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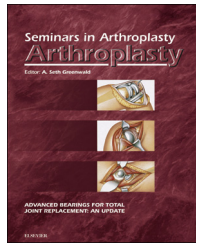

Periprosthetic fractures: Repair, revise, or treat conservatively

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ABSTRACT

Periprosthetic fractures occuring in total shoulder arthroplasty (TSA) present challenges both in decision-making as well as surgical management. These fractures more frequently involve the humerus but can also occur in the scapula. In a few cases with minimal displacement conservative care may be employed. In most, however, surgical intervention is needed. Depending on the quality of the surrounding bone, the health of the patient, the stability of the existing implant, and the integrity of the surrounding soft tissues, options for management include open reduction and internal fixation, long stem intramedullary fixation with implants, bone grafting, strut and cable fixation, or a combination of all these techniques. In some cases, complete revision arthroplasty may be indicated. An approach to surgical decision-making, operative techniques and avoidance of complications will be presented.

1. Introduction

Fractures about implants in total shoulder arthroplasty (TSA) are challenging to manage. They occur both in the humeral and scapula sides, although humeral fractures predominate. Therefore this article will focus on the humeral periprosthetic fractures, but we will consider scapular fractures in reverse total shoulder arthroplasty (RTSA).

Periprosthetic fractures tend to occur in the transitional zone between the stiff prosthesis filled bone and the native unoccupied bone. This juncture provides a very sharp transition which represents a significant stress concentrator through which fractures can propagate.

Inadequate surgical technique can increase the risk of periprosthetic fracture. We surgeons can actually make things worse if we, through our surgical technique, do not perform very careful preparation. For example, creation of a cortical defect near the tip of the stem (which may be caused by overreaming or perforation as the intramedullary bone is prepared) can weaken the cortical bone. (Fig. 1) this may also result in eccentric stem positioning resulting in the tip of the stem itself acting as a stress concentrator. (Fig. 2).

A relatively basic general classification of periprosthetic fractures has been developed at the University of Texas (Fig. 3). Type I occurs more commonly intraoperatively unless the implant is loose. Type II is the most common which starts at the tip of the stem and moves proximally. The next most common is type III which extends from the tip of the stem and propagates distally. Periprosthetic scapular fractures, type IV, are rare except in the face of high-speed or high energy injury in anatomic total shoulder arthroplasty. More commonly, however, these are seen in reverse shoulder arthroplasty as stress fractures presenting through the acromion or spine of the scapula. In RTSA over-

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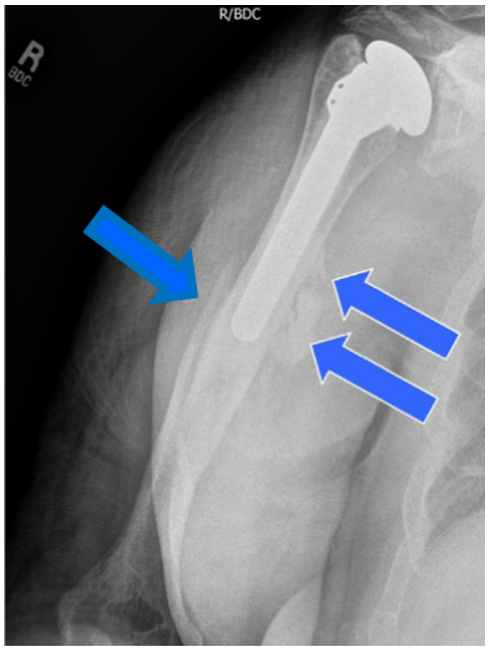

Figure 1 – A fracture can be seen near the tip of the humeral stem of an anatomic TSA (arrow) at the same level, extruded polymethylmethacrylate cement can be noted indicating a perforation of the cortex (double arrows).

tensioning the deltoid can result in an acromial stress fracture. Baseplate screws violating the coracoid can also result in fractures of the coracoid or spine of the scapula. Some of these may be tolerated and treated conservatively but when symptomatic, frequently require open reduction and internal fixation (Fig. 4).

Figure 2 – A total shoulder arthroplasty has been performed with eccentric reaming and lateral cortical thinning at the off center tip of the humeral implant within the medullary canal. This can lead to stress concentration and propagation of a fracture.

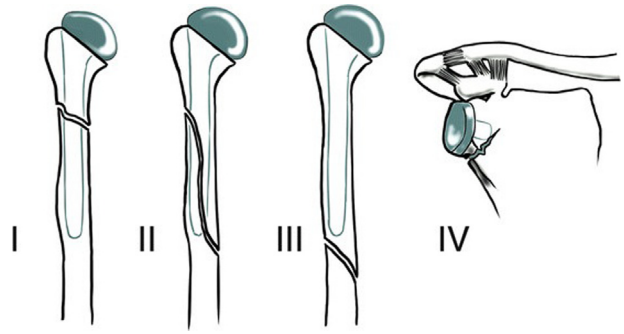

Figure 3 – University of Texas classification for periprosthetic fractures in TSA.

2. Nonoperative treatment

In the author's experience, the nonoperative treatment of periprosthetic fractures in total shoulder arthroplasty is rarely indicated. The rare indication may be a nondisplaced stress fracture between a humeral total shoulder arthroplasty stem and the tip of a total elbow prosthesis more distally. If there is no displacement and adequate bony apposition conservative care can be attempted using a fracture brace (Fig. 5). If this treatment does not yield union within 3 months open reduction and internal fixation will be required.

3. Operative treatment

In the vast majority of humeral periprosthetic fractures some form of open reduction and internal fixation is indicated. Sometimes revision with a long stem implant acting as an intramedullary rod can be effective. Typically, spanning the fracture with plate and screw fixation, sometimes with additional cortical strut and screw fixation, can be utilized effectively with or without a longer stem implant. When cortical struts are used they are chosen from fresh frozen femoral allografts and may be incorporated with screw fixation as plates or with cables, usually with additional bone graft which may be autologous cancellous bone, autologous bone marrow in combination with irradiated freeze-dried cancellous chips or with a variety of synthetic bone graft products. Frequently a combination of these techniques is effectively utilized (Fig. 6).

It is important to remember that if there is an ipsilateral elbow prosthesis and a total shoulder procedure may be indicated, the space between the stem can become a potent stress concentrator (Fig. 7). Therefore, in such cases when anticipating having to replace both joints, such as in a rheumatoid patient, one should consider utilizing a short stem or resurfacing implant at the shoulder to minimize such stress concentration (Fig. 8).

Once a fracture has occurred in the humerus, key principles include: Spanning the fracture adequately; adding cortical struts and securing them above and below the fracture as needed; utilizing additional cables for fixation where screw purchase is limited by an indwelling implant (we have found