Subcapital femoral neck fracture following successful trochanteric fracture treatment with a dynamic hip screw: a report of five cases

YT Lung, WL Kam, YF Leung, OM Chung, YL Wai
Department of Orthopaedics and Traumatology, Yan Chai Hospital, Hong Kong

ABSTRACT

A subcapital femoral neck fracture complicating a healed trochanteric fracture is rare. Such cases are managed in a rather heterogeneous manner, i.e. there exists a mixture of cases treated by either fixed angle devices or dynamic compression screws. We describe 5 patients who developed subcapital femoral neck fractures after healed trochanteric fractures treated with dynamic compression screws. The subjects' clinical data, operative records, and radiographs have been studied retrospectively and the literature reviewed. The risk factors for such a complication include being of advanced age, female, osteoporotic, and having a small femoral head and neck, and a basicervical type of fracture.

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

INTRODUCTION

From July 1999 to June 2002, 5 patients presented to our hospital with spontaneous subcapital femoral fractures following healing of a trochanteric fracture. All were females aged 79 to 90 years who had their trochanteric fractures surgically treated with dynamic compression screws in this hospital. None recalled suffering any second trauma and the intervals between the primary fixation and the subsequent subcapital fracture ranged from 2 months to 3 years. We analysed the patients' clinical data, operative records, and radiographs, and reviewed the literature to identify possible risk factors for such a complication.

CASE REPORTS

Case 1

In October 2000, a 79-year-old woman presented to us 2 months after fixation of a trochanteric fracture. She complained of a sudden onset of left hip pain, not associated with any trauma. Radiographs revealed a healed basal neck fracture treated with a dynamic hip screw and an additional 16-thread 6.5 screw as an anti-rotational device. A new subcapital fracture around the tip of the fixation device—the lag screw—was noticed. As a result, the patient underwent a
cemented Thompson hemiarthroplasty after removal of the hardware.

**Case 2**

In October 2000, an 85-year-old woman presented with several months’ history of progressive right hip pain. She fell 3 years earlier, suffering a right trochanteric fracture, which healed well after fixation with a dynamic hip screw. Radiographs revealed a recent subcapital fracture at the tip of the screw (Fig. 1), which was managed with a cemented Thompson hemiarthroplasty.

**Case 3**

In July 2001, a 78-year-old woman presented with a recent onset of left hip pain. She had undergone fixation of a left intertrochanteric fracture with a dynamic hip screw 14 months earlier. Radiographs revealed a well-healed previous fracture and a subcapital fracture around the tip of the screw. As a result, she underwent a cemented Thompson hemiarthroplasty.

**Case 4**

In July 1999, a 90-year-old woman presented with...
She had undergone fixation of a right trochanteric fracture with a dynamic hip screw 18 months earlier. Radiographs showed a well-united previous fracture and a new subcapital fracture around the base of the threads of the screw (Fig. 2).

Case 5
In June 2002, a 77-year-old woman presented with several months’ history of right hip pain. She had undergone fixation of a right trochanteric fracture with a dynamic hip screw 27 months earlier. Radiographs showed good union of the trochanteric fracture, a collapse of the femoral head suggesting avascular necrosis, and an impacted subcapital fracture around the base of the threads of the screw (Fig. 2).

DISCUSSION
Trochanteric fractures have traditionally been treated with fixed angle devices rather than dynamic compression screws. The mechanisms governing these fixation devices are different and therefore difficult to compare. Subcapital fractures were more often associated with trochanteric fractures treated with fixed angle devices e.g. Zickel nail fixation, McLaughlin nail plates, Ender nails, and AO blade plate fixation. To avoid the risk of nails penetrating into the joint as the fracture collapses, the tip of these static fixation devices should not be placed close to the articular surface. In some cases, the device did not even reach the subchondral bone, which could give rise to a stress fracture around the tip of the device. Therefore, it has been recommended that these fractures be treated with a dynamic hip screw to allow ‘controlled collapse’ of the fracture. The tip of the fixation device—the lag screw—can be placed close to the articular surface into the stronger subchondral bone, thus avoiding stress risers within the bone, especially in osteoporotic bones. A dynamic hip screw is considered the optimal fixation device for this type of fracture, but spontaneous subcapital fractures

---

Table 1
Patient characteristics and treatments

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Sex/age (years)</th>
<th>Interval between trochanteric and subcapital fractures (months)</th>
<th>Length of dynamic hip screw (mm)</th>
<th>Additional 16 thread 6.5 screw*</th>
<th>Avascular necrosis</th>
<th>Side plate†/barrel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F/79</td>
<td>2</td>
<td>80</td>
<td>Yes</td>
<td>No</td>
<td>4-hole/short</td>
</tr>
<tr>
<td>2</td>
<td>F/85</td>
<td>36</td>
<td>80</td>
<td>No</td>
<td>No</td>
<td>4-hole/short</td>
</tr>
<tr>
<td>3</td>
<td>F/78</td>
<td>14</td>
<td>80</td>
<td>No</td>
<td>No</td>
<td>4-hole/short</td>
</tr>
<tr>
<td>4</td>
<td>F/90</td>
<td>18</td>
<td>70</td>
<td>No</td>
<td>No</td>
<td>4-hole/short</td>
</tr>
<tr>
<td>5</td>
<td>F/77</td>
<td>27</td>
<td>70</td>
<td>Yes</td>
<td>Yes</td>
<td>4-hole/short</td>
</tr>
</tbody>
</table>

* An additional anti-rotational screw is inserted in an unstable basicervical fracture
† All side plates were at 135°

Table 2
Summary of previous cases treated with compression hip screws

<table>
<thead>
<tr>
<th>Studies</th>
<th>Patient sex/age (years)</th>
<th>Interval between trochanteric and subcapital fractures (months)</th>
<th>Distance of screw tip from articular surface (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parker and Walsh, 1993</td>
<td>F/76</td>
<td>6</td>
<td>Not mentioned</td>
</tr>
<tr>
<td></td>
<td>F/75</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>F/84</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>F/89</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>Heck et al., 1996</td>
<td>F/91</td>
<td>4</td>
<td>Not mentioned</td>
</tr>
<tr>
<td></td>
<td>F/91</td>
<td>8</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Fairbank et al., 1993</td>
<td>F/82</td>
<td>9</td>
<td>≤10</td>
</tr>
<tr>
<td>Gogan et al., 1988</td>
<td>M/42*</td>
<td>3</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Mariani and Rand, 1989</td>
<td>F/82</td>
<td>7</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>Wolff and Kessler, 1990</td>
<td>F/79</td>
<td>3</td>
<td>≤10</td>
</tr>
</tbody>
</table>

* The patient had chronic alcoholism–induced osteoporosis predisposing to the complication
following healed trochanteric fractures treated with compression hip screws still happen.

We reviewed 15 such cases (10 from the literature and 5 from our series, Tables 1 and 2) and identified the risk factors as advanced age, female gender, and osteoporosis. Apart from one patient who had chronic alcoholism-induced osteoporosis predisposing to the complication, all the other patients had the abovementioned risk factors. The distance between the articular surface and the dynamic hip screw tip is another risk factor. The tip should be placed within 10 mm of the articular surface. Better placement of the screw can prevent such spontaneous subcapital fractures. In all our cases, radiographs revealed no technical problems with the fixation, but the complication still occurred even when all technical aspects of the procedure had been correctly observed.

In our series, all the side plates were short barrels, because the length of the lag screws were ≤80 mm, as the femoral heads and necks of our patients were small. The dynamic hip screw has a 22-mm long cancellous thread with an outer diameter of 12.5 mm and a core diameter of 8.0 mm. The length of the short barrel is 25 mm while that of the long (standard) one is 38 mm. In our cases, the subcapital fractures developed around or at the base of the threads. It is not uncommon to have femoral heads measuring 40 to 42 mm in diameter. The southern Chinese body frame, especially that of females, is much smaller than that of Caucasians. The stress in the bone adjacent to the screw threads is much higher in patients with smaller femoral heads and shorter necks, as most of the screw threads are in the weaker central part of the femoral head, even though the screw tip is within 10 mm of the articular surface. Whether the use of the short barrel side plate (greater bending stress) creates further stress is unknown.

Tapping of the track preceding the insertion of the screw was not performed. It has been suggested that torque creates subcapital microfractures as the screw engages the denser subchondral bone of the femoral head. Four of our patients had the basicervical type of trochanteric fracture. Two of these had an additional 16-thread 6.5 screw inserted for anti-rotation, indicating that such fractures are inherently unstable.

CONCLUSION

A subcapital femoral neck fracture following a healed trochanteric fracture is rare. The risk factors for this complication are: advanced age, female gender, osteoporosis, smaller size of the femoral head and neck, and a basicervical type of fracture. Surgeons should be aware of the ways to recognise, treat, and prevent such complications.

REFERENCES