Conventional muscle-reflection approach versus mini-incision muscle-splitting approach in dynamic hip screw fixation

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ABSTRACT

Purpose. To compare the short-term results of conventional versus mini-incision approaches to dynamic hip screw (DHS) fixation.

Methods. 41 geriatric patients with either basal femoral neck or intertrochanteric fractures (Kyle types I to III) who underwent closed reduction and DHS fixation by a single surgeon were retrospectively reviewed. From January 2001 to June 2005, 6 men and 19 women aged 60 to 94 (median, 83) years underwent DHS fixation through a conventional muscle-reflection approach with a skin incision of ≥10 cm. From July 2005 to March 2006, 9 men and 7 women aged 67 to 95 (median, 81) years underwent DHS fixation through a mini-incision (4 cm) approach at the lower border of the lesser trochanter. Operating time, drain output and duration of drain placement, decrease in haemoglobin level and receipt of blood transfusions, deterioration in ambulation status, analgesic intake, duration of hospital stay, and bone healing time for the 2 groups were compared. An independent observer retrospectively assessed the fracture pattern, reduction quality, and bone healing time.

Results. Compared to patients in the conventional group, those in the mini-incision group had shorter operating times (50 vs 43 minutes, p=0.02), a higher proportion whose drain was removed within 24 hours (28% vs 69%, p=0.01), and consumed fewer dosages of oral analgesics within 48 hours (8 vs 5, p=0.001). Classification of the fracture pattern in 21 of 38 patients were consistent between the surgeon and observer. The Kappa value for agreement was 0.32, denoting marginal agreement (p=0.003). Reduction quality (p=0.66) and bone healing time (p=0.73) assessed by the observer were not significantly different between the 2 groups.

Conclusion. The short-term clinical outcome of mini-incision DHS fixation for geriatric pertrochanteric fractures was favourable.

Key words: bone screws; femoral neck fractures; fracture fixation, internal; hip fractures
INTRODUCTION

Dynamic hip screw (DHS) fixation is commonly used for basal neck1 and intertrochanteric femoral fractures.2,3 New devices such as resistance augmented Baixauli plates,4 Medroff plates,5 trochanteric stabilising plates,6 percutaneous compression plates,7–10 and intramedullary devices11,12 focus on unstable intertrochanteric fractures. In a study comparing conventional with mini-incision technique in DHS fixation, significantly reduced blood loss, operating times, and morphine consumption were reported with the latter technique.13 The benefits of mini-incision may not be obvious in the Chinese population because of their smaller stature. Besides, their muscle is easier to retract and less prone to bleeding and postoperative pain, even when operated on using the conventional technique. We aimed to compare the short-term results of these 2 approaches in our Chinese population, and assess the inter-observer variation in classifying intertrochanteric fractures according to Kyle et al.14

MATERIALS AND METHODS

41 geriatric patients with either basal femoral neck or intertrochanteric fractures (Kyle types I to III) who underwent closed reduction and DHS fixation by a single surgeon were retrospectively reviewed. 24 patients were operated on within 2 days of admission, 10 within 3 days, and 7 more than 3 days later. Intravenous cefazolin (1 g) was administered at induction, but no routine prophylaxis for deep vein thrombosis was given.

From January 2001 to June 2005, 6 men and 19 women aged 60 to 94 (median, 83) years underwent DHS fixation through a conventional muscle-reflection approach with a skin incision of ≥10 cm.2,3 An L-shape or ‘hockey-stick’ tenotomy of the vastus lateralis fascia was achieved with diathermy leaving a 1-cm cuff for repair. The vastus lateralis was reflected with diathermy and perforators were cauterised if encountered. A DHS was inserted using the standard AO technique.2–3 In the frontal view, the axis of the DHS was situated at or below the axis of the femoral neck. In the lateral view, the DHS was aimed at the midline. A 4-hole 135º plate was applied, a 25-mm barrel plate was for a DHS length of ≤80 mm and a 38-mm barrel plate was for a DHS length of ≥85 mm. Undue retracted muscle was excised and haemostasis secured after placement of DHS. At the end of operation, a drain was inserted beneath the vastus lateralis without anchorage. The fascia lata were closed separately with polyglycolic acid. The subcutaneous fat and skin were closed with polyglycolic acid and nylon, respectively.

From July 2005 to March 2006, 9 men and 7 women aged 67 to 95 (median, 81) years underwent DHS fixation through a mini-incision (4 cm) approach at the lower border of the lesser trochanter. The fascia lata was incised and the vastus lateralis split along the proximal axis of the femur with scissors. The vastus lateralis was separated from the femur by a periosteal elevator without stripping the periosteum. A 135º angle guide was inserted through the 4-cm incision (Fig. 1). To minimise muscle trauma during insertion, the distal end of the angle guide was passed beneath the muscle first (Fig. 2a). After insertion of the guide pin for the DHS, the 135º angle guide was retrieved by rotating its distal end anteriorly. The soft tissue was protected during reaming of the femoral neck and head (Fig. 2b). The DHS was inserted in the same manner as in the conventional method, except that the plate was initially inserted with the barrel facing laterally (Fig. 2c). When the whole plate was underneath the vastus lateralis, it was turned 180º with the barrel facing medially. The proximal end of the barrel was guided to the distal end of the DHS by direct palpation. A T-handle was inserted through the barrel and acted as a joystick to realign the barrel to

Figure 1  The 4-cm mini-incision is equal to the distance between the proximal end and the post of the angle guide (arrows).
the DHS axis. Under fluoroscopy, the proximal end of the barrel was advanced a few millimetres after complete tightening of the coupling screw (Fig. 3). The first cortical screw inserted was usually the 3rd screw (counting from a proximal to distal direction). Soft tissue was protected with a 4.5-mm drill sleeve during drilling and tapping (Fig. 2d). Repeated fluoroscopy was performed using anteroposterior and lateral views, so as to exclude any offset of the plate. The 1st and 2nd screws were inserted in the usual manner. Difficulty could be encountered when inserting the 4th screw. If adequate exposure could not be obtained after releasing traction, a separate stab incision was created for its insertion, which could be used as an exit portal for any subsequent drain. Stability of fixation and alignment of the implant was checked using fluoroscopy. The incision edge and muscle were debrided if necessary and followed by haemostasis and wound closure.

Operating time, drain output and duration of drain placement, decrease in haemoglobin level and receipt of blood transfusions, deterioration in ambulation status, analgesic intake, duration of hospital stay, and bone healing time for patients in the conventional and mini-incision groups were compared. To eliminate bias in assessment by the surgeon, an independent experienced orthopaedic surgeon not involved in the operations acted as an observer who retrospectively assessed the fracture pattern, reduction quality, and bone healing time.

RESULTS

Compared to patients in the conventional group, those in the mini-incision group had shorter operating times (50 vs 43 minutes, \( p=0.02 \), Mann-Whitney \( U \) test), a higher proportion whose drain was removed within 24 hours (28% vs 69%, \( p=0.01 \), Chi squared test), and consumed fewer dosages of oral analgesics within 48 hours (8 vs 5, \( p=0.001 \), Mann-Whitney \( U \) test). The drain output, decrease in haemoglobin level, and the number of patients receiving transfusions were not significantly different in the 2 groups. Nor was there any difference in the duration of hospital stay and deterioration in ambulation status (Table 1).

The operative and 30-day mortality was 0%; the 6-month mortality was 8% (3/38); and the one-year mortality was 17% (5/30). All these mortality rates were comparable to rates reported in other series.15–17 All patients achieved bone union within 4 months. Nine died of diseases unrelated to surgery.

Figure 2 (a) The distal end of the 135° guide is inserted first. (b) The soft tissue is protected during reaming of the femoral neck and head. (c) The plate is inserted with the barrel facing laterally. (d) A 4.5-mm drill sleeve is used during drilling and tapping for cortical screw.

Figure 3 Fluoroscopic examination (a) before and (b) after tightening of the coupling screw.
including chest infection, septic shock, acute coronary syndrome, and cerebrovascular accident. No patient developed wound infection.

The classification of fracture patterns in 21 of 38 patients was consistent between the surgeon and the observer (Table 2). The Kappa value for agreement was 0.32, denoting marginal agreement (p=0.003). The inter-observer error was slightly more than that described in other reports using the AO classification without subgroups. Reduction quality (p=0.66) and bone healing time (p=0.73) assessed by the observer were not significantly different between the 2 groups.

**DISCUSSION**

Intramedullary nailing has not been shown to be superior to DHS fixation with respect to long-term outcomes of most patients with intertrochanteric fractures. Percutaneous compression plating requiring 2 separate 2-to-2.5-cm incisions has been reported to be successful. A 2.5-cm incision for DHS fixation was reported, in which the guide pin was inserted into the femoral head without using the 135° angle guide flushed to the lateral cortex of the femur. Any error in projection of radiographs, such as magnification and parallelism, may result in loss of reduction. We considered that the shortest incision length required to pass the 135° angle guide was 4 cm. Reduction in operating time and pain has been reported in implants designed for small incisions such as for the percutaneous compression plates. Their benefits are likely due to the small incision rather than the new design. The operating times for percutaneous compression plate fixation (47 to 55 minutes) were longer than those for our mini-incision DHS fixations (43 minutes). The operating time in our conventional group was shorter than that in other studies.

### Table 1

**Demographic data, early and late postoperative parameters, and radiological findings**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Conventional</th>
<th>Mini-incision</th>
<th>p value (Mann-Whitney U test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>82.6 (60–94)</td>
<td>81.2 (67–95)</td>
<td>0.5</td>
</tr>
<tr>
<td>Sex (male/female)</td>
<td>6/19</td>
<td>9/7</td>
<td>0.05</td>
</tr>
<tr>
<td>Side operated (left/right)</td>
<td>14/11</td>
<td>8/8</td>
<td>0.76</td>
</tr>
<tr>
<td>Operating time (minutes)</td>
<td>50 (24–80)</td>
<td>42.5 (30–60)</td>
<td>0.02</td>
</tr>
<tr>
<td>Drain output (ml)</td>
<td>50 (0–250)</td>
<td>20 (0–140)</td>
<td>0.08</td>
</tr>
<tr>
<td>Drain removal within 24 hours‡</td>
<td>28%</td>
<td>68.8%</td>
<td>0.01, Chi squared test</td>
</tr>
<tr>
<td>Decrease in haemoglobin level‡ (g/l)</td>
<td>20.5 (1–32)</td>
<td>16 (6–32)</td>
<td>0.8</td>
</tr>
<tr>
<td>No. (%) of patients transfused‡</td>
<td>4 (16)</td>
<td>2 (12.5)</td>
<td>0.8</td>
</tr>
<tr>
<td>No. of oral analgesic use within 48 hours‡</td>
<td>8 (4–8)</td>
<td>4.5 (0–8)</td>
<td>0.001</td>
</tr>
<tr>
<td>No. of parenteral analgesic use within 48 hours‡</td>
<td>0 (0–4)</td>
<td>0 (0–2)</td>
<td>0.29</td>
</tr>
<tr>
<td>Duration of hospital stay (days)</td>
<td>25 (4–117)</td>
<td>23.5 (14–61)</td>
<td>0.75</td>
</tr>
<tr>
<td>Deterioration in ambulation status‡</td>
<td>0.5 (0–4)</td>
<td>2 (0–4)</td>
<td>0.19</td>
</tr>
<tr>
<td>No. of patients with reduction quality (satisfactory/good/fair)¶</td>
<td>14/5/3</td>
<td>11/4/1</td>
<td>0.66</td>
</tr>
<tr>
<td>Bone healing time** (weeks)</td>
<td>10 (3–16)</td>
<td>9 (4–16)</td>
<td>0.73</td>
</tr>
</tbody>
</table>

* All values are expressed as median (range), unless otherwise stated

† The suction drain was put beneath the vastus lateralis in all patients (except one in the mini-incision group). Decision for drain removal was made by the attending physician. Most drains were taken out when the daily output was <50 ml. Patient without a drain was considered zero output and the drain was taken off within 24 hours

‡ Postoperative haemoglobin levels of 4 patients from each group were not checked because of minimal blood loss and drain output and stable haemodynamics. Blood transfusion was initiated when the haemoglobin level fell below 80 g/l or clinically indicated

§ Total analgesic consumption within 48 hours is a combination of oral analgesic (Dologesic, one tablet 4 times daily or on demand) and parenteral analgesic (intramuscular pethidine injection, 50 mg every 6 hours or on demand)

¶ Reduction quality was graded as satisfactory (anatomic reduction), good (near anatomic reduction with good medial cortical contact), fair (non-anatomic reduction but with reasonable medial bone contact, advised close radiological monitoring for bone healing), or poor (unacceptable reduction and advised revision surgery for mechanical failure or delay in full weight-bearing walking)

** Bone healing was defined as formation of trabeculae across fracture sites. Radiographs of 36 patients were available for assessment. The proportion of Kyle type-III intertrochanteric fractures was higher in convention group (38% vs 13%)
Table 2

Distribution of patients according to fracture pattern, reduction quality, and bone healing time

<table>
<thead>
<tr>
<th>Fracture Pattern</th>
<th>Preoperative classification</th>
<th>Reduction quality</th>
<th>Median bone healing time (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By surgeon</td>
<td>Satisfactory</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>By observer</td>
<td>Good</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fair</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>36</td>
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<tr>
<td></td>
<td></td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fracture Pattern</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal neck fractures</td>
<td>40</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Intertrochanteric fractures (Kyle’s classification)</td>
<td>5</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

* Preoperative radiographs of one patient in the conventional group was unavailable. Follow-up radiographs of 4 patients in the conventional group were incomplete.
† One patient in the mini-incision group died 2 months after operation, whose radiographs were available for assessing the reduction quality but not bone healing.
‡ Excluding basal neck fractures, the bone healing time was longer in higher Kyle types (p=0.08, Kruskal Wallis test).

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