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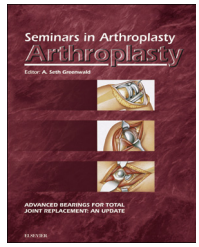

Assuring success in primary total shoulder arthroplasty: Pearls and pitfalls to make your next case a success

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ABSTRACT

Shoulder arthroplasty has grown in popularity over the past decade and orthopedic surgeons at both academic and community-based practices are performing an increasing number of these procedures in the United States. Understanding common technical challenges as well as emphasizing the importance of certain pre-operative and intra-operative measures can be proven beneficial toward ensuring a successful outcome for patients. We review several topics and share simple recommendations with regard to patient selection, positioning, infection prevention, instrumentation, and intra-operative subscapularis management.

1. Introduction

Total shoulder arthroplasty (TSA) is a well-established surgical option for many degenerative shoulder conditions. The past decade has been witness to a significant increase in primary shoulder arthroplasty numbers with an over fivefold increase in the past decade in the United States [1]. We aim to highlight a few simple strategies that may help assure success and optimize patient outcomes for primary TSA.

TSA indications have been readily documented that include primary osteoarthritis, rheumatoid arthritis, post-traumatic arthritis, osteonecrosis, instability arthritis, and rotator cuff arthropathy. Along with understanding general indications for primary TSA, it is crucial to consider patient selection and recognize different patterns of glenoid deficiency that may affect your operative plan. Once in the operating theater, properly positioning of the patient during surgery to assure appropriate exposure and arm manipulation is essential. A third point is that of infection prevention; specifically, we share our infection protocol that has decreased our infection rate and eliminated *Propionibacterium acnes* infections in our TSA population. We briefly address instrumentation choices that have improved our efficiency in the operating room while performing shoulder arthroplasty. Lastly, we touch on our preferred surgical approach and our management techniques for the subscapularis tendon.

2. Patient selection

The treatment approach for a patient with osteoarthritis is different than a patient with rheumatoid arthritis and different than that for post-traumatic arthritis that may have

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pre-existing deformity or hardware in place. Patients with osteonecrosis have dealt with chronic shoulder pain for longer periods and may not experience full pain relief post-operatively. For these patients, the goal may be to simply reduce their pain severity to a manageable level. For instability arthritis, the subscapularis may have already been violated numerous times which presents a problem when considering which subscapularis tendon approach to use. Understanding the underlying conditions that tend to lead to predictable patient deformities and appropriately altering your approach to TSA in these patient populations can lead to better outcomes.

Glenoid dysplasia is due to a developmental failure of formation of the posteroinferior growth plate of the glenoid and adjacent scapular neck [2]. This presents a special challenge for reconstruction for these patients who have had this deformity their entire life. It may be unrealistic to try to fully correct this deformity. Most of these patients have a discoid labrum similar to a discoid meniscus found in the knee and may be sufficient to significantly cover the inferior glenoid. Patients with glenoid dysplasia can successfully be treated with either a surface replacement or hemiarthroplasty in most cases. For patients with rotator cuff arthropathy but appropriate deltoid function, recommendations for a reverse TSA prosthesis are typically more appropriate than anatomic TSA.

Two-thirds of all patients undergoing TSA will have a normal wear pattern on the glenoid [3]. A high index of suspicion must be taken during pre-operative planning to identify the abnormal one-third of patients with abnormal wear patterns. In a patient with osteoarthritis, the most likely deformity will be posterior wear and increased glenoid retroversion with posterior subluxation of the humeral head [2]. This posterior wear pattern is caused by contractures of the anterior soft tissue and osteophyte formation leading to loss of external rotation. Patients with inflammatory arthritis will have medial wear or central wear, as in patients with a longstanding hemiarthroplasty with an intact rotator cuff. Cuff tear arthropathy usually wears superoposteriorly and chronic anterior instability may have significant loss of anterior glenoid bone. It is important to recognize and categorize these glenoid deficiencies; unaddressed deficiency will result in early glenoid loosening, poor clinical outcome, and subsequent need for revisions [2,4,5].

3. Patient positioning

Positioning and anesthesia considerations go hand-in-hand to ensure patient safety but also assure appropriate joint exposure and arm manipulation. We and our anesthesia physicians prefer general anesthesia combined with an interscalene block. This is important for older people who may have hypertension as it is difficult to put these patients in a 30° beach chair position and control their blood pressure with sedation and an interscalene block alone. The anesthesiologist can more easily control the patients' blood pressure when put under general anesthesia, while a scalene block makes post-operative recovery easier for pain control. To keep the surgical field clear, the endotracheal tube should be on the opposite side of the mouth to be completely out of your operative field (Fig. 1). The operating table needs to be versatile to offer good head support, chest support, and full extension of the upper extremity (Fig. 2).

4. Infection prevention

A periprosthetic infection is a challenging complication that can be costly as well as compromise outcomes. Intra-operatively acquired infections are primarily *Staphylococcus aureus* and, more recently, *P. acnes* [6]. *S. aureus* is a gram-positive coccal bacterium commonly found on the skin and in the respiratory tract that is often pathogenic causing skin and deep surgical site infections. *P. acnes* is an opportunistic gram-positive rod bacterium that lives in the healthy pores, sebaceous glands, and follicles in the skin. Pilosebaceous glands protect these organisms from common antibiotics and antimicrobials [7]. In addition, it seems that *P. acnes* is found in higher concentration around the shoulder. In a study done by Phadnis et al. [7], it was found that 14% of their patients still cultured positive for *P. acnes*, even after surgical preparation with 70% alcohol chlorhexadine. In addition, there was a higher incidence of *P. acnes* in the skin and dermis of patients over 50 years old, especially in those undergoing revision shoulder surgeries.

In our previous study looking at infection in shoulder arthroplasty, 814 primary arthroplasties were performed between 2004 and 2012, including 350 primary TSAs and 464 primary Reverse TSAs (RTSA); the infection rate was 2% [8]. We found no statistically significant difference in infection rate between reverse versus anatomic total shoulder arthroplasty. However, if patients had a previous shoulder surgery, such as rotator cuff repair, labral repair, or general arthroscopy the risk of infection doubled in an anatomic total shoulder and was four times higher in a reverse total shoulder. The infections were mostly due to staphylococcus; five out of the last seven infections were due to *P. acnes*.

Figure 1 – Our preferred head position is a supported upright position with endotracheal tube taped to the non-operative side of the mouth to clear the operative field.