Waking up the healing potential of the bone: subtrochanteric non-union in femoral dysplasia successfully treated after 40 years of pain and disability

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SUMMARY

We describe a successful valgus osteotomy for a subtrochanteric non-union in a dysplastic femur that had not healed in 40 years despite many earlier attempts. The optimisation of biology and biomechanics in the subtrochanteric area shows that even in a longstanding and complex deformity around the hip salvage is possible.

BACKGROUND

Non-unions are relatively common. Treatment most often consists of bone grafting, compression and rigid fixation. Although most of these are relatively straightforward if adhered to these well-known principles, non-unions of the subtrochanteric area of the femur remain a challenge. Proximity to the joint, poor bone quality and limited bone stock complicate its successful treatment.

By improving not only biology but also the biomechanics, union can be achieved in even the most challenging and longstanding non-unions.

This case of a very longstanding (40 years) non-union of the proximal femur description refreshes these principles.

CASE PRESENTATION

A 48-year-old woman presented as a second opinion with a right subtrochanteric non-union. She had undergone two surgeries on her right hip for what she was told was 'removal of proximal femoral cysts' as a 4-year-old child in her native Turkey. There was no further information on the type of surgery and/or pathological diagnosis. Radiographs of those lesions are not available. Until the age of four she allegedly had been ambulating normally (starting at age 1), similar to her siblings. There is no family history of inheritable skeletal abnormalities. Five years after the two surgeries on her proximal femur she sustained a fracture on her right leg after a fall. The fracture was treated non-operatively with a hip spica cast for many months. Unfortunately, the fracture did not heal and further treatment was not offered. Instead, she was given two crutches, which she has been using ever since to maintain her independence in daily life.

The patient moved to our country when she was 19. For the next 14 years she continued to ambulate with crutches and used adjusted shoe wear to accommodate her leg length discrepancy. She did not seek further medical treatment for her

leg until she was aged 33. At that age she was offered an operative procedure consisting of debridement of the non-union, plate osteosynthesis and autologous bone grafting. This failed and hardware was removed 7.5 years later (2004). A second attempt was made 3 years later by the same surgeon (2007) with placement of an intramedullary fibular allograft and locked plating. In addition, demineralised bone graft was added around the non-union. Unfortunately, the non-union again did not heal.

In 2011, she was referred to the author's clinic for a second opinion. At that time, her subtrochanteric non-union had been present for nearly 40 years. She complained of right hip pain and was not able to walk without two crutches. She was otherwise healthy, had given birth to a healthy (now adult) son and was working in her own printing office. On physical examination, her right leg was atrophic and much shorter than her left leg. Range of motion of her right hip was significantly decreased because of pain. Her right knee was stiff allowing only 30° of flexion. Her right foot was in 40° of equinus. Her right leg was neurovascularly intact. All scars had healed without signs of infection and there had been no evidence of infection in the past. Treatment options were discussed with the patient. An increased valgus inducing osteotomy, with compression and bone grafting was felt to offer the most chance of success. By changing the shearing forces into compressive forces non-unions are known to heal. In addition, we anticipated harvesting posterior iliac bone graft (anterior iliac crest had been harvested during prior procedures).

INVESTIGATIONS

Radiographs showed an obvious non-union of her right subtrochanteric area (figure 1). The fibular allograft was still in situ but had failed proximally. There were obvious radiolucencies around the locking screws distally. There was a remarkable radiographical difference in bone density between the left and the right leg and a significant leg length discrepancy. Routine laboratory testing showed no evidence of infection.

TREATMENT

After induction of general anaesthesia the patient was first placed prone on a radiolucent table. Harvesting of autologous cancellous bone from both posterior iliac crests was done. After closure of the wounds, the patient was placed supine. Until

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Figure 1 (A) Antero-posterior pelvic radiograph showing non-union of the proximal femur. Also note the dysplastic femur and right hemipelvis and (B) a CT showing the non-union and the intramedullary graft.

deep cultures of the non-union were obtained, no antibiotics were given. A lateral approach of the right proximal femur was performed using the old incision. There were no signs of infection. All hardware was removed. The non-union was opened with a laminar spreader and interposed tissue was cleaned with a curette and rongeur. Multiple holes were drilled proximally and distally in the shaft to further open the medullar canal. The failed fibular allograft was left in place. Based on preoperative planning a 30° lateral closing wedge of the proximal femur was removed. A 95° blade plate was modified into 125°. The plate was inserted and indirect reduction of the non-union was done. Using the AO-tensioner device distally the non-union was compressed (figure 2). Using a narrow sharp osteotome, small 'petals' of cortical bone were elevated on both sides of the non-union leaving them attached to the soft tissues. Autologous cancellous bone graft was then placed around this area.

OUTCOME AND FOLLOW-UP

The postoperative course was uneventful except for mild paraesthesia in her right foot and lower leg that resolved within weeks. Bridging of the non-union was noticed on a CT at 4 months after surgery. Fourteen months after the last surgery the patient was able to walk independently without crutches

(but still carried one with her for long distances). This was quite remarkable for her as she had not been able to walk without assistive devices for 40 years. Passive motion examination of the hip showed 40° flexion, full extension, 45° abduction, 5° of exorotation and 45° of endorotation. Leg-length discrepancy remained obvious (10 cm) for which orthopaedic footwear was optimised. Hip flexion muscle strength was assessed using the Medical Research Council scale and was rated 3 of 5. Radiographical images were obtained. The non-union had bridged and there was no evidence of avascular necrosis of the hip. She scored 50.5 on the mental component summary and 45.5 on the physical component summary of the SF-36 questionnaire and 11 (suggesting a fair outcome) on the Merle d'Aubigne hip score. She was very pleased with the outcome (see figure 3).

DISCUSSION

Treatment of most subtrochanteric non-unions is challenging. There is often bone loss, deformity, scarring and a small proximal fragment.¹⁻⁴ Large forces (compressive and tensile) will significantly affect any fixation type used. Although intramedullary devices can be used for those subtrochanteric non-unions that only have mild or no deformity, the use of a blade plate is much more versatile. This relatively cheap device combines fixed angle fixation, with the ability to allow correction of a multiplane deformity and also provides necessary compression. In addition, it preserves bone stock in an area that often contains voids from previous fixation attempts. We and others reported successful treatment with this technique.²⁻⁴ Others have used intramedullary nailing for subtrochanteric non-union with high success rates.⁴⁻⁶

In summary, this case reinforces the unsurpassed and impressive regenerative capacity of the skeleton when biology and biomechanics are optimised. The idea of introducing an increased valgus alignment, compression and bone grafting for a proximal femoral non-union has withstood the test of time. We are not aware of a similar long-standing case of a subtrochanteric non-union presented in the literature. Exposure to and experience with this powerful technique are still very useful for the surgeon treating non-unions of the hip and proximal femur.

Figure 2 Intraoperative fluoroscopy. (A) The closing wedge is measured; (B) the modified blade plate is placed. Notice the anticipated valgus correction; (C) final position of the plate.

Figure 3 (A) Antero-posterior radiograph at last follow-up (2 years) showing healing of the non-union; (B) detail showing crossing bone trabeculae; (C) lateral radiograph at last follow up (2 years); (D and E) clinical photographs at last follow-up.

Learning points

- The subtrochanteric area of the hip is prone to non-union because of the large tensile and compressive forces in this area.
- Bone has an unsurpassed healing capacity being one of the few tissues in humans to heal without leaving a scar.
- Optimising biology (bone grafting) and biomechanics (increased valgus alignment, compression and stable fixation) will generally allow non-unions of the proximal femur to heal.

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