SUBTROCHANTERIC FRACTURE AFTER GARDEN SCREW FIXATION OF SUBCAPITAL FRACTURES

C. B. HOWARD, R. M. DAVIES

From Cardiff Royal Infirmary and Neath General Hospital, Wales

Ten cases of a complication of Garden screw fixation of subcapital fracture, namely subtrochanteric fracture through the lower screw hole, are presented. Their possible aetiology, prevention and difficulties in management are discussed. It is recommended that, during the insertion of Garden screws, care should be taken to avoid multiple attempts at passing the guide wire. If subtrochanteric fracture occurs internal fixation with a nail plate or screw plate is advised. Ideally the nail or screw should be inserted along the track of one of the existing screws.

Subcapital fractures are usually treated by replacement arthroplasty or internal fixation. At the Cardiff Royal Infirmary both methods are used in roughly equal proportions. In the period of study 408 subcapital fractures were fixed with crossed screws as described by Garden (1961). Ten of these were complicated by a subtrochanteric fracture through the lower screw hole. The management of these cases is presented.

MATERIAL AND METHODS

From October 1975 to June 1980, 408 cases of subcapital fracture were treated with crossed Garden screws at the Cardiff Royal Infirmary. Two hundred and thirty were performed by the open operation described by Garden while in 178 patients the screws were inserted percutaneously, using an image-intensifier. A total of 10 of these patients (2 4 per cent) developed a subtrochanteric fracture through the lower screw hole 1 to 24 weeks after the original operation. Of these, five had been operated on using the open method and five by the percutaneous method.

Blood calcium, phosphorus and alkaline phosphatase levels were routinely estimated and no patient was found to have the biochemical stigmata of osteomalacia; nor was there radiological evidence of demineralisation of bone suggesting osteomalacia or osteoporosis.

All the patients were mobilised fully weight-bearing after operation and apart from the observation that the 10 were an active group of patients putting some demands on their legs there was no common aetiological factor indicating why these patients sustained this second fracture.

The subtrochanteric fracture. In all cases the cause of the injury was trivial, such as a stumble or a fall. In one patient there was no precipitating incident, although this lady had complained of pain in her thigh for two days before the definitive fracture; radiographs taken on the first day revealed no abnormality (even on reviewing the films) but on the second day a crack had appeared passing from the distal end of the lower screw hole and extending halfway across the femur.

The appearances of all the fractures were similar, being transverse or slightly oblique and of a zigzag pattern. These appearances suggested pathological fractures; they had none of the characteristics of traumatic subtrochanteric fractures as classified by Seinsheimer (1978), and they followed the line of stress set up when a screw is inserted at a low angle in the femur (Garden 1961).

Treatment. This presented some difficulties as it was complicated by the presence of the subcapital fracture and therefore any method used had to maintain the reduction of the subcapital fracture as well as holding the subtrochanteric fracture. In six patients a McLaughlin pin and plate was used, the pin being substituted for one of the screws; in two patients a Richards’ fixed angle screw and plate was used; one patient was treated by traction; and one patient with a Jewett nail plate and a bone graft together with light restraining traction.

RESULTS

Results of treatment for each patient are summarised in Table I. Of the six patients treated with a McLaughlin pin and plate the fractures healed satisfactorily in two; one patient died of bronchopneumonia soon after the operation; the plate broke opposite the subtrochanteric fracture site in two patients and across the end of the pin where it was bolted to the plate in a third. However, in two of the last three patients the plate had lasted long enough to have allowed healing of the subcapital fracture.
and in both a Zickel nail was substituted for the McLaughlin pin and plate, with subsequent healing of the subtrochanteric fracture (Figs 1 to 4); the third patient showed sufficient callus around the shaft fracture to prevent loss of reduction and successful union occurred after six weeks of traction.

The seventh patient was treated with a Richards' fixed angle screw and plate as the lower screw had fortuitously been placed at the same angle as the plate (135 degrees). Union occurred without problems.

The eighth patient was undisplaced and it was elected to treat her on traction. Successful union was achieved in 12 weeks (Figs 5 to 6).

The ninth patient was treated with a Richards' sliding screw and plate, but unlike the case of the seventh patient neither Garden screw had been placed at an appropriate angle and the reduction was therefore very poor and could not be maintained. The patient was unable to mobilise and a total hip replacement was carried out six weeks later.

The tenth case was treated with a Jewett nail plate and a bone graft together with light restraining traction.

Table I. Results of treatment of subtrochanteric fracture in 10 patients

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (years)</th>
<th>Garden Grade</th>
<th>Injury</th>
<th>Time of fracture after fixation (weeks)</th>
<th>Treatment of fracture</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75</td>
<td>1</td>
<td>Fall</td>
<td>6</td>
<td>McLaughlin pin and plate</td>
<td>Healed without complications</td>
</tr>
<tr>
<td>2</td>
<td>69</td>
<td>1</td>
<td>Fall</td>
<td>24</td>
<td>McLaughlin pin and plate</td>
<td>Fracture of the plate opposite the subtrochanteric fracture after eight weeks; treated with Zickel nail as subcapital fracture had healed</td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>1</td>
<td>Stumble</td>
<td>3.5</td>
<td>McLaughlin pin and plate</td>
<td>Fracture of plate opposite subtrochanteric fracture 19 weeks later; treated with Zickel nail as subcapital fracture had healed</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>1</td>
<td>Stumble</td>
<td>3.5</td>
<td>McLaughlin pin and plate</td>
<td>Died from bronchopneumonia after operation</td>
</tr>
<tr>
<td>5</td>
<td>82</td>
<td>3</td>
<td>Fall</td>
<td>4</td>
<td>Long McLaughlin pin and plate plus two lag screws</td>
<td>Healed without complications</td>
</tr>
<tr>
<td>6</td>
<td>86</td>
<td>4</td>
<td>Stumble</td>
<td>8</td>
<td>McLaughlin pin and plate</td>
<td>Loosening of nut; this was tightened but fracture through the base of the threaded portion of the nail occurred; treated on traction for six weeks as there was enough callus to prevent loss of reduction; fracture then went on to heal</td>
</tr>
<tr>
<td>7</td>
<td>72</td>
<td>2</td>
<td>Fall</td>
<td>7</td>
<td>Richards' pin and plate through lower screw hole</td>
<td>Healed satisfactorily</td>
</tr>
<tr>
<td>8</td>
<td>58</td>
<td>1</td>
<td>Stumble</td>
<td>12</td>
<td>Traction as fracture was undisplaced</td>
<td>Healed satisfactorily</td>
</tr>
<tr>
<td>9</td>
<td>83</td>
<td>3</td>
<td>None</td>
<td>1</td>
<td>Richards' pin and plate; reduction did not hold and fracture occurred; converted to a Charnley total hip replacement</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>10</td>
<td>82</td>
<td>3</td>
<td>Fall</td>
<td>5</td>
<td>Jewett nail plate and bone graft, and bed rest.</td>
<td>Developed small bowel obstruction and died after the operation</td>
</tr>
</tbody>
</table>
neutralisation plate produces a bending moment around the lateral femoral cortex at the site of insertion. The magnitude of the moment depends on the site of insertion; the lower it is located the greater is the force. However, the angle of insertion is not under the operator’s control but is predetermined by a line drawn through the centre of the articular cartilage of the head and the calcar. Even after anatomical reduction this leads to a site of insertion already uncomfortably low and when a valgus reduction is present it may be very low indeed; three of our patients were in this category. It is a consideration that perhaps should be borne in mind when the decision to use this type of fixation is made.

**Treatment.** Treatment of the complication has proved difficult. Subtrochanteric fractures have a reputation for producing plate failures (Fielding and Magliato 1966). Zickel in 1966 introduced an intramedullary device for subtrochanteric fractures that has been shown to produce good results (Zickel 1976). However, because the pin of this nail is unable to hold the subcapital fracture, it is unsuitable for these cases except when the subcapital fracture has had time to heal.

Thus we recommend that during the insertion of Garden screws great care is taken to avoid multiple attempts at passing the guide wire, and in particular not to pass the wire through the medial cortex which would create two opposing stress raisers.

If a subtrochanteric fracture does occur internal fixation with a nail plate or screw plate will be required, unless it is undisplaced. Ideally the nail or screw should be inserted along the track of one of the existing screws to minimise damage to the head, but unfortunately the variable-angle nail plates currently available appear not to be strong enough to allow the patient to bear weight subsequently. However, the use of a stronger fixed-angle device is only possible if the original angle of insertion of one of the Garden screws corresponds with the angle of the plate. If these favourable circumstances are not present, we have no alternative but to recommend a variable-angle device supplemented by a non-weight-bearing regimen, even if this means confining the patient to bed for a period.

We would like to acknowledge with thanks the assistance given to us in writing this paper by Professor B. McKibbin and Mr K. Tayton. We would also like to thank the orthopaedic surgeons of the Cardiff Royal Infirmary for allowing us to report their cases.

**REFERENCES**