delay in surgery was 12 weeks. Magnetic resonance imaging could have performed to detect avascular necrosis of the femoral head, but would not have changed the treatment modalities, as avascular necrosis of the femoral head was not contraindicated for either procedures we were undertaking.\textsuperscript{22}

Osteoporosis is a contributing factor leading to implant failure. Bone densitometry should be performed to avoid internal fixation for osteoporotic patients.\textsuperscript{23}

We formulated a treatment protocol based on the degree of osteopenia assessed by the Singh index\textsuperscript{6} (on radiographs). Although not very accurate (90% sensitivity but 35% specificity)\textsuperscript{24} compared to dual energy X-ray absorptiometry or quantitative computed tomography, the Singh index is more affordable and accessible. Communition of the posterior femoral neck is associated with an

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. of patients</th>
</tr>
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<tbody>
<tr>
<td>Non-union</td>
<td>1</td>
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<tr>
<td>Implant breakage</td>
<td>1</td>
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<tr>
<td>Fibular graft slippage</td>
<td>-</td>
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<tr>
<td>Delayed union</td>
<td>1</td>
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<tr>
<td>Avascular necrosis of the femoral head</td>
<td>1</td>
</tr>
<tr>
<td>Limb length discrepancy</td>
<td>2</td>
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<tr>
<td>Limb length discrepancy (1 lengthening, 1 shortening)</td>
<td>1</td>
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<tr>
<td>Superficial infection</td>
<td>0</td>
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</tbody>
</table>

Table

Complications

Figure 6 Avascular necrosis of the femoral head.
increased complication rate. Valgus osteotomy was not performed for such patients, as it is technically demanding and may result in intraoperative anterior angulation and difficulty in reduction. Fibular grafting supports the healing process, but alters biomechanics (shearing force) at the fracture site. Healing of femoral neck fractures was influenced far more by biomechanical than biological factors. Valgus osteotomy improves biomechanics, whereas fibular grafting does not.

REFERENCES