

Grapefruit Method: Metaphyseal Bone Grafting to Improve Press-fit of Cementless Humeral Stems in Reverse Shoulder Arthroplasty

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Abstract

Reverse shoulder arthroplasty is one of the fastest-growing orthopedic surgeries globally. There exist two options for stemmed humeral components: Cemented and cementless or press-fit designs. In cases of osteoporosis or poor metaphyseal bone stock, generally, the choice is made to opt for the former. We describe a method for metaphyseal bone grafting using the resected humeral head as an autograft to improve metaphyseal bone stock and allow for press-fit humeral component in such cases.

Keywords: Shoulder replacement, shoulder surgery, reverse shoulder replacement, bone grafting

Introduction

Reverse shoulder arthroplasty is one of the fastest-growing orthopedic surgeries globally, with expanding indications, updated implant designs, and growing surgeon skillset. As such, one of the mainstays of reverse shoulder replacement has been the choice between a cemented and an uncemented or press-fit humeral stem component on the humeral side. Conventionally, in cases of osteoporosis, lack of metaphyseal bone stock, or lack of tight fit of the humeral stem, the choice has been to cement the humeral stem to allow for better fit.

Press-fit or uncemented humeral implants use a metaphyseal proximal coating to allow for bony integration, with most implant designs featuring a distal polished component of the stem (Fig. 1). As such, the metaphyseal fit and subsequent bony integration in this region are of utmost importance to the success of the humeral component. Failure at this interface triggers humeral-sided loosening and ultimate failure of the reverse prosthesis.

To address the metaphyseal fit of these uncemented stems, we have developed a technique (known as the “grapefruit method”) for harvesting autograft from the resected humeral head and impacting into the wall of the metaphysis. This builds up the metaphyseal bone stock allowing for a better press-fit of the uncemented humeral component and should theoretically

improve bony integration at the proximal prosthesis-bone interface. Some authors [1, 2] have previously described a similar technique for stemless humeral designs but have not translated this into stemmed components. More recently, Micheloni et al. shared their early results of this technique for cementless components [3].

Surgical Technique

A standard deltopectoral approach with superficial and deep dissection is performed to reach the humerus. Once the subscapularis has been tagged, a lesser tuberosity osteotomy or a subscapularis peel-off (our preferred technique) can be done to allow for joint entry and subsequent resection of the humeral head according to pre-operative templating.

Once the humeral head has been resected, it is morcellized on the table in a “grapefruit method” leaving the cortex of the head intact and harvesting the metaphyseal bone only (Figs. 2 and 3). The metaphyseal chips are soaked in normal saline; vancomycin can be added to the normal saline solution if the surgeon is worried about table preparations of autograft.

The humerus is delivered and reamed and broached according to the system being used for implantation. Once the version-specific broaching and varus/valgus alignment of the stem has been completed and the canal cleared of debris and blood, the final humeral component is ready for implantation.

The morcellized bone graft chips are now placed at the metaphyseal region and thumb pressure is applied to push them against the metaphyseal wall. Alternatively, gentle impaction against the wall can be performed using an artery or the tip of glenoid component impactor with a flat base can also be used to

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Figure 1: An example of a typical implant design of a reverse shoulder prosthesis featuring a proximal metaphyseal coating with a distal polished component.



Figure 2: Grapefruit cut in half resembling the resected autograft humeral head.



Figure 3: Resected humeral head after being harvested for autograft chips, resembling a grapefruit.

massage the chips into the metaphyseal wall (Fig. 4). It is important not to simply place the chips at the mouth of the metaphyses but impact them; otherwise, the majority of the chips will migrate distally at the time of humeral stem impaction. The metaphyseal stem component of the prosthesis can also be loaded with chips but we have found that this association table is weak and is not similar to pre-loading the stem with cement.

Once the metaphyseal chips are seated, the humeral stem is correctly aligned for both varus/valgus and version and impacted into the canal. Post-operative radiographs show good metaphyseal coverage of the humeral component (Fig. 5).

Conclusion

To obviate the need for cementing the humeral component in cases of poor metaphyseal bone stock in press fit systems, we describe a technique (known as the “grapefruit method”) for using the humeral head as an autograft to allow for better metaphyseal seating of the humeral component and theoretically improved bony integration.



Figure 4: Artery being used to massage the bone chips against the metaphyseal wall of the humeral head cut.

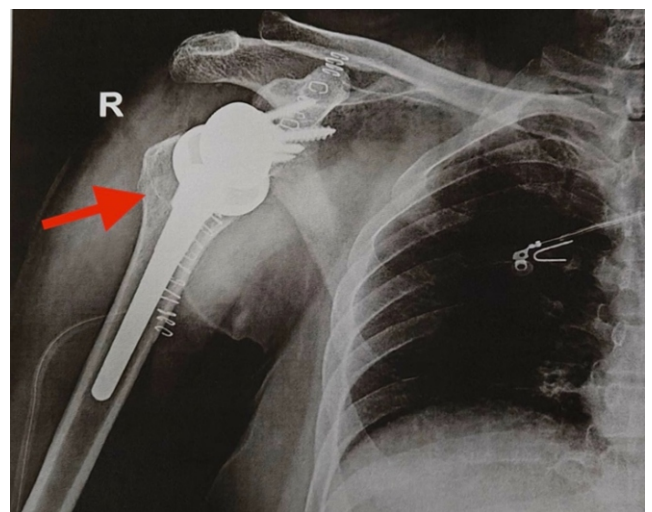


Figure 5: Post-operative radiograph showing metaphyseal bone grafting (red arrow) at the metaphyseal bone-implant interface.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL; **Source of Support:** NIL

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