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Case Report

Management of infected non-union of the proximal femur: A combination of therapeutic techniques

Thomas A.J. Goff *, Nikolaos K. Kanakaris [1]

Academic Department of Trauma and Orthopaedics, Leeds Teaching Hospitals, NHS Trust, UK

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ABSTRACT

A challenging case of a nonunion of the proximal femur complicated by infection attributed to microbial and fungal pathogens requiring a combination of novel surgical techniques to achieve eradication of infection, preservation of the native hip joint, and restoration of function.

In all cases of fracture non-union, an analytical approach to the particular problem of each individual case according to the principles of the "diamond" concept is of paramount importance. The mechanical factor – adequacy of applied fixation; the local and systemic biological factors – healing potential, as well as the vascularity of the bone fragments and the local soft tissue envelope, alone or in combination could determine the prognosis of a fracture [1,2].

Moreover, the inoculation of microbial pathogens at the time of initial trauma, during the initial fixation surgery or even secondarily at the process of healing, represents and additional complicating factor, leading to the delay of fracture union, and often loosening of the fixation devices and chronic osteomyelitis [3,4].

When all of the above factors are present in a non-union case, complex management strategies need to be employed, often in a sequel of surgical stages. Usually, the first aim is to eradicate the infection by means of aggressive surgical debridement, local and systemic pathogen specific antibiotics and temporary stabilisation of the non-union area, followed by definite fixation of the non-union site and means of reconstitution of the bone/soft tissue defect either via distraction histogenesis with external fixation frames or internal fixation and bone grafting [5,6].

Significant experience already exists for long bone reconstruction within the diaphysis, however unusual presentations such as in this case of the proximal femur metaphysis in a young patient pose additional surgical dilemmas. We report our approach combining a number of novel concepts and surgical techniques.

Case report

A 31-year-old healthy, non-smoking male suffered a right sided intertrochanteric proximal femoral fracture and lung contusions and severe chest trauma following a road traffic collision in Pakistan in November 2009. Soon after his injury he underwent locally operative fixation with a 4-hole dynamic hip screw device (DHS), however the post-operative period was complicated with deterioration of his respiratory function and prolonged stay at the local ICU for 2 weeks. He received prolonged antibiotic administration (second generation cephalosporin for 4 weeks), and had a slow rehabilitation, and a delayed discharge at 5 weeks post admission. Eleven months later he presented to our institution in October 2010 following a recent simple fall, with increased right hip pain and worsening mobility. On review he was apyrexial, with a well healed surgical scar on his right proximal thigh, shortening of 2 cm on the right and marginally elevated inflammatory markers (WBC 9.21,

* Corresponding author at: Department of Orthopaedics, Huddersfield Royal Infirmary, Acre Street, Huddersfield HD3 3EA, UK. Tel.: +44 01484 342000.
E-mail addresses: Thomasajgoff@googlemail.com (Thomas A.J. Goff), Nikolaos.Kanakaris@leedsth.nhs.uk (N.K. Kanakaris).
[1] Academic Department of Orthopaedics, Leeds General Infirmary, Great George Street, Leeds LS1 3EX, UK. Fax: +44 01133923290.

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CRP 12, ESR 11 mm). Radiographs appeared to show an atrophic non-union of the right hip fracture with a well-positioned DHS in situ (good neck shaft angle, lag screw position in a centre-centre position, and excellent tip apex index) (Fig. 1). CT scanning confirmed fracture non-union (Fig. 2).

Despite no clear history suggestive of post-operative surgical site infection, deep infection was suspected as a complicating factor considering the verified radiological evidence of an atrophic non-union in an otherwise healthy adult with high energy trauma, given the absence of poor surgical fixation technique or obvious mechanical causation. Therefore an initial exploratory operation of open biopsy was undertaken for bone and soft tissue samples. Culture confirmed infection with *Candida albicans* (1 of 5 specimens) and also Coagulase negative staphylococcus (1 of 5 specimens). Extended tests included serial blood cultures which had no yield, serology for Hep B/C and HIV which were negative, and samples excluding tuberculosis.

Preservation of the native hip was fundamental to the staged surgical strategy. In the first stage radical debridement, removal of all existing metalwork, bridging external fixation, and filling of the created bony void with PMMA cement (Palacos® preloaded with Gentamicin) loaded with additional 2 g of Vancomycin and 400 mg of Amphotericin-B (Fig. 3). Fluconazole 50 mg OD and Amoxicillin 1 g TDS were orally continued for six weeks, allowing time for soft tissues to settle and the inflammatory markers to normalise

Fig. 1. AP femur radiograph on presentation.

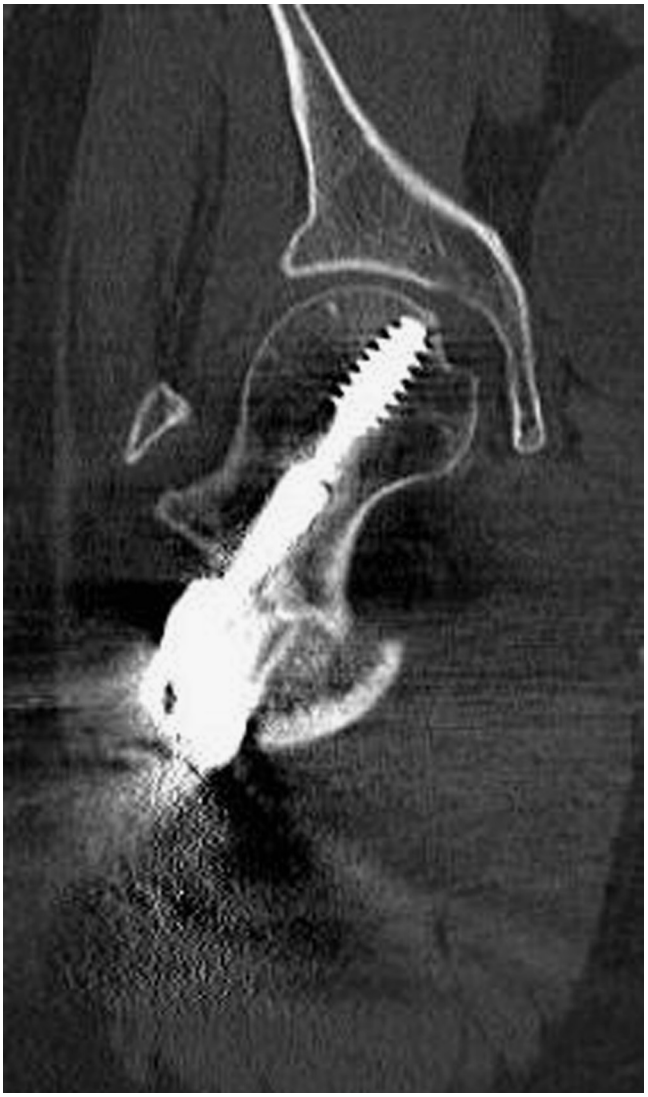

Fig. 2. CT coronal section of proximal femur fracture non-union.

(WBC 6.85, CRP 6.1, ESR 5 mm). The patient was discharged home and was followed up until re-admission as an outpatient at weekly appointments for pin site review and laboratory testing. He remained nonweight bearing on the right, using his left leg to pivot from bed to chair/wheelchair during this period. He also received chemical thromboprophylaxis (tinzaparin 4500 units sc) during the period of restricted mobilisation as per institutional guidelines.

The second stage was undertaken after two months by initially harvesting morsellised bone graft from the contralateral femur (70 ml) using the Reamer/Irrigator/Aspirator system (RIA®) (Synthes Inc., West Chester, PA). This was followed by removal of the bridging external fixation, curettage of the pin sites and repositioning of the patient at the traction table. Using careful dissection in order to avoid destruction of the induced membrane, through a single longitudinal split the cement plug was removed in pieces using an osteotome. The void and the femoral canal was irrigated with 2 l of normal saline. Then the morsellised autologous graft combined with 1 vial of BMP-7 (Osigraft® Olympus, UK) was inserted into the defect through the window created in the bioactive membrane, which was subsequently closed with a 1 pds continuous suture. A 12 hole 95° angle blade plate (Fig. 4) was inserted and his wound closed in layers. He was allowed toe touch weight bear on the right immediately post-surgery and then