Other full case

Management of tibial non-union with tricalcium phosphate and BMP 7

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Summary

We present the case of a 30-year-old woman who was referred with an established tibial non-union with a bone defect following a spiral fracture of the tibia. Initial attempts at union with intramedullary fixation and then autograft were unsuccessful. We achieved union by debriding the fibrous tissue and packing the defect with Bone Morphogenetic Protein 7 (Osigraft, Stryker, UK) and a tricalcium phosphate bone void filler (Calstrux, Stryker, UK). We did not use any additional surgical fixation and the patient was supported in an aircast boot.

BACKGROUND

Non-union is a common complication following spiral fractures of the tibia. Many different methods of treating this problem have been described using either autograft or allograft^{1 2} and several studies on bone morphogenetic proteins (BMPs) being used to encourage bone healing have been published.^{3 4} Our case demonstrates the successful use of BMPs when other attempts at union have failed. This technique can be used as a useful 'get out of jail free card' in the context of prolonged tibial non-unions.

CASE PRESENTATION

A 30-year-old woman presented in February 2005 with a low-velocity spiral fracture to her left tibia and fibular when she was playing football with her son. Her initial management was in another hospital where she was treated with traction pins proximally and distally in an above knee plaster, which was later converted to a Sarmiento plaster and then a walking boot. At 7 months there was no sign of bone healing in the tibia and an attempt was made to stabilise the non-union with an intramedullary nail (figure 1A).

She presented to our hospital 14 months after the original injury and a CT scan showed a partial union of the left tibia. To investigate the cause of her low velocity fracture and

subsequent non-union she underwent a dual x-ray absorptiometry scan. This scan demonstrated reduced bone density of the femoral heads and she was started on bisphosphonates. On further questioning she gave a history of asthma as a child for which she regularly took steroids. She was otherwise fit and well and had no other medical problems. She was not taking any regular medicines. She was an ex-smoker, stopping several years before. She had no family history of any bone or endocrinological diseases.

Four months later the intra-medullary nail was removed and bone marrow (autograft) was injected into the fracture site. She initially showed some mild improvement; however, 12 months later her symptoms returned to the point where she found it difficult to walk and that the leg was painful at rest.

INVESTIGATIONS

Plain radiographs (figure 1B) and a CT scan (figure 2A,B) demonstrated a persistent non-union unchanged since the first CT scan.

TREATMENT

She fulfilled the licensing criteria for Osigraft—namely, an established non-union and failed treatment with

Figure 1 (A) Initial x-ray with IM nail. (B) x-ray following removal of IM nail and use of autograft. (C) The most recent x-ray showing new bone formation.

Figure 2 (A) Initial CT scan showing non-union, coronal views. (B) Axial views of non-union. (C) CT scan showing union, coronal views. (D) Axial views of union.

autograft—therefore, she underwent curettage of the non-union removing all fibrous tissue and obvious sclerotic bone leaving bleeding bone edges. The defect was packed with 10cc of Calstrux and 3.5 mg of eptotermin α (BMP 7) mixed with 10 ml of her blood to provide a paste. She was allowed to weight bear postoperatively for the first 3 months in an aircast boot and after this she was allowed to move without support.

OUTCOME AND FOLLOW-UP

One year following the final procedure she is able to run and walk without problems and a CT scan shows complete union (figure 2C,D).

DISCUSSION

We have presented a case of a prolonged tibial non-union, which was unsuccessfully treated with autograft but successfully treated with BMPs.

Many techniques have been developed to aid the healing of non-unions, including fixation techniques (internal and external), bone grafts and substitutes, and electromagnetic stimulation; however, the gold standard still remains autologous bone graft.⁵ The success of autologous bone graft lies in its osteoconductive and osteoinductive properties; however, there is an associated donor site morbidity with increased postoperative pain, increased intraoperative blood loss and extended operative time.⁶ BMPs have been

used for a variety of purposes to improve bone healing ranging from acute closed and open fracture management,⁷ maxillofacial surgery,⁸ limb lengthening⁹ and fracture non-unions (tibial and scaphoid).^{10–11} In these cases, BMP has proved successful by not only initiating bone formation through the induction of cellular differentiation in mesenchymal cells but also providing an osteoconductive scaffold allowing ingrowth of bone into the defect. In a review of the literature, Garrison *et al* demonstrated that there was no significant difference in the healing rates of tibial non-union between patients who received BMP versus autologous grafts; however, the autologous graft group did have the associated donor site morbidity.⁵ In the majority of these cases, the BMP is used in combination with surgical fixation either internal or external; however, in our case, the patient was only supported in an aircast boot postoperatively.

Our case demonstrates the use of BMPs in a complex tibial non-union, where other attempts to unite the fracture had failed, without additional surgical fixation.

Learning points

- ▶ BMPs can be used to treat a non-union even when autograft has failed.
- ▶ The combination of BMPs and bone void filler can be used to fill a bone defect in a non-union.
- ▶ There is no need for any additional surgical fixation when BMPs and bone void fillers are used to treat tibial non-unions with bone defect.

Competing interests None.

Patient consent Obtained.

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