Addition of an Anti-rotation Screw to the Dynamic Hip Screw for Femoral Neck Fractures

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Abstract

The authors investigated the use of an anti-rotation screw with the dynamic hip screw (DHS) during internal fixation of Garden I and II femoral neck fractures. Sixty-five patients with Garden I and II femoral neck fractures (mean age, 70 years) were treated with internal fixation at the authors’ institution. In 31 patients, a 2-hole DHS was used alone (group 1), and in 34 patients, the DHS was combined with an anti-rotation screw placed in the cranial part of femoral head and neck (group 2). Patients’ preinjury function and mental level were assessed using the Barthel index and the Abbreviated Mental test, respectively. The outcome measures included cost implications, operative time, and intraoperative radiation dose. The modified Harris Hip Score and a radiological assessment were performed at a mean of 11 months (range, 8-24 months) postoperatively. The use of the anti-rotation screw was associated with a longer operative time (mean, 44.54 minutes in group 1 vs 51.52 minutes in group 2; \( P < .0001 \)) and more fluoroscopy screening (mean dose area product, 28.39 cGy/cm\(^2\) in group 1 vs 44.33 cGy/cm\(^2\) in group 2; \( P = .03 \)). The additional cost of using an anti-rotation screw was £106 ($170) per case. No difference existed between the 2 groups with regard to radiological union, onset of avascular necrosis, and rate of revision surgeries.

An anti-rotation screw, used with the dynamic hip screw, involves extra costs, prolongs operative time, and requires more intraoperative fluoroscopy screening but offers no advantages with regard to fracture union.

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The authors have no relevant financial relationships to disclose.

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doi: 10.3928/01477447-20130624-15
Internal fixation remains a favorable treatment option for undisplaced intracapsular femoral neck fractures in elderly patients. However, complications such as displacement of the fracture, non-union, and avascular necrosis may warrant revision procedures. The choice of implants includes sliding hip screws with 1-hole or 2-hole plates and multiple cannulated screws. Besides the sliding hip screw, some surgeons consider an additional anti-rotation screw placed in the cranial part of femoral neck and head.

The goal of this study was retrospectively to investigate the role and implications of an anti-rotation screw used with a 2-hole dynamic hip screw (DHS) in the treatment of undisplaced subcapital femoral neck fractures.

**Materials and Methods**

Seventy-one patients with undisplaced intracapsular neck of femur fractures were treated with internal fixation using a 2-hole DHS alone or combined with an anti-rotation screw. The diagnosis in 58 fractures was made using the patients’ history, clinical examination, and plain radiographs. Computed tomography scans were required in 5 patients and magnetic resonance imaging in 2 patients. The time from injury to surgery was calculated using the admission notes (medical history and clinical examination) and operative notes. The majority of patients (53 patients) had been treated for established osteoporosis prior to injury. Two patients were known to have malignancies, but their preadmission records (including bone scan) showed no evidence of metastasis within the skeleton.

Fractures were evaluated using the Garden classification. Mobility and dependency were assessed using the Barthel index, and mental capacity was evaluated using the abbreviated mini-mental test. Fitness for surgery was evaluated using the American Society of Anesthesiologists (ASA) grading system.

### Surgical Technique

All fractures were fixed in situ, and no displacement occurred during the procedure. The DHS system used in all cases consisted of 2-hole plates with a 135° angle and lag screws with a 22-mm thread length. The key step in all cases was the insertion of a temporary additional guide wire into the proximal part of femoral neck and head to obtain rotational stability while reaming.

As per surgeon preference, 33 patients received the 2-hole DHS alone (group 1) and 38 patients received the 2-hole DHS with a 6.5-mm partially threaded cannulated screw placed in the cranial part of the femoral neck (group 2). The anti-rotation screw was inserted first, followed by the DHS lag screw. Intraoperative compression was performed through the DHS lag screw.

The use of intraoperative radiography was evaluated by measuring the dose area product in cGy/cm². Operative time was recorded for all patients. The costs of using the anti-rotation screw and its cannulated drill set were estimated.

### Postoperative Assessment

All patients were fully weight bearing as tolerated. Radiological evaluation was performed at 6 weeks and then at variable intervals between 8 and 24 months (mean, 11 months).

The presence of avascular necrosis of the femoral head was evaluated on plain radiographs using the Ficat classification. Functional assessment was performed at final follow-up using the modified Harris Hip Score.

### Statistical Analysis

SPSS version 11.0 statistical software (SPSS Inc, Chicago, Illinois) was used for data analysis. Unpaired Student’s *t* test was used for continuous data and Fisher’s exact test was used for categorical data. All tests were 2-sided. The results were considered to be statistically significant when *P* was less than or equal to .05.

### RESULTS

Six patients (2 in group 1 and 4 in group 2) had no postoperative radiological...
cal assessments because they were discharged to their local hospitals. The data of the remaining 65 patients were available for review. Group 1 comprised 31 patients and group 2 comprised 34 patients. Fourteen fractures were Garden type I and 51 were Garden type II. All procedures were performed by attending or resident physicians. Patient demographics are summarized in Table 1.

Radiological assessments were performed initially at 6 weeks, and then at a mean of 11 months (range, 8-24 months). Mean dose area product from intraoperative fluoroscopy screening was 28.39 cGy/cm² (range, 0.1-63 cGy/cm²) in group 1 and 44.33 cGy/cm² (range, 0.6-98 cGy/cm²) in group 2 (P < .03). Mean operative time was longer when the anti-rotation screw was used (51.52 minutes in group 2 vs 44.54 minutes in group 1; P < .0001) (Table 2).

An additional cost of £106 ($170) was associated with the use of the anti-rotation screw and the relevant cannulated drill set.

Overall, complete radiological union was seen in 60 (92.3%) patients, avascular necrosis (AVN) in 4 (6.1%) patients, nonunion in 1 (1.5%) patient, and infection in 2 (3%) patients. No difference existed between the 2 groups with regard to these complications (Table 2). The patient with nonunion belonged to group 2 and required revision of the internal fixation. Plain radiographs demonstrated that the threads of the anti-rotation screw were within the fracture’s site. The patient underwent a revision of internal fixation that involved removal of the anti-rotation screw and further in situ compression of the fracture through the DHS lag screw. Follow-up radiographs showed a complete union of the fracture.

Two patients with infection in group 1 were treated successfully with wound washout and retention of metalwork. Five (7.6%) deaths occurred, all from unrelated causes: 2 from preexisting malignancies, 1 from renal failure, and 2 from ischemic heart disease. However, all deceased patients had undergone the second radiological assessment and showed completed union of the fracture.

Modified Harris Hip Scores were obtained for 56 (84.6%) patients. Data of the remaining 9 patients were not recorded due to mortality (5 patients) and loss of contact (4 patients). When assessed, patients were asked to refer to the operated hip to rate their function. The outcome was excellent in 8 (12.3%) patients, good in 29 (44.6%) patients, fair in 12 (18.4%) patients, and poor in 7 (10.7%) patients. Higher scores were recorded in younger patients.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Summary of Results</th>
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<tbody>
<tr>
<td><strong>Result</strong></td>
<td><strong>Group 1</strong>&lt;sup&gt;a&lt;/sup&gt; (n=31)</td>
</tr>
<tr>
<td>Mean operative time (range), min</td>
<td>44.54 (33-55)</td>
</tr>
<tr>
<td>Mean dose area product (range), cGy/cm²</td>
<td>28.39 (0.1-63)</td>
</tr>
<tr>
<td>Complete radiological union, No.</td>
<td>30</td>
</tr>
<tr>
<td>Nonunion requiring revision of fixation, No.</td>
<td>0</td>
</tr>
<tr>
<td>AVN (Ficat grade IIA and above)</td>
<td></td>
</tr>
<tr>
<td>Total No.</td>
<td>1</td>
</tr>
<tr>
<td>No. cases revised to THR</td>
<td>1</td>
</tr>
<tr>
<td>Modified Harris Hip Score, No.</td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>3</td>
</tr>
<tr>
<td>Good</td>
<td>13</td>
</tr>
<tr>
<td>Fair</td>
<td>8</td>
</tr>
<tr>
<td>Poor</td>
<td>2</td>
</tr>
<tr>
<td>Not recorded</td>
<td>1</td>
</tr>
<tr>
<td>Infection, No.</td>
<td>0</td>
</tr>
<tr>
<td>Mortality, No.</td>
<td>4</td>
</tr>
</tbody>
</table>

*Abbreviations: AVN, avascular necrosis; THR: total hip replacement.*

<sup>a</sup>Dynamic hip screw alone.
<sup>b</sup>Dynamic hip screw with anti-rotation screw.
<sup>c</sup>Student’s t test.
<sup>d</sup>Fisher’s exact test.
**DISCUSSION**

The total cost of adding an anti-rotation screw has been estimated to be approximately £106 ($170). This includes the price of the screw itself (£76) and the cost of sterilizing the cannulated drill set (£30), which is packed separately. No advantages were shown in this study that could justify these costs.

Every attempt should be made to minimize operative time and iatrogenic insult when dealing with patients with femoral neck fractures. The insertion of an anti-rotation screw was associated with prolonged operative time. This was an unnecessary surgical step that could have been avoided in this particular group of patients. More intraoperative radiography screening was required to guide the insertion of the anti-rotation screw. This predisposed the patient, surgeon, and staff to unnecessary risks of radiation.

It has been demonstrated biomechanically through a cadaveric study that the addition of a 6.5-mm anti-rotation screw to the DHS increased bending stiffness but did not affect torsional stability. In intracapsular fractures, Chen et al reported that the DHS combined with an anti-rotation screw had high success rates and less revision rates compared with cannulated screws alone.

The current study is the first to compare the clinical outcome between the DHS alone and the DHS combined with an anti-rotation screw during internal fixation of intracapsular hip fractures. However, it lacks the strength of a randomized trial, and the sample size is small. A methodologically rigorous randomized controlled trial with larger populations or a biomechanical study comparing the DHS alone with the DHS combined with an anti-rotation screw would be of value, but the cost effectiveness of such studies may be questionable.

The addition of an anti-rotation screw did not affect the union rate; the majority of patients (92.3%) showed a complete union of the fracture, with no difference between the 2 groups. However, it could be argued that an anti-rotation screw may impede fracture union, as occurred in the current case of nonunion. The space within the proximal part of femoral head may not accommodate all the threads that will end up lying in the fracture’s site.

Similarly, the rate of avascular necrosis was low overall, and the difference between the 2 groups was not statistically significant. However, follow-up may not have been long enough to include all cases of avascular necrosis because changes could take up to 24 months to become apparent on plain radiographs. However, if avascular necrosis were present but not radiologically apparent, patients may re-present with hip pain that would warrant further investigations.

**CONCLUSION**

The use of an anti-rotation screw requires more operative time and more intraoperative radiography screening and is associated with unjustifiable extra costs that could be invested in other procedures.

**REFERENCES**