Shoulder Replacement Surgery

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What are the indications for shoulder replacement surgery?

The most common indication for shoulder replacement remains primary glenohumeral osteoarthritis. Other indications include complex proximal humeral fractures, rheumatoid arthritis and other inflammatory arthropathies, humeral head osteonecrosis, instability arthropathy, posttraumatic arthritis, chronic fixed glenohumeral dislocation, rotator cuff tear arthropathy, postinfectious arthropathy, glenohumeral chondrolysis, glenohumeral arthritis associated with neurologic pathology such as Parkinson’s disease, glenohumeral arthritis associated with prior radiation therapy, glenohumeral arthritis associated with skeletal dysplasia, certain shoulder girdle tumors, certain proximal humeral malunions, certain proximal humeral nonunions, massive irreparable rotator cuff tears with chronic pseudoparalysis without glenohumeral arthritis, and failure of a previous shoulder arthroplasty.

What types of surgical options are available, and who are the best candidates for each type?

Shoulder replacement surgery can be subdivided into unconstrained or anatomical arthroplasty and semiconstrained or reverse arthroplasty. In general, the status of the rotator cuff determines which type is best suited for a particular patient. A patient with a competent or minimally compromised rotator cuff is best treated with an anatomical shoulder arthroplasty, whereas a patient with a massive irreparable rotator cuff tear and an unbalanced shoulder is best treated with a reverse shoulder arthroplasty.

Within the realm of anatomic shoulder arthroplasty are hemiarthroplasty, in which the glenoid is not addressed, and total shoulder arthroplasty, which involves resurfacing of the glenoid, typically with a polyethylene component. For most diagnoses with a competent rotator cuff, a total shoulder arthroplasty provides results superior to those of hemiarthroplasty. In select cases, such as early-stage osteonecrosis and proximal humeral fracture, a hemiarthroplasty provides results equivalent to those of total shoulder arthroplasty.

Traditionally, anatomic humeral arthroplasty involved implantation of a stemmed component extending into the humeral diaphysis. More recently, humeral resurfacing implants, short-stem implants, and stemless implants have been introduced, with the potential advantage of bone preservation; however, no scientifically validated data declaring superiority of these implants over more conventional designs are currently available. On the glenoid side, a host of prosthetic design options exist, including pegged and keeled polyethylene implants that are fixed using polymethylmethacrylate cement. Although long-term data are lacking, short- to midterm data suggest that pegged implants may fare better than keeled implants.

Another option that has been used for the glenoid in young patients is resurfacing using a biological soft tissue, such as fascia lata, but results with these techniques have been mixed.

In patients with massive deficiency of the rotator cuff combined with various types of glenohumeral arthritis, reverse shoulder arthroplasty has become the surgical option of choice. In select patients with severe malunion of the proximal humerus, reverse shoulder arthroplasty may be indicated even with an intact rotator cuff. Certain cases of osteoarthritis with static posterior subluxation of the humeral head and severe posterior glenoid bone loss are often best treated with reverse shoulder arthroplasty and concomitant glenoid reconstruction using a bone graft, even in patients with a competent rotator cuff. In general, reverse shoulder arthroplasty is reserved for elderly patients. However, as experience with the reverse prosthesis has increased, certain younger patients may be considered candidates for reverse shoulder arthroplasty when no other reasonable alternative treatment exists.

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In patients undergoing shoulder arthroplasty for severely comminuted proximal humeral fractures, many fracture-specific prostheses have been developed that have features such as a lower profile shape that allow for healing of the tuberosities. These fracture prostheses have included both unconstrained and reverse designs.

**How do you determine which surgical option to use?**

The primary consideration in deciding between conventional shoulder arthroplasty and reverse shoulder arthroplasty is the status of the rotator cuff. To clarify, patients with 2 or more massive, irreparable tendon rotator cuff tears with an unbalanced shoulder are considered to have severe rotator cuff deficiency that could benefit from reverse shoulder arthroplasty. Patients with primary osteoarthritis and a concomitant isolated supraspinatus tear are best treated with conventional shoulder arthroplasty. For fracture cases in general, an unconstrained fracture stem is used in younger patients and a reverse design is used in elderly patients who have significant osteopenia that could prevent tuberosity healing.

**What role does imaging play in shoulder replacement surgery?**

I obtain good-quality radiographs in all patients preoperatively, including a glenohumeral anterior posterior view, a scapula outlet view, and an axillary lateral view. In addition, I obtain preoperative secondary imaging studies in all patients to evaluate the integrity of the rotator cuff and the osseous morphology of the glenoid. My preferred secondary imaging modality for chronic indications is computed tomographicarthrography because of its superior bony detail. If a patient has already had magnetic resonance imaging of sufficient quality to allow evaluation of the rotator cuff and the glenoid, I will accept that in lieu of a computed tomographic arthrogram. For fracture cases, I obtain computed tomography to better define fracture fragments preoperatively.

**What complications do physicians need to be aware of?**

Intraoperative complications include humeral injury such as diaphyseal and tuberosity fractures, glenoid fracture during reaming, rotator cuff injury, and neurovascular complications. Fortunately, most of these complications are uncommon and are usually avoidable through use of proper surgical technique. Postoperative complications include infection, aseptic prosthetic failure, prosthetic instability, secondary rotator cuff failure, including failure of the subscapularis repair, and postoperative stiffness. An additional complication unique to shoulder arthroplasty performed for acute fracture is tuberosity nonunion or malunion. Another complication that can occur following reverse shoulder arthroplasty is occurrence of an acromial stress fracture.

**Is there a high occurrence of revision surgery after shoulder replacement surgery?**

Fortunately, revision shoulder arthroplasty is fairly uncommon. Most mid- to long-term series report revision rates of well less than 20% for conventional shoulder arthroplasty. Mid- to long-term revision rates for reverse shoulder arthroplasty appear to be even lower.

**What is the rehabilitation protocol after shoulder replacement surgery?**

Initiation of rehabilitation following shoulder arthroplasty in my practice varies by patient factors and the type of arthroplasty performed. For conventional shoulder arthroplasty for chronic conditions, aquatic therapy emphasizing active mobility is started 1 week postoperatively. External rotation beyond neutral is prohibited until 4 weeks postoperatively in most cases. In patients with inflammatory arthropathy and in patients with prior surgery to the subscapularis, external rotation beyond neutral is prohibited until 6 weeks postoperatively. For cases of reverse shoulder arthroplasty and arthroplasty for fracture, formal rehabilitation is delayed until 3 to 4 weeks postoperatively.

**What progress has been made in shoulder replacement surgery?**

A major area of progress has been prosthetic design, with the introduction of adaptable shoulder arthroplasty in the 1990s. These so-called anatomic humeral implants allow for replication of the patient’s normal anatomy by permitting adjustment of humeral head size, humeral head offset, and humeral neck inclination. In addition, the reintroduction of the reverse shoulder prosthesis around the same time has permitted treatment of severe shoulder problems that previously had no good solution.

**What does the future hold for shoulder replacement surgery?**

I believe advances will continue to be made on the humeral side, but I expect more significant innovations to be made on the glenoid side. Recently, the importance of glenoid subchondral bone preservation in prevention of glenoid failure has been recognized. I expect the next generation of glenoid components to be bone preserving, thereby increasing shoulder arthroplasty survivability.

I also look for advances to be made in materials research in shoulder arthroplasty. Recent interest has focused on pyrolytic carbon as a bearing surface for humeral replacement because it seems to articulate favorably with native glenoid tissue. A great deal of work needs to be done in this area.

**References**
