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Case Report

An alternative management option for infected non-union of long bone fractures

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ABSTRACT

Management of infected non-union following fracture of a long bone is a challenge to the orthopaedic surgeon. Several methods of treating these cases have been described.^{1–7} Although reports of single stage or multiple stage procedures exist in the literature, general consensus appears to favour a two-stage approach with initial debridement followed by the use of local antibiotic cement in the first stage.^{2,5,8} This antibiotic-impregnated cement has been reported in previous papers as placed around an intramedullary nail or via antibiotic cement beads.^{4–6,9} Cement beads offer no mechanical stability to the fracture site. Placing cement around an intramedullary device provides added concerns, such as cement nail debonding and the continued presence of metal, which could cause persistence of infection when in contact with endosteal sequester. We describe the use of an antibiotic cement nail fashioned by hand intra-operatively around a length of nylon tape. This eliminates the need for further metalwork during the infected stage, thereby reducing the chance of persistent non-union as well as providing some stability across the fracture site.

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1. Case

A 59-year-old lady presented with an open, comminuted, segmental fracture of the mid-shaft and neck of the right femur following a road traffic accident. This was initially treated with wound debridement and a long intramedullary nail. Unfortunately the procedure was complicated by *Staphylococcus aureus* infection, and sinus formation; at 8 months there was still non-union. This was treated with admission, high dose antibiotics (Fucidin, Flucloxacillin, and Trimethoprim), and exchange nailing with reaming and lavage of the canal. The organism was found to be resistant to the Flucloxacillin, and treatment was changed to Teicoplanin, given through a PICC line.

Despite the new fixation and antibiotic cover, the non-union persisted.

At 1 year following the initial injury the second nail was removed and the femoral canal thoroughly lavaged. The canal was then sequentially reamed until cortex was reached. A cement nail was fashioned intra-operatively around a length of nylon tape with no metalwork included (Fig. 1). The tape was used to allow retrieval of the cement rod in the event of rod fracture. The nail was shaped to the approximate diameter of the reamed femoral canal. The cement nail was left longer than the femur to allow the proximal portion to lie outside the femur to facilitate removal. The fashioned nail was intentionally left straight, again to aid removal. The procedure was performed with the patient on a traction table.

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Fig. 1 – Cement nail hand fashioned around a length of nylon tape.

Post-operatively the patient was kept in a long leg resin/fibre cast for the first 2 weeks post-operatively and was kept non-weight bearing on the limb for 6 weeks. Antibiotic cover was continued after the procedure. The patient was reviewed in clinic at serial time points and inflammatory markers were repeatedly checked. At 6 months the fracture appeared to be uniting both radiographically and clinically although without proximal and distal locking there had been a 3 cm shortening of the femur (Figs. 2 and 3). The inflammatory markers had settled to the normal range and the patient was able to mobilise full weight bearing with no pain. At 8 months following the insertion of the cement nail, a further procedure was performed to remove the cement rod and replace this with a standard locked nail. Removal of the cement nail was easy and facilitated by the nylon tape left protruding from the proximal end of the femur. The cement nail was intact,

Fig. 2 – AP radiograph of the right hip showing cement nail in situ. The cement nail was left longer than the femur, protruding proximally to aid removal.

Fig. 3 – AP radiograph of the femur showing the cement nail in situ stabilising the fracture.

bonded to the tape and no cement was left in situ. After removal the cement nail was broken to demonstrate how the cement would remain attached to the nylon tape in the event of a fracture within the patient (Fig. 4).

2. Discussion

Management of infected non-union is a particular challenge to the orthopaedic surgeon, with potential risk to limb and even life.^{1–3} Several treatment options have been previously described including single stage and multiple stage procedures.^{1–7} General consensus appears to support the idea of a two-stage procedure with removal of infected metalwork and debridement followed by subsequent fixation after infection has been eradicated.^{2,5,8} Achieving stability whilst at

Fig. 4 – The cement nail was deliberately broken post-operatively to demonstrate how the nylon tape would aid removal with no loss of cement if the cement nail fractured in situ.

the same time treating the infection has proven difficult but several methods have been described, including immobilisation with bed rest, internal or external fixation.^{1–7} The use of antibiotic-impregnated cement to deliver high concentrations of antibiotic locally without systemic absorption has been described for infected non-unions in both lower and upper extremity as well as in revision arthroplasty.^{1,2,8} Several publications describe the use of an intramedullary nail coated with cement with various methods used to obtain an equal, uniform coating.^{4–6,9} Cement placed free-hand in to a cortical defect as an interposition mass has also been described in the upper limb.¹ These techniques offer some support at the fracture site. Cement beads manufactured to elute cement have been used, as has a mass of antibiotic cement placed in an extramedullary position next to the fracture site.^{1,2,5} These techniques avoid further metalwork but require further methods to stabilise the bone.^{2,4} Techniques requiring the use of metalwork either within or external to the bone could potentially attract micro-organisms and aid persistent infection. The use of a cement rod in isolation facilitates local antibiotic delivery and affords some stability to the fracture site without the use of further metalwork. It is minimally obtrusive, avoiding additional skin incisions and is readily removable with no risk of cement debonding from a spacer or nail. Although this case went on to mal-union with a 3 cm leg length discrepancy, it eradicated the infection after a failed exchange nailing procedure. Further surgery could be considered later on to address the shortened limb after discussion with the patient. The cement nail was removed intact without fracture in this case, however it could be removed en masse in the event of fracture because it was fashioned around a nylon tape, a testament to the safety of the system.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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