

CORR Insights®: What Factors Are Associated with Poor Shoulder Function and Serious Complications after Internal Fixation of Three-part and Four-part Proximal Humerus Fracture-dislocations?

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Where Are We Now?

Proximal humerus fractures account for about 5% to 6% of all fractures in adults. About 70% occur in patients older than 60 years of age, most occur in women, and the frequency of this injury increases with age. In general, treatment options for these types of fractures include

nonoperative treatment, internal fixation, and replacement [8]. Most of these fractures can be treated without surgery, which is good, because the results of surgical treatment are unpredictable [2, 3, 7]. However, observational studies have shown an increased use of surgical treatment, with large variations among regions or countries [5, 6].

A study in this month's *Clinical Orthopaedics and Related Research*® [4] examined the treatment of patients with three-part and four-part fractures and found that factors associated with a poor outcome (a prespecified composite endpoint the authors defined as poor Constant scores and/or one or more serious complications or revision surgery) included being a woman, four-part fracture dislocation, absence of a metaphyseal head extension, absence of activity, back-bleeding from the humeral head, height of the head segment < 2 cm, and absence of capsular attachments to the head fragment. Interestingly, none of these parameters can be influenced by the patient or the surgeon.

Based on these results, surgical treatment of proximal humerus fractures remains far from straightforward.

Even if the surgeon can fix the fracture to the point where the postoperative radiographs look great, the outcome is unpredictable and sometimes will be disastrous. In this study [4], 8% of the patients experienced nonunion, 21% developed avascular necrosis, 15% underwent revision, 37% had to restrict or modify work or activities, and more than one in five had a poor Constant score (< 55 points). Surgeons must be aware—and make their patients aware—of what is at stake here.

Additionally, surgeons should not do this operation unless they're really sure there's a good reason to, and the other alternatives (nonsurgical management, shoulder arthroplasty, or minimally invasive procedures) are obviously inappropriate for reasons such as the amount of dislocation, open or concomitant vascular injury, loss of reduction, or persistent pain.

Where Do We Need To Go?

Which patients will benefit from operative treatment, and which will benefit from nonoperative treatment? In general, there is a tendency toward reverse arthroplasty, especially in older patients. But what about the young, athletic patient with a dislocated proximal humerus fracture? I think

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every surgeon would like to look for a joint-preserving approach in younger patients. Can we improve results using metal or cement? Should there be age-based cutoffs for different treatment options?

Several classification systems have been used to describe these fractures; the reason for the number and variety of classifications is that none really provides a complete picture of the injury or an adequate roadmap for treatment. We know from spine surgery that the fracture pattern depends on bone quality. We need a more bone quality–based classification that will help in the decision process [9].

In addition, we need to realize that shoulder function depends on not only the integrity of the rotator cuff but also its good function; the blood supply to the humeral head is critical. It will be worth exploring whether we can reduce avascular necrosis or improve the blood supply using a surgical intervention.

Finally, we need revised thresholds for measuring angulation and displacement, as well as good guidance for how to use them as factors in our clinical decision-making. Is an angulation of 45° and displacement of 1 cm (or 0.5 cm), as used historically, still adequate to guide treatment? How much displacement is likely to be tolerated, either before surgery or after repair?

How Do We Get There?

Regarding nonoperative treatment, more-standardized protocols and guidelines are needed to determine how to treat the deforming forces of the muscles around the shoulder, how to

obtain reduction (such as a Gilchrist or Dessault procedure, abduction pillow, or shoulder sling), and for how long to use an orthosis.

We must investigate minimally invasive procedures such as percutaneous fixation, K-wire fixation, or external fixation. In some cases, anatomic repositioning might be disadvantageous, but minimally invasive treatment could increase our chance to obtain or maintain the residual blood supply of fragments [1].

Still, most fractures do not have to be treated immediately. Surgeons should consider not only radiologic imaging, but also the status of the patient. The patient must be involved in the decision process and be informed about the inconsistent results associated with surgery, as observed by Gavaskar et al. [4].

Performing surgery for a displaced proximal humerus can be challenging, and preoperative planning is crucial. CT is usually performed in most trauma centers. 3D visualization can help the surgeon analyze the fracture pattern according to some of the confounding variables described in the current study [4]. Additionally, 3D printing and a dry test procedure through the fracture can help to improve our understanding of the fracture and plan for surgery.

Independent, even governmental, registry studies could be used and would help to compare and evaluate the outcomes of treating proximal humerus fractures to avoid biases triggered by surgeons, manufacturers, insurance companies, or societies. I think this step is essential to develop a more standardized way to understand and treat proximal humerus fractures.

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