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Commentary: Implant selection for proximal humerus fractures

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Proximal humerus fractures continue to be a challenging condition to treat due to the lack of an optimal treatment algorithm. Successful outcome can be accomplished with a variety of treatment modalities, however the ideal management should be based on injury pattern, patient age and health status, bone quality, and functional demand. Management algorithms are useful and have been successful in guiding decision making for the majority of patients[1,2]. However, there will always be exceptions to these algorithmic approaches, and patient-centered treatment is encouraged. As described in our article[3], there are many surgical options with a wide array of pros and cons that make it difficult to decide what option to use and one of our goals was to provide some insight for making a surgical decision.

Discussion of nonoperative treatment and its role in the treatment algorithm

One treatment modality not fully addressed in our recent review of implant choices for operative proximal humerus fractures, is nonoperative treatment[3]. The majority of geriatric low-energy osteoporotic proximal humerus fractures can be managed without surgery with success. Randomized trials including the PROFHER study[4] support this treatment choice for the majority of patients. We do feel that there is a large patient population who may benefit from nonoperative treatment, specifically for patterns such as two-part surgical neck fractures. When considering more complex fractures such as 3-part, 4-part or head split fractures, operative management is often considered a better option that leads to improved functional outcomes. Prior studies of nonoperative management show that low demand patients can achieve pain free range of motion and acceptable outcomes without surgery[5,6].

When determining operative versus nonoperative management, we did comment that one should assess a patient's physiologic age. The difficulty with discussing physiologic age is that it is hard to objectively define what qualifies as low activity and demand and what physiologic factors are most important for defining poor physiologic status. We feel that it is important to assess the patient's level of function, hand dominance, functional demand, and ability to participate in rehabilitation to help contribute to making this decision.

Caveats of operative fixation options

Once a surgical decision is made, implant selection can be difficult. Understanding the pros and cons of each procedure helps guide treatment. Our recent review article[3] provides an evidence based guide to implant selection based on patient age, bone quality, injury characteristics and functional demand.

While closed reduction and percutaneous pinning is a theoretical option for fixation, it tends to be an option we generally avoid performing. As evidenced in our recent review[3], while there is benefit of being minimally invasive, we feel that the high rate of loss of reduction provides a significant risk making it a less optimal option in many patients[7]. External fixation can be an option particularly for two and three part fractures[8] however, we do not routinely perform this fixation with the exception of complex open injuries as it can be technically demanding.

For the appropriate fracture pattern, open reduction and internal fixation can be accomplished with plates and screws or intramedullary nails. As discussed in our review, newer intramedullary nail designs avoid insertion through the tendinous portion of the rotator cuff and careful technique can avoid impingement from a prominent implant. There is considerable overlap regarding indications for plates and intramedullary nails, both implants can accomplish appropriate fixation for complex fracture patterns. Newer intramedullary nail designs allow for appropriate tuberosity fixation and fixed angle fixation options. Ultimately, surgeon experience may drive decision making between open reduction and internal fixation with plates versus intramedullary nails.

Role of augmentation

While structural augmentation could potentially play a role in the treatment of proximal humerus fractures, the absolute indications are still unclear. In general, augmentation was suggested for patients with poor bone quality and lack of medial calcar support. Saltzman[9] showed that augmentation led to decreased reoperation rates and screw cut out. Low-energy proximal humerus fractures occur as an osteoporosis related fracture, therefore they don't typically occur in healthy bone, but selecting which patients are indicated for augmentation of fixation remains difficult. We hope that future research may be able to quantify bone quality and create a more absolute indication for augmentation. Additionally, performing augmentation may make future arthroplasty more challenging. Retained intramedullary augments and the implication for their management during future arthroplasty should be a consideration prior to use.

Considering arthroplasty for fracture

Another challenge of treating proximal humerus fractures is determining which patients should undergo fixation versus arthroplasty. As referenced in our paper[3], many studies suggest patients older than 65 may benefit from arthroplasty over open reduction and internal fixation, however some studies use an age cut off of 70[11]. Again, we feel that this stresses the importance of addressing a patient's physiologic age for helping to guide treatment. There is no clear underlying pathophysiologic cause as to why 65 is the generally accepted age cutoff, and thus it may not be advised to use this as a hard cutoff.

Newer studies show arthroplasty at the time of injury (early) may lead to better patient outcomes than delayed arthroplasty[10]. As discussed in our article, prior studies did not show a difference in performing reverse total shoulder arthroplasty early versus delayed, however, as new data emerges, it may lead to a shifting paradigm in timing of arthroplasty. Unfortunately, this provides an additional challenge when addressing proximal humerus fractures as previously patients could be managed nonoperatively, then if they had residual pain or decreased function, one could then perform the delayed reverse total shoulder arthroplasty. If patients are having better outcomes with early arthroplasty, then this management scheme of attempting nonoperative treatment followed by delayed arthroplasty may not be optimal. Unfortunately, it is hard to predict what patient population will have suboptimal nonoperative outcomes and require operative treatment. We hypothesize that this is a more common problem in physiologically younger patients who had better overall preoperative functional status than recognized and subsequently did not do well with nonoperative treatment. When trying to determine whether or not to acutely perform a reverse total shoulder arthroplasty, we feel a thorough assessment of a patient's functional status, medical comorbidities, and hand dominance to help guide decision making.

Both delayed and early arthroplasty present their own technical challenges. Delayed arthroplasty can be difficult in the setting of malunion considering the altered anatomy. However, acute arthroplasty for fracture is also challenging with tuberosity reduction and healing around an arthroplasty stem. Ideally, risk factors will be elucidated that predict which patients should receive early arthroplasty versus a trial of nonoperative treatment with delayed arthroplasty as a salvage option.

Conclusion

While there remain many unanswered questions regarding the ideal treatment of proximal humerus fractures, our review offers an evidence-based guide to treatment selection. Future research will be necessary to continue the evolution of treatment for these difficult fractures.

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Conflict of Interest

Gary Updegrove: Consultant for Aevumed

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