



Through-the-nail technique

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Ipsilateral fractures of the neck of the femur and the femoral shaft are uncommon injuries and they present considerable challenge as the concurrent survival of the femoral head and union of the femoral shaft fracture is of paramount importance.

We present a young male patient who sustained a Garden IV fracture of the neck of his right femur following a road traffic accident, with the fracture being adjacent to an ipsilateral intramedullary nail inserted 10 years previously for a midshaft femoral fracture ; the nail was broken, with its proximal fragment lying behind the greater trochanter. The patient was operated on within 6 hours from the injury. An attempt was made to remove the nail but this was abandoned as warring iatrogenic bone loss was encountered, due to the proximity of the fracture to the nail entry point. Instead, three cancellous lag-screws were inserted to fix the fracture in a triangular fashion. Two screws placed posteriorly behind the nail, and one anterior screw through the nail.

nal rotation in comparison to the opposite side. The secondary survey revealed a Garden IV fracture of the neck of his right femur adjacent to an ipsilateral intramedullary femoral nail (fig 1 and 2). The proximal part of the nail was broken and the metallic fragment was sitting behind the greater trochanter (fig 2). A shell of bone over the greater trochanter was representing either an island of heterotopic ossification or a fragment detached from its origin. However the rounded edges of the fragment indicated either mature heterotopic bone or an old injury. Detailed history taken from the patient revealed two previous injuries to his right lower limb. The original one was a midshaft femoral fracture following a road traffic accident, treated with an intramedullary nail 10 years ago. The second more recent injury was again a road traffic accident 2 years ago. He fell off his bicycle and radiographs showed a fracture of the proximal part of the nail which was protruding over the piriformis fossa.

CASE REPORT

A 33-year-old male cyclist presented to our Accident and Emergency department following a head-on-side collision with a vehicle. As a result of the collision he fell on the ground forcefully onto his right hip. He sustained no head injury and he maintained his Glasgow Coma Scale 15/15. He was transferred to our hospital as a trauma emergency via ambulance. The primary Advanced Trauma Life Support (ATLS) survey identified inability to move the right lower limb which was held in exter-

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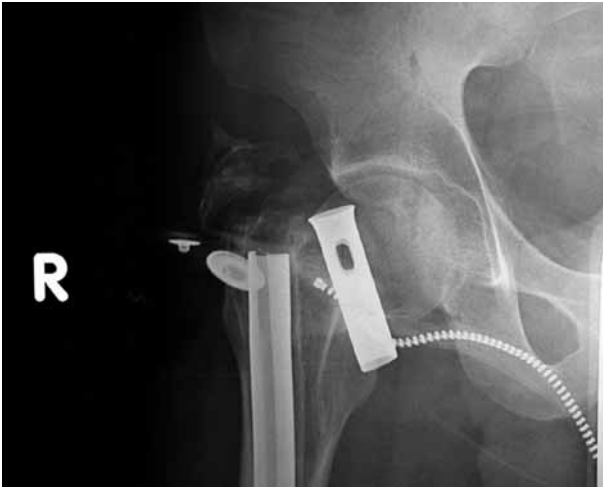


Fig. 1. — Anteroposterior radiograph of the right hip. The radiograph was taken with the patient not fully undressed (artefacts zip and two buttons). The trousers were cut off but not completely removed due to pain. Basicervical Garden IV fracture of the neck and nail fragment. Bony island over the greater trochanter.

Six hours later the patient was in theatres on a traction table. The decision to remove the nail and to fix the femoral neck fracture with cancellous lag-screws was contemplated. The femoral neck fracture was first reduced and the limb was put in longitudinal traction. The proximal nail fragment was found posterior to the femoral neck in the substance of gluteus maximus. It was encapsulated into thick fibrous tissue in proximity to the sciatic nerve which was identified and protected. Following removal of the proximal nail fragment, attention was turned to the distal intramedullary one. A vigorous effort was made to identify and re-open the piriformis fossa and channel down the bone to the top of the distal nail fragment. A considerable amount of bone was removed and the limb was positioned in adduction in order to reach and remove the nail. As a result the neck fracture reduction was lost. A second attempt to reduce the neck fracture was made and the position was maintained with a K-wire passed posterior to the nail with the limb in neutral position (zero abduction/adduction). The attempt to remove the *in situ* nail was abandoned as concern was raised regarding the femoral head viability, due to bone loss and repeti-



Fig. 2. — Lateral radiograph of the right hip. The neck fracture is oblique and totally displaced.

tive reduction attempts. Under the image intensifier control, a second K-wire was passed posterior to the nail cephalad and parallel to the original one. The lateral view of the hip showed very limited bone bridge anterior to the nail to insert a third K-wire. Using a high speed burr (Midas Rex, Osteonics) a hole was made into the lateral cortex and to the nail itself in a direction parallel to the inserted K-wires and anterior to them. Following this manoeuvre a third K-wire was introduced through the nail. Three consecutive cancellous lag-screws were placed and tightened gradually and alternatively until good and stable reduction of the fracture was achieved in antero-posterior and lateral views (fig 3). The operating time was 45 minutes and the blood loss 200 ml.

An anteroposterior radiograph taken at one year follow-up revealed a relatively expected degree of neck collapse in valgus but no sign of avascular



Fig. 3. — Immediate postoperative lateral radiograph of the right hip. Anatomical reduction and fixation of the neck fracture. Two screws behind the nail and one through the nail. Clips for the skin closure.



Fig. 4. — Anteroposterior radiograph of the pelvis at 12 months follow-up. Fracture healing in valgus. Mild degree of neck shortening. Arrow points out the hole through the nail.

necrosis of the head (fig 4). The fracture was considered healed as the patient was walking full weight bearing and pain free.

DISCUSSION

Concurrent ipsilateral hip and femoral shaft fractures occur in as many as 9% of all shaft fractures that are treated. The patients are relatively young and are usually victims of high-energy trauma (1, 6). Numerous treatment options have been recommended for the treatment of this combined injury pattern. Anterograde femoral nailing of the shaft with cancellous lag-screws placed anterior to the nail for fixation of the neck (1, 7, 8); reconstruction-type nails using the proximal interlocking screws to fix the femoral neck fracture with or without additional cancellous lag-screws (2, 3, 4); various plates and screws combinations (including dynamic hip screw with or without cancellous lag-screw aug-

mentation for the neck and plate for the femoral shaft fracture or cancellous lag-screws and plate respectively) (1, 6); retrograde intramedullary nailing for the shaft and cancellous lag-screws for the neck of the femur (5).

Our case presented with a different sequence of events. The femoral neck fracture was a periprosthetic fracture around an already implanted femoral nail following a shaft fracture 10 years earlier. The shaft fracture was healed and the neck fracture was independent to it. Most probably the *in situ* nail protected the shaft from a new fracture. Furthermore the nail possibly altered the biomechanics of the proximal femur in a favourable way to provoke neck fracture. Fatigue fracture of AO femoral nails occurring after fracture healing have been seen in a number of cases, at the junction between the closed and open section parts of the nail; extraction of the distal part of the nail in such cases is notoriously difficult.

The above sequence of events obviously reduced the severity of the presenting injury, comparing to the simultaneous occurrence of both fractures. Nevertheless the importance of the neck fracture reduction and fixation remained a major priority in order to decrease the risk of avascular necrosis of the femoral head in such a young patient. Reduction and fixation however, was dependent on the placement of the *in situ* nail. Not only were we been unable to remove the nail even by taking out a lot of viable bone but we also lost the fracture reduction. Concerns regarding the viability of the head were then raised due to the close proximity of the nail to the fracture site and the location of the fracture near to the trochanteric line. Further violation of the proximal femur was discouraged and the solution of bypassing the nail with cannulated lag-screws was elected. Following successful placement of two guide K-wires posterior to the nail, the next problem was encountered. The nail was placed too anterior to allow a third screw to be inserted anterior and inferior to the latter two screws, in a biomechanically sound position. The options were to place a third screw posterior and inferior parallel to the first two or to attempt a placement through the nail. The high speed burr is a useful tool for hip revision and spinal surgery. We used it to penetrate the nail from the lateral side and reach the femoral neck anterior to the already inserted two K-wires. A third K-wire was then introduced giving the opportunity to insert a third lag-screw through the nail, allowing at the same time fracture compression and sound fixation.

We found the above described technique rewarding in terms of surgical time, quality of reduction

and fixation and optimisation of iatrogenic surgical trauma. There is no doubt that removing the nail altogether and fixing the fracture using either three cancellous lag-screws or a combination of a dynamic hip screw and plate with or without an additional cancellous lag-screw might had provided a better option.

In our hands this option remained unfulfilled. The risk of damaging the vascular supply to the head and the iatrogenic removal of critical and viable bone mass from the top of the femur in our case could not outweigh the compulsory removal of the nail.

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