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Case Report

Antegrade insertion of a retrograde intramedullary femoral nail for treatment of a subtrochanteric pathological femoral shaft fracture in a patient with pre-existing coxa vara[☆]

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ABSTRACT

Objective: We report the unorthodox use of a retrograde intramedullary nail via antegrade technique for the treatment of a subtrochanteric pathological femur fracture in the presence of significant coxa vara. No similar use has been documented previously in literature. **Methods:** A standard approach to the proximal right femur was performed and standard antegrade technique used to introduce a guide wire into the proximal femur after which the femoral shaft was reamed. A 38-cm long 10 mm diameter retrograde nail was attached to the retrograde insertion and targeting device as if to perform a left sided retrograde femoral nailing. The nail was then inserted antegrade into the proximal right femur and locked. **Results:** The patient made a good recovery without complications and was followed up regularly at the clinic until complete healing of the fracture. **Conclusion:** We believe that a retrograde intramedullary nail inserted antegrade, enabling proximal locking with screws passing into the femoral head, provides a mechanically sound fixation of a subtrochanteric fracture, where a reduced neck-shaft angle precludes the use of a standard cephalo-medullary nail.

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Introduction

The treatment of Subtrochanteric fractures is particularly challenging for any orthopedic surgeon for biomechanical and

anatomical reasons. Currently, there are numerous implants, both intramedullary and extramedullary, designed to treat subtrochanteric fractures.

Based upon current knowledge, long-stem cephalomedullary (CM) nails are the implants of choice

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Fig. 1 – AP pelvis on admission demonstrating a pathological subtrochanteric fracture of his right femur.

to treat femoral ST fractures [1–3]. All subtrochanteric fractures can be stabilized with long-stem CM nails, regardless of the fracture pattern or degree of comminution. Short stem CM nail cannot be recommended for ST fractures because of the many iatrogenic problems and relatively high complication rate [4–6]. In pathological fractures intramedullary nailing appears safe and effective for treatment of metastatic bone

disease, and confers good functional results, pain relief, and mobility [7].

However proximal locking screws of such devices pass through the nail into the femoral head at a fixed angle (usually 130 or 135) and so assume a constant neck shaft angle. Problems could therefore arise with the use of this device in patients with an unusual neck-shaft angle.

We report the unorthodox use of a retrograde intramedullary nail via antegrade technique for the treatment of a subtrochanteric pathological femur fracture in the presence of significant coxa vara.

Case report

A 75-year-old male presented with a mechanical fall followed by severe pain and unable to weight bear on the right lower limb. He was known to have follicular non-Hodgkin's lymphoma with femoral metastasis confirmed by MRI, bone scan and a CT-guided biopsy. The metastasis has been previously treated with a course of radiotherapy.

X-rays showed a pathological subtrochanteric fracture of his right femur (Fig. 1), and a minimally displaced fracture of the ipsilateral lateral tibial plateau.

There was also an appearance consistent with avascular necrosis of the right femoral head and a pre-existing coxa vara with a neck-shaft angle of 115 degrees (Fig. 2).

The low-neck shaft angle meant that we are unable to consider the use of a conventional cephalo-medullary nail.



Fig. 2 – Lateral pelvis on admission with an appearance consistent with avascular necrosis of the right femoral head and a pre-existing coxa vara with a neck-shaft angle of 115 degrees.



Fig. 3 – AP and lateral views of pelvis and knee with nail and locking screws in-situ.

It was observed that a retrograde intramedullary nail introduced antegrade would allow locking perpendicular to the shaft into the femoral head given the more proximal position of what would then be its proximal locking holes. We therefore planned to perform antegrade intramedullary femoral nailing with a femoral nail designed for retrograde insertion.

The ipsilateral tibial plateau fracture was treated conservatively in a cylinder cast applied post fixation of the femoral fracture.

Procedure

The patient was operated on within 24 hours of admission, under general anesthesia, and was positioned on an orthopedic traction table. The fracture was reduced under image intensifier guidance.

An additional technical difficulty was experienced with regards to limb positioning due to the presence of left sided ac-

etabular protrusion. This had rendered his left hip joint very stiff, reducing its flexibility required for suitable limb positioning to allow image intensifier access. Lateral imaging of the right hip proved problematic because of this.

A standard approach to the proximal right femur was performed and standard antegrade technique used to introduce guide wire into the proximal femur after which the femoral shaft was reamed.

A 10 mm × 38 cm diameter retrograde nail was attached to the retrograde insertion and targeting device as if a left sided retrograde femoral nailing was performed. The nail was then inserted antegrade into the proximal right femur.

The nail was locked proximally with two 5.5-mm cortical screws into the femoral head, perpendicular to the nail and shaft of the femur using the targeting device attached to the nail. Distal anteroposterior locking was then performed free-hand with a single 4.2-mm cortical screw through the nail's dynamic slot (Fig. 3).

The patient made a good recovery without complications and was followed up regularly at the clinic. The follow up x-



Fig. 4 – One-month postoperative check radiograph.

rays done 1-month post-op showed the fracture well aligned with the proximal locking screws passing through into the femoral head (Fig. 4). The patient was then regularly followed up at monthly intervals until signs of healing developed (Fig. 5).

Discussion

There are a number of different fixation options available for the treatment of subtrochanteric fractures of the femur including sliding hip screws, fixed-angle plate and screw devices, intramedullary and cephalomedullary nails, of which there are numerous variations, both long and short.

Cephalo-medullary devices are preferred to the first generation interlocking intramedullary nails to fix proximal femoral shaft/subtrochanteric fractures as they utilize a locking screw passing through the nail into the femoral head to form a more stable construct [1,8]. They are also increasingly used instead of internal fixation with plate-screw devices due to being considered mechanically superior with a lower failure rate, especially when used to treat unstable intertrochanteric and subtrochanteric fracture patterns. They offer several advantages over plate and screw fixation: (1) the IM nail is closer to the central axis of the femur than a laterally positioned plate, reducing the bending load on the implant; (2) IM nails act as load-sharing devices capable of withstanding cyclic loading and early weight-bearing in fractures having cortical contact; (3) IM fixation offers a simple minimally in-



Fig. 5 – AP views of follow-up radiographs demonstrative of fracture healing.

vasive technique that maintains the blood perfusion to the fracture.

In the case of a pathological subtrochanteric fracture of the femur, secondary to metastasis, a long intramedullary device is preferable to sliding screw, plate and short IM devices, as it provides better rotational and axial stability to the femoral shaft. As well as providing a mechanically sound construct for fracture fixation, it minimizes potential problems relating to further metastasis, which may subsequently develop in the shaft distal to the original fracture site. Especially with more unstable subtrochanteric fractures and patients who require early weight bearing, implant selection becomes critical. Biomechanical studies reported that a small proximal diameter led to greater fracture site motion, and a titanium implant leads to twice the motion at the fracture site than a stainless-steel implant. The choice of implant should be restricted to those allowing minimal fracture motions especially in subtrochanteric fractures with significant comminution and segmental bone loss.

Our technique of antegrade insertion of a retrograde intramedullary femoral nail for the treatment of a pathological subtrochanteric femoral fracture helped us to overcome the obstacle of the low-neck shaft angle in our patient, which precluded the use of the conventional cephalo-medullary nail. Furthermore, we were neither able to fix the fracture with sliding screw nor fixed angle plate devices as these were considered suboptimal given the absence of distal stability and potential for further metastases.

We believe that a retrograde intramedullary nail inserted antegrade, enabling proximal locking with screws passing into the femoral head, provides a mechanically sound fixation of a subtrochanteric fracture, where a reduced neck-shaft angle precludes the use of a standard cephalo-medullary nail.

Author contribution

All authors have made equal contributions to the article.

Patient consent statement

Patient consent for publication has been obtained.

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