Retrograde autologous bone grafting through the intramedullary canal using the reamer irrigator aspirator

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Introduction

Local bone grafting in shaft fractures treated with an intramedullary nail usually requires opening of the site of interest in addition to the incisions made for insertion and locking of the implant. This involves an additional incision, dissection of musculature, and the stripping of bone, especially if the graft is applied to more than one plane around the fracture.9,11 Among the potential complications of open bone grafting are infection, muscle damage, and damage of the vascular supply with subsequent jeopardy of the bone graft.2,8 We describe a minimal invasive retrograde technique for local bone grafting through the medullary canal.

Case description

4 months prior to admission to our unit, a 17-year-old female had sustained multiple injuries, including a left femur shaft fracture treated by reamed, locked retrograde nailing at an outside facility. While on partial weight bearing status, she tripped and fell from her parent’s porch and re-fractured her femur and the hardware (Fig. 1). Due to a change in health insurance, the patient presented to our hospital.

We performed revision surgery via the previous incisions. The distal part of the nail was withdrawn using an extraction device. The tip of the broken nail was removed through the femoral canal using a hook (Fig. 2).

The fracture was reduced and a retrograde guide wire was inserted up to the area of the greater trochanter. Bone graft was then harvested from the medullary canal using the reamer aspirator irrigator technique (RIA). Reaming was performed using single-pass one step with the Reamer aspirator irrigator device. Thereby, about 15 cm³ of cancellous canal bone graft was harvested.

The aspirated bone graft was sequentially mounted into the plastic tube of the RIA, from which the tip had been removed (Fig. 3). To visualise the tip of the plastic tube, the guide wire was inserted just 2 in. short of the tip and a plunger was introduced into the plastic tube. The extremity was placed into a valgus position in order to apply the bone graft to the medial fracture site. The placement of the bone graft was assessed using fluoroscopy (Fig. 4). All 15 cm³ were applied to the anterior and medial portion of the re-fractured area. Then, a 13 mm by 320 mm retrograde intramedullary nail was selected and inserted into the canal, followed by locked nailing (Fig. 5).
Postoperatively, the patient recovered well. She was allowed to perform touch down weight bearing for 6 weeks and progressed to full weight bearing 9 weeks after the injury. She had no complaints at her 12-week follow-up and uneventful healing had occurred at this stage.

Discussion

Although numerous graft substitutes have recently been advocated, autologous bone graft continues to represent the gold standard in extremity surgery since it has the best biological properties. When the iliac crest is selected as donor site, a considerable morbidity has been described, and the volume of harvested cancellous bone is limited. Recently, a new reamer system has become available that allows the harvest of bone from the intramedullary cavity. This may be advantageous because bone harvested from the intramedullary cavity has better biological properties than iliac crest bone graft and a higher concentration of growth factors. The irrigation process is also known to cause considerable cooling, and reduces the degree of inflammatory response.
Several aspects of the described technique require discussion. First, one may argue that exchange nailing alone might have been sufficient in this particular case. However, given the large medial bone defect area and the fact that the first procedure had failed at an outside facility, we felt that the additional support of biologic potential was advantageous. Moreover, we assume that avoiding the lateral approach for application of an adjunct bone graft prevented further stripping caused by the local procedure. Second, the placement of the bone graft is certainly difficult to control—in our case, valgisation of the femur was performed intraoperatively and the placement of the graft was visualised via fluoroscopy. Additional tools may be required to improve the technique. These should (1) allow for periosteal dissection of soft tissues and (2) allow for direct positioning of the graft.

In summary, the illustrated case suggests that in selected cases an autologous bone graft through the intramedullary cavity using the RIA device may be an alternative method to support exchange reamed nailing.

References