Operative fixation of a subtrochanteric fracture in a patient with previous spontaneous hip fusion

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ABSTRACT

Patients with a fused hip can present with various clinical problems, such as contralateral hip arthritis, ipsilateral knee arthritis and degenerative disc disease. There are significant deforming forces at the proximal femur in patients with a fused hip who have ipsilateral subtrochanteric fractures. We report a 66-year-old patient with a spontaneously fused right hip, who sustained an ipsilateral comminuted proximal femoral fracture secondary to a road traffic accident. Optimal operative fixation of this patient posed as a surgical challenge. We discuss the management options in this paper. Intramedullary nailing was used so as to minimise the blood loss and because of its favourable biomechanical characteristics. The patient had postoperative femoral nerve neuropraxia that eventually resolved. In patients with a fused hip who have ipsilateral subtrochanteric fractures, retrograde nailing of such fractures can serve as an optimal treatment option. However, femoral nerve palsy can be a potential complication.

Keywords: femoral nerve palsy, hip fusion, intramedullary nailing, proximal femur, retrograde, shaft fracture, subtrochanteric

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INTRODUCTION

Subtrochanteric fractures constitute only a small proportion of the patient population with femoral fractures.[1] The biomechanical constraints in the subtrochanteric region are significant, and hence require a dense strata of bone to predominate the macroarchitecture. Fractures in this area are usually secondary to high-energy trauma, and surgical fixation of these fractures is technically demanding due to the increased propensity for implant failure.[2]

There are various options for the surgical fixation of subtrochanteric fractures. These include open reduction and internal fixation using fixed angle systems, proximal femoral locking plates and the use of an intramedullary nail.[1] Due to favourable biomechanics afforded by the latter construct, it is often the preferred fixation option for subtrochanteric fractures. In proximal fractures, the antegrade nailing technique provides optimal control and reduction of the proximal fragment. Retrograde nailing is typically done for distal femoral fractures.

We report a patient with a spontaneously fused right hip who sustained a subtrochanteric fracture on the ipsilateral side in a road traffic accident. Due to loss of hip motion, the standard antegrade principles could not be applied in the operative fixation of this patient. Therefore, a retrograde nail was applied unconventionally for the proximal femoral fracture in this patient. To the best of our knowledge, this is the first case report discussing the use of retrograde nailing for such a proximal femoral fracture in a patient with a fused hip. The authors also discuss the various possible surgical considerations and the technical difficulties that were encountered in the management of this patient.

CASE REPORT

A 66-year-old Chinese man was admitted to our institution following a road traffic accident. He had a previous history of Hansen's disease and mitral valve surgery with chronic atrial fibrillation requiring lifelong warfarin treatment. He also indicated a long-standing stiff right hip for more than two decades. There was no prior history of tuberculosis, ankylosing spondylitis or surgical procedures for the right hip. Clinical examination revealed right upper thigh swelling and deformity. No neurovascular deficits were observed in the lower limbs. Radiographs revealed a spontaneously fused right hip and a comminuted ipsilateral subtrochanteric fracture (Fig. 1).

Following the pre-operative clinical optimisation of the patient's cardiac status and thromboembolic prophylaxis, he underwent surgical fixation using an intramedullary nail. Warfarin was stopped and subcutaneous clexane was administered for a total of ten days and stopped 24 hours prior to his operation. Subsequently, clexane was restarted on the sixth

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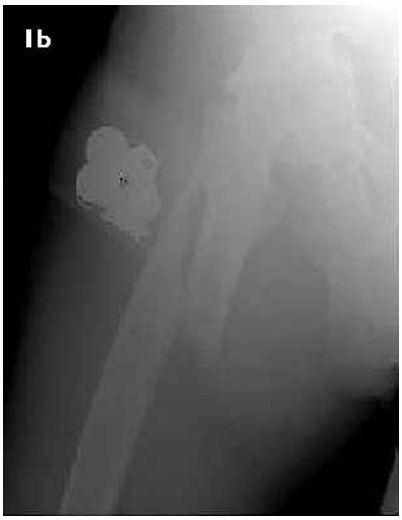
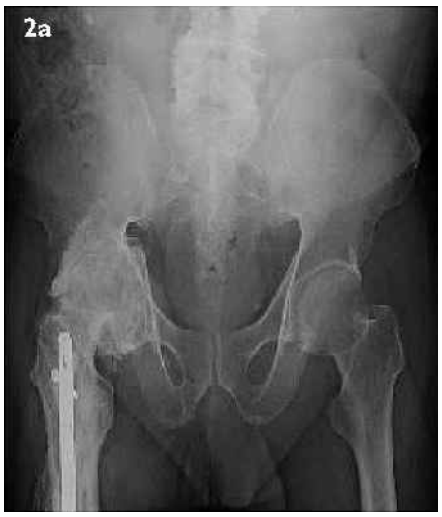


Fig. 1 Preoperative radiographs in (a) anteroposterior and (b) lateral views show a spontaneously fused right hip and a comminuted ipsilateral subtrochanteric fracture.



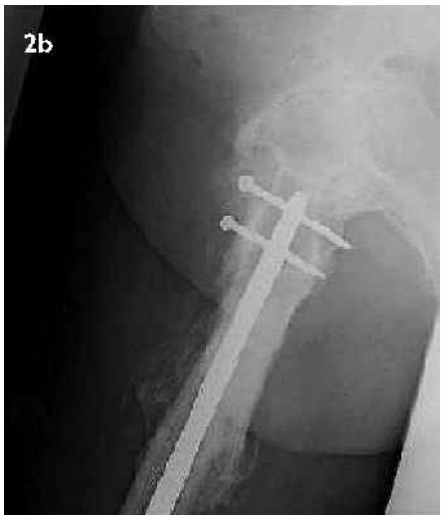


Fig. 2 Radiographs in (a) anteroposterior and (b) lateral views 14 months post operation show complete fracture consolidation.

postoperative day. Warfarin was restarted on the seventh postoperative day and adjusted until the international normalised ratio (INR) was in the desired range. Thromboembolic deterrent stockings were used both before and after surgery. Postoperatively, the patient was commenced on non-weight-bearing ambulation with clutches.

For the use of an antegrade nail, hip motion is necessary in order to facilitate access to the piriformis fossa for the delivery of the intramedullary guidewire and the subsequent nail. Even if the patient had been placed in a lateral position, due to the fixed position of the hip, it would have been difficult to access the proximal femur, and distal locking would have been slightly difficult without a special lateral position favouring the traction table. Due to the patient's history of a spontaneously fused hip, no hip adduction could be conducted to deliver the piriformis fossa. A decision was made therefore to use a retrograde nail to facilitate the internal fixation of the proximal femoral fracture.

The patient was placed on a radiolucent table in a supine position. To facilitate knee flexion in a fused hip, the patient's knee was suspended at the edge of the operating table. The initial retrograde instrumentation was performed using a medial parapatellar surgical approach to the knee. Due to posterior medial calcar comminution and an immobile proximal segment with a sclerotic endosteal canal, technical difficulties were encountered during close fracture reduction. This necessitated an open reduction through a limited lateral longitudinal incision to facilitate fracture reduction.

Following the reduction of the fracture, the ball-tipped guidewire was advanced, and progressive reaming was performed followed by the insertion of an intramedullary nail (diameter 11 mm, length 420 mm). During standard placement of the retrograde nails, the proximal end

Fig. 3 Photographs of the patient's knee show a good range of motion and resolution of the femoral nerve neuropraxia.

is usually at the peritrochanteric site; this reduces the likelihood of an inadvertent injury to the femoral nerve during proximal interlocking. However, the proximal extension of the fracture was beyond the latter described safe zone; hence, the nail tip had to be advanced into the femoral neck region. Following the optimal placement of the nail, a large anterior longitudinal incision was made at the fluoroscopy-determined location for the proximal locking. Following the identification of the femoral nerve and its branches, it was carefully retracted, and proximal anteroposterior interlocking was performed under fluoroscopy guidance. Subsequently, one distal locking screw was inserted.

The patient was commenced on partial weight-bearing ambulation for a period of eight weeks; thereafter, he was allowed progressive full weight-bearing ambulation. At 12 weeks post operation, the clinical review revealed a persistent weakness in the right lower limb quadriceps. Electromyography studies confirmed a femoral neuropraxia pattern of injury; this was probably attributable to the nerve being retracted during proximal interlocking. However, the symptoms progressively resolved over a ten-month period, with no residual deficits. The patient was last reviewed at 14 months post surgery. His radiographs revealed complete fracture consolidation (Fig. 2). He had an optimal knee range of motion of 0°–110°, his femoral nerve neuropraxia was resolved (Fig. 3) and he was able to walk on his own.

DISCUSSION

In the published literature, hip fusion has been performed for patients with varied hip pathology, such as post-traumatic arthritis and infection.[3] Resilient motion in both the hip and knee joints is necessary for the optimal joint mechanics of the axial skeleton. As such, patients with a fused hip over an extended period of time often complain of ipsilateral knee pain and contralateral hip and knee pain.[3,4] This indicates that there is a relative increase in load transmission across the other joints. Patients with hip fusion can therefore incur a subtrochanteric fracture secondary to a stiff, ankylosed hip. The deforming forces in subtrochanteric fractures are immense, and matching them with an implant of optimal fatigue failure properties can be difficult.

Various potential treatment options were considered during the management of our patient. Non-operative treatment is associated with immobility-related complications. Furthermore, it would not be a favourable option, even in a patient who is physiologically well. Moreover, with a fused hip, designing of the traction construct can be technically challenging.

A second option would be a plate-screw construct such as a fixed-angle device (i.e. angle blade plate or a dynamic condylar screw) or a proximal femur locking plate. Since the fracture was rather proximal, application of a plate-screw construct would give limited screw purchase proximal to the fracture line. Thus, due to the subtrochanteric region of the fracture and the fused hip, the increased forces at the proximal femur would probably exceed the pullout strength of the plate-screw construct and result in fixation failure.

Since the hip is fused to the right hemipelvis, the plate-screw construct fixation strength can be augmented by extending the screw purchase proximal to the fracture by spanning the hemipelvis using a Cobra plate. This third option would require an extensive violation of the proximal soft tissue sleeve. Furthermore, the standard Cobra plate devices are intended for hip fusion and as such, the length options are limited. Insufficient plate lengths would result in compromise to the distal screw purchase and thus affect the overall stability of the fixation.

The rate-limiting step with plate constructs has been described to be partly related to the stiff hip joint. An alternative approach would be a hip fusion takedown with a reduction of the proximal fracture using long-stem prosthesis and multi-filament cables. However, fusion takedowns are surgically quite demanding, with often unpredictable clinical results.[3,4] Since this patient had a fused hip for more than 20 years, the quality of the remaining hip abductor musculature will be quite doubtful. Moreover, fusion takedown is associated with significant blood loss, and in this patient with anticoagulation treatment, there might be potential problems in maintaining the physiological blood volume.

The intramedullary nailing of femoral fractures involves the preservation of the periosteal sleeve with favourable implant biomechanical strength. The intramedullary nailing of subtrochanteric fractures of the femur is commonly conducted by applying the antegrade approach. When the latter approach is applied in obese patients, proximal femoral access is often difficult, and the various reports of lateral hip pain with the antegrade approach have led some surgeons to advocate retrograde nailing for femoral fractures.[5-10] Retrograde nailing has also been shown to be a valuable technique in the management of ipsilateral femoral neck and shaft fractures, ipsilateral femoral and pelvic or acetabular fractures, as well as ipsilateral femoral and tibial fractures.[7] It may also be suitable for patients with hip diseases, previous proximal femoral fractures or a fused hip.[6,7]

As our patient's hip was immobile secondary to spontaneous fusion, accessing the piriformis fossa would be difficult using an antegrade approach. Retrograde nailing, however, enables easier surgical access through the intercondylar region. The primary concerns with regard to retrograde nailing would be related to the proximal interlocking due to the proximity of the femoral neurovascular structures. An additional drawback in using a retrograde nail in some patients is the possibility of anterior knee pain for an extended period following surgery. In our patient, fortunately, this was not the case. Complications reported in the literature refer to the potential neurovascular injury associated with proximal interlocking[11] and the creation of subtrochanteric stress zones secondary to the proximal locking screws.[12,13] To avoid such complications, it is usually recommended that the nail be positioned in the proximal femur to allow interlocking at or above the level of the lesser trochanter.

However, due to the proximal nature of this patient's fracture, the intramedullary nail had to be advanced far up into the femoral neck. Proximal interlocking was performed using a large anterior incision to visualise and retract the neurovascular structures. Due to the retraction of the femoral nerve, there was a limited period of neuropraxia, as evident from the electromyographic studies.

Retrograde nailing can serve as a suitable surgical option in patients with a previously fused hip who have sustained subtrochanteric fractures. However, during proximal interlocking, optimal visualisation of the femoral neurovascular structures and gentle retraction is important in order to avoid potential femoral nerve complications.

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