MINI-SYMPOSIUM: SHOULDER RECONSTRUCTION

(i) Shoulder arthroplasty for osteoarthritis and rheumatoid arthritis

Joaquin Sanchez-Sotelo

Department of Orthopedic Surgery, Mayo Clinic Rochester, 200 First Street SW, Rochester MN 55905, USA

KEYWORDS
Shoulder; Arthroplasty; Osteoarthritis; Rheumatoid arthritis

Summary
Replacement arthroplasty represents the treatment of choice for most patients with end-stage glenohumeral osteoarthritis or rheumatoid arthritis. Multiple studies have documented reliable improvements in pain, range of motion, function and quality of life after this procedure. Total shoulder arthroplasty seems to be associated with more reliable pain relief and improvements in elevation when compared to hemiarthroplasty. The main surgical principles of shoulder arthroplasty apply equally to patients with osteoarthritis and rheumatoid arthritis; however, the different underlying pathology associated with these two conditions needs to be understood in order to modify the surgical technique accordingly. Most patients with osteoarthritis have an intact rotator cuff and enough glenoid bone stock to allow implantation of a glenoid component. Asymmetric posterior glenoid erosion often needs to be corrected and capsular releases are needed to restore elevation and external rotation. In rheumatoid arthritis, implantation of a glenoid component may not be possible in the presence of severe glenoid bone loss or a massive irreparable cuff tear; in addition, rheumatoid involvement of other joints needs to be taken into consideration. Infection, instability, periprosthetic fractures, and glenoid loosening or erosion are the main failure mechanisms of shoulder arthroplasty. Careful surgical technique and a well-executed physical therapy program translate into successful outcomes in most patients with osteoarthritis and rheumatoid arthritis.

© 2007 Elsevier Ltd. All rights reserved.

Introduction
Replacement arthroplasty of the glenohumeral joint is indicated most commonly in patients with end-stage osteoarthritis and rheumatoid arthritis of the shoulder.1,2 The general principles of shoulder arthroplasty apply to both osteoarthritis (OA) and rheumatoid arthritis (RA), but there are some fundamental differences in the underlying pathology of these conditions with clinically relevant implications for both the surgical technique and the anticipated outcomes of the procedure.

Pathology of shoulder osteoarthritis and rheumatoid arthritis
Osteoarthritis and rheumatoid arthritis are two of the most common conditions affecting the glenohumeral joint.
Both are characterized by various degrees of articular cartilage loss, but they behave differently in terms of the patterns of bone loss and the involvement of the rotator cuff tendons and other soft-tissues (Table 1).

**Osteoarthritis**

Primary osteoarthritis is characterized by cartilage loss, which usually affects both the humeral head and the glenoid. Prominent osteophytes are commonly present at the humeral head–neck junction and at the glenoid rim. The joint remains well centered in some patients, but many shoulders develop posterior subluxation, which is associated with posterior glenoid erosion and posterior capsular elongation (Fig. 1). These abnormalities need to be taken into consideration at the time of arthroplasty to correct abnormal glenoid version and posterior subluxation. The inferior capsule is contracted, especially in patients with loss of passive elevation; release of the inferior capsule is needed to restore elevation reliably. The rotator cuff tendons are usually intact; associated rotator cuff tendon tears, when present, tend to be small or medium in size and should be repaired at the time of arthroplasty. Radiographic findings of acromioclavicular joint osteoarthritis are very common; however, this joint needs to be addressed surgically at the time of arthroplasty only when found to be symptomatic in the preoperative evaluation.

**Rheumatoid arthritis**

Cartilage degradation is usually present both at the humeral head and glenoid. Many patients with rheumatoid disease present with decreased bone mineral density, which increases the risk of intraoperative fractures and may compromise component fixation, especially when cement is not used. Bone loss tends to be central (Fig. 2); superior bone loss is seen

---

**Table 1** Surgical pathology of osteoarthritis and rheumatoid arthritis.

<table>
<thead>
<tr>
<th></th>
<th>Primary osteoarthritis</th>
<th>Rheumatoid arthritis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cartilage loss</td>
<td>• Humeral head</td>
<td>• Humeral head</td>
</tr>
<tr>
<td></td>
<td>• Glenoid (posterior)</td>
<td>• Glenoid (central)</td>
</tr>
<tr>
<td>Glenoid bone loss</td>
<td>• Posterior</td>
<td>• Central</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Superior (cuff pathology)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Associated osteopenia (glenoid, humerus)</td>
</tr>
<tr>
<td>Capsule</td>
<td>• Anterior shortening</td>
<td>• Attenuated</td>
</tr>
<tr>
<td></td>
<td>• Posterior lengthening</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Inferior shortening</td>
<td></td>
</tr>
<tr>
<td>Rotator cuff</td>
<td>• Usually intact</td>
<td>• Attenuated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Torn in some</td>
</tr>
<tr>
<td>Other</td>
<td>• AC joint may be</td>
<td>• Other joints may be involved (AC,</td>
</tr>
<tr>
<td></td>
<td>affected</td>
<td>sternoclavicular, cervical spine, elbow,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wrist, hand)</td>
</tr>
</tbody>
</table>

---

Figure 1  Anteroposterior (A) and axillary (B) radiographs of a shoulder with primary osteoarthritis. Note the decreased joint line space, the prominent osteophytes at the humeral head–neck junction, and the posterior subluxation and posterior glenoid erosion.
mostly in patients with associated rotator cuff tears. When central or superior bone loss is severe, secure implantation of a glenoid component may not be possible. The joint capsule is often attenuated; extensive releases are less commonly needed. In addition to rheumatoid synovitis and arthritis, some patients with rheumatoid arthritis may present with superimposed steroid-induced osteonecrosis or deep infection.

A substantial number of rheumatoid patients have associated rotator cuff tears; in some, the size of the tendon tear precludes surgical repair, which affects surgical decision-making in terms of implantation of a glenoid component or consideration of a reverse prosthesis. Rheumatoid arthritis may affect other joints in the shoulder region (acromioclavicular, sternoclavicular), may be associated with scapulothoracic fibrosis, and oftentimes will affect the cervical spine, elbow, wrist and hand (Table 2).

**Preoperative evaluation**

The evaluation of patients with osteoarthritis or rheumatoid arthritis being considered for shoulder arthroplasty should start with a clear assessment of the pain severity and functional limitations experienced. Most patients complain of moderate to severe pain, both during the day and at night, aggravated by the use of the shoulder, and associated with various degrees of decreased motion.

**Physical examination**

Examination of the shoulder usually reveals pain with glenohumeral range of motion, which is associated with crepitus in many patients with osteoarthritis. It is important to document passive and active range of motion. Limitation of passive external rotation is more typical of osteoarthritis, and may require elongation of the anterior capsule and subscapularis at the time of the arthroplasty. A large difference between active and passive motion is more common in rheumatoid arthritis, and usually indicates associated rotator cuff dysfunction. Strength in abduction, external rotation and internal rotation should also be tested; strength is usually normal in osteoarthritis, but may be decreased in patients with rheumatoid arthritis, again indicating associated rotator cuff dysfunction.

The physical examination of patients with rheumatoid arthritis should be completed by evaluation of the cervical spine, acromioclavicular and sternoclavicular joints, elbow, wrist and hand. Some patients may benefit from elbow, wrist or hand surgery before or after shoulder arthroplasty, depending on the degree of pain and limitations imposed by these other joints. In general, the most affected joint should be addressed first, and it is important to formulate a comprehensive surgical plan for the whole upper extremity. A limited number of patients with osteoarthritis will also have pain secondary to acromioclavicular joint osteoarthritis; failure to recognize and address these symptoms at the time of shoulder arthroplasty may result in incomplete pain relief and satisfaction.
Imaging studies

Radiographs
The radiographic features of osteoarthritis and rheumatoid arthritis of the shoulder are quite typical (Figs. 1 and 2) and help establish the diagnosis and plan the surgical procedure. Our usual radiographic projections include two anteroposterior radiographs in the plane of the scapula in internal and external rotation of the shoulder and one true axillary radiograph. If the joint line space is well preserved in all three views in a patient with rheumatoid arthritis, the patient should be evaluated for symptomatic synovitis, infection or rotator cuff disease. The axillary view is very helpful to identify posterior subluxation and posterior glenoid erosion in patients with osteoarthritis. Attention should be paid to the remaining glenoid bone stock. Secure implantation of a glenoid component may not be possible when glenoid bone loss results in medialization of the glenoid face to the base of the coracoid or severe asymmetric glenoid bone loss superiorly or posteriorly. The acromioclavicular and sternoclavicular joints should be evaluated for degenerative changes, especially in patients with rheumatoid arthritis. Radiographs of the cervical spine should also be obtained in rheumatoid patients to identify atlantoaxial instability in preparation for anesthesia.

Computed tomography
Computed tomography is obtained by many surgeons routinely in every patient scheduled to undergo shoulder arthroplasty. This is due in part to difficulties obtaining a satisfactory axillary radiograph in some institutions. Computed tomography allows accurate estimation of glenoid version and the amount of bone stock remaining for glenoid component implantation (Fig. 3). In addition, it helps understand the location and size of glenoid osteophytes, which when unrecognized may mislead the surgeon at the time of preparation of the glenoid. Associated atrophy and fatty infiltration of the rotator cuff muscles may also be evaluated.

Magnetic resonance imaging
This imaging technique plays a minor role in the evaluation of patients with osteoarthritis but can be very helpful in patients with rheumatoid arthritis. It is indicated mainly when associated rotator cuff tears are suspected as well as in patients with minor radiographic changes and other possible explanations for their pain, such as synovitis, infection, rotator cuff disease or steroid-induced avascular necrosis.

Surgical technique
Total shoulder arthroplasty is the most reliable surgical procedure for patients with end-stage osteoarthritis or rheumatoid arthritis of the shoulder. Hemiarthroplasty has been shown to provide incomplete pain relief in some patients and is associated with lesser improvements in motion. However, severe glenoid bone loss may preclude the secure implantation of a glenoid component, and in those cases shoulder hemiarthroplasty is the only viable option. In patients with rheumatoid disease and a large irreparable rotator cuff tear, the risks and benefits of shoulder hemiarthroplasty and a reverse total shoulder arthroplasty should be discussed with the patient. Shoulder hemiarthroplasty in this patient population will not reliably restore motion and may be associated with persistent pain, but has a very low rate of mechanical failure. Reverse total shoulder arthroplasty is likely to result in better pain relief and active motion, but the mid- and long-term survival of this design is a concern in rheumatoid patients with bone loss and osteopenia. Tables 3 and 4 summarize some specific technical considerations to take into account for shoulder arthroplasty in osteoarthritis and rheumatoid arthritis.
Table 3 Shoulder arthroplasty in osteoarthritis: technical considerations.

- Careful assessment of passive external rotation (ER) under anesthesia
  - In passive ER < 30° consider subscapularis release off bone for elongation
- Extensive inferior capsular release required in most patients
  - ↑↑ active elevation
  - Improves exposure
- Careful assessment of posterior glenoid erosion/abnormal glenoid version
  - Asymmetric glenoid reaming for defects < 1 cm
  - Larger defects
    - a. Hemiarthroplasty
    - b. Bone grafting
    - c. Custom-made components
- Stable cementless fixation of the humeral stem is possible in most cases
- Correct soft-tissue imbalances
  - Internal rotation contracture
  - Posterior subluxation
- The acromioclavicular joint rarely needs to be addressed

Table 4 Shoulder arthroplasty in rheumatoid arthritis: technical considerations.

- Early rather than late surgery may improve outcome
- High risk intraoperative fractures
  - Consider anteromedial approach
- High incidence of rotator cuff attenuation and tears
  - Preserve coracocromial arch
  - Repair associated rotator cuff tears if possible
- Glenoid bone loss
  - Preoperative CT scan
  - Intraoperative assessment
  - Better outcome when glenoid component implanted
  - Consider hemiarthroplasty if
    - a. Insufficient glenoid bone stock
    - b. Irreparable cuff tear
- Humeral stem
  - Selective uncemented fixation
  - Beware of current or future elbow replacement
    - a. Cement restrictor
    - b. Shorter stems
    - c. Consider resurfacing (bone stock permitting)
- Humeral head size based more on soft-tissue tension than humerus size
- Address associated acromioclavicular/sternoclavicular pathology
- Postoperative rehabilitation
  - Standard vs limited-goals program
  - Scapulothoracic fibrosis may limit range of motion

Surgical approach

The long deltopectoral approach is the standard surgical exposure for shoulder arthroplasty in osteoarthritis and rheumatoid arthritis. Although this exposure is well described in the orthopedic literature and well known to most orthopedic surgeons, a few technical pearls may help in the performance of shoulder arthroplasty. At our institution, we tend to place the skin incision lateral to the anatomic location of the deltopectoral interval. This requires elevation of a larger medial and superior skin flap to reach the deltopectoral interval, but centers the surgical field in the more difficult part of the procedure, the glenoid preparation and implantation. It is important to develop the whole length of the deltopectoral interval, from the clavicle to the humeral shaft. Preservation of the cephalic vein seems to be associated with decreased postoperative hand swelling; the vein is displaced medially with the pectoralis, which requires coagulation of its multiple deltoid branches. Release of the adhesions between the rotator cuff group and the deltoid and conjoined tendon helps increase exposure and motion. The joint is accessed by incision of the subscapularis tendon and capsule in a single layer and minimal extension of the arthroscopy along the inferior aspect of the rotator cuff interval. In patients with passive external rotation inferior to 30° (typical of osteoarthritis), the incision is performed at the lesser tuberosity to allow a more medial reattachment at the end of the procedure in order to achieve greater postoperative external rotation.

Most of the times the incision is performed about 1 cm medial to the lesser tuberosity, as tendon to tendon repair seems to be more secure in the shoulder.

The so-called anteromedial approach may be useful in some circumstances. It involves extending the deltopectoral approach by detaching the deltoid off the clavicle, acromion and spine of the scapula. This approach is well tolerated as long as a meticulous transosseous reattachment is performed. It is mainly indicated in rheumatoid patients with severe osteopenia and stiffness in order to prevent intraoperative fractures. It may also be helpful in patients with osteoarthritis and severe posterior glenoid bone loss requiring structural bone grafting.

Glenoid preparation and implantation

Adequate glenoid exposure is critical for proper glenoid preparation and implantation (Fig. 4A). Glenoid exposure is improved full development of the deltopectoral interval, selective release of the pectoralis tendon, inferior capsular release, complete removal of humeral osteophytes after resection of the humeral head, use of adequate glenoid retractor, and complete excision of the labrum.
Loss of glenoid bone stock should be recognized on preoperative radiographs and computed tomography and confirmed intraoperatively (Fig. 3). When central glenoid bone loss may compromise secure glenoid implantation, a pilot hole may be drilled at the center of the glenoid to determine how much bone remains to provide fixation. A minimum of 2–3 cm is required for safe implantation of a glenoid component. Posterior glenoid defects typical of osteoarthritis may be corrected by asymmetric glenoid reaming, structural bone grafting or custom-made components (Fig. 4B). Asymmetric glenoid reaming may be used for defects up to 1 cm in depth. When a glenoid component cannot be implanted, consideration should be given to reaming the glenoid to improve its congruency with the humeral head and bone grafting of large defects to improve bone stock should further reconstruction be needed in the future.

Currently, most glenoid components in anatomic total shoulder arthroplasty are all-polyethylene cemented components. The quality of cement fixation seems to be associated with radiolucent lines and loosening. Better cement fixation is obtained with careful bone preparation, a dry surgical field with minimal blood at the bone–cement and cement–implant interface, pulsatile lavage, and pressurization of the cement (Fig. 5). The rate of early radiolucent lines seems to be less with pegged as compared to keeled components. Radiolucent lines are also less prevalent when there is a slight mismatch between the radius of curvature of the glenoid and the humeral head.5

Reverse arthroplasty is very controversial in rheumatoid shoulders with irreparable cuff tears.3 Reverse glenoid components are cementless and fixed with screws. Ideally, these components should be implanted with their inferior edge flush with the inferior aspect of the glenoid to decrease the risk of glenoid notching. There are substantial

Figure 4  (A) Adequate exposure is paramount for adequate glenoid preparation and implantation. (B) Structural bone grafting may be required in patients with osteoarthritis and severe posterior bone loss.

Figure 5  Anteroposterior radiograph of a modern shoulder arthroplasty design using a cementless humeral stem, anatomic humeral head and cemented pegged all-polyethylene glenoid component. Note the appropriate positioning of the humeral head relative to the tuberosity and the absence of postoperative glenoid radiolucent lines.

Figure 6  The humeral head should be implanted approximately 1 cm above the highest point of the greater tuberosity.
Humerus metaphysis at the time of component implantation should be given to antibiotic-impregnated polymethylmethacrylate, especially in patients with rheumatoid arthritis. Both components are fixed with cement. In about 30% of cases, cement is used whenever primary implant stability cannot be achieved with a cementless stem, which is more commonly the case in patients with rheumatoid arthritis. Impaction of bone from the resected humeral head into the humeral metaphysis at the time of component implantation increases the number of components which can be securely fixed without cement. When cement is used, consideration should be given to antibiotic-impregnated polymethylmethacrylate, especially in patients with rheumatoid arthritis (Fig. 7). Most reverse humeral components are fixed with bone cement. In patients with rheumatoid arthritis, attention should be paid to the length of the humeral stem. Patients may have or need an elbow arthroplasty and the humeral stem needs to leave room in the canal for the stem of the elbow arthroplasty component. Use of a resurfacing humeral component is quite popular in some countries. The benefits of a resurfacing humeral component include preservation of bone stock and ease of implantation in patients with humeral deformity, elbow stems or previous hardware. Their disadvantages include a more difficult glenoid exposure, limited ability to modify offset and soft-tissue tension by use of modular humeral heads, and potential failure of fixation in patients with compromised proximal humerus bone stock. We have limited experience with the use of resurfacing components, but good results have been published by some authors.\(^8,9\)

**Soft tissue balance**

The soft tissues around the shoulder should be tensioned to achieve joint stability and restore as much motion as possible. Soft tissue tensioning is affected by component positioning, humeral head size, and selective shortening or lengthening of the capsule and rotator cuff. Ideally, the prosthetic humeral head should translate in all directions to the rim of the glenoid component and spontaneously return to a centered position, and the reconstruction should allow passive elevation to approximately 160\(^\circ\) and passive internal and external rotation to approximately 85\(^\circ\) without dislocation. Excessive joint stuffing results in decreased range of motion and may place excessive tension on the subscapularis and interval repair; failure of this repair may result in anterior instability, decreased active range of motion, weakness and pain, and the results of a later repair or reconstruction are somewhat unpredictable.\(^10\) For these reasons, the subscapularis repair cannot be overemphasized.

**Primary osteoarthritis**

In primary osteoarthritis, the two most common patterns of joint imbalance are internal rotation contracture and posterior shoulder subluxation. As mentioned above, lengthening of the anterior soft tissue structures should be planned when passive external rotation under anesthesia is less than 30\(^\circ\). Although z-plasty of the subscapularis and capsule has been reported as a method for anterior elongation, it compromises the thickness of the anterior structures. We prefer to detach the subscapularis and capsule off the lesser tuberosity and repair them in a more medial position into the humeral neck. In addition, the anterior capsule may be divided at its junction with the anterior labrum to mobilize the capsule and subscapularis; in cases of severe capsular shortening and thickening, a subtotal anterior capsulectomy may be performed.

Figure 7 Anteroposterior radiograph after total shoulder arthroplasty in a patient with rheumatoid arthritis. Both components are fixed with cement.
given to plication of the posterior capsule and rotator cuff to decrease the volume of the posterior joint space. Three to six nonabsorbable sutures may be placed into the posterior capsule and the posterior cuff in a horizontal mattress fashion before implantation of the humeral component. Sutures are then tied after all of them have been placed.

**Rheumatoid arthritis**

In rheumatoid arthritis, the two most common patterns of joint imbalance are multidirectional joint laxity and anterosuperior instability in patients with an associated massive irreparable cuff tear. Capsule and tendon attenuation with rheumatoid disease usually results in elongated soft-tissue structures. Use of a humeral head size relatively larger than anticipated for the patient size usually helps correct this problem; some systems provide heads with increased thickness for the same diameter, which may be especially useful in these circumstances. In the second category of patients with a massive irreparable cuff tear, if anterosuperior instability is noted at the time of hemiarthroplasty, consideration may be given to conversion to a reverse prosthesis, although reverse arthroplasty is controversial in rheumatoid arthritis as mentioned above.

**Physical therapy**

An adequate physiotherapy program is a key element for a successful outcome after shoulder arthroplasty. The goals of the physical therapy program are to restore motion, protect any soft-tissue repairs, improve the overall strength of the different shoulder muscle groups, and maintain stability. Physiotherapy in our unit is advanced according to the following protocol:

- For the first 6 weeks, the shoulder is placed in a shoulder immobilizer and patients perform passive range of motion exercises three to four times a day. The limits for elevation and external rotation are based on intraoperative assessment of stability and the soft tissues.
- The shoulder immobilizer is removed at 6 weeks and patients are advanced to active-assisted range of motion exercises with no limits unless the physical examination at the time recommends differently.
- Isometric strengthening exercises are added at 10 weeks.
- Active-resisted strengthening exercises with elastic rubber bands are added at 12 weeks.

Physiotherapy is continued for 4–6 months, and many patients continue to improve their motion and strength up to 1 or 2 years after surgery. A home-based program similar to the one described above has been shown to maintain the range of motion achieved at the time of shoulder arthroplasty. In rheumatoid patients with a deficient rotator cuff and compromised soft tissues at risk for instability after shoulder hemiarthroplasty, the so-called limited-goals rehabilitation may be used. This program sacrifices mobility in the interest of stability. Motion is limited to no more than 90° or 100° for elevation and no more than 20° of external rotation for the first 3 postoperative months.

Currently, the author uses a more aggressive rehabilitation protocol after reverse prostheses unless the fixation of the glenoid component is suboptimal. Patients are usually immobilized for 2 or 3 weeks, and then start a program of active-assisted range of motion exercises. Strengthening exercises for the deltoid are started 6 weeks postoperatively and continued for 3–6 months.

**Outcome**

Many studies have documented a high rate of satisfactory outcomes after shoulder arthroplasty for osteoarthritis than rheumatoid arthritis. Pain improves in most patients. Motion and function are usually improved as well. Total shoulder arthroplasty seems to be associated with a better outcome than hemiarthroplasty in both primary osteoarthritis and rheumatoid arthritis.11,12,13

**Primary osteoarthritis**

Shoulder arthroplasty is associated with improved pain, motion, strength, function and patient-perceived outcome in patients with primary osteoarthritis. Several investigators have reported good results using hemiarthroplasty in patients with osteoarthritis. Wirth et al.14 and Lynch et al.15 reported significant improvements in pain and function in 50 and 35 shoulder hemiarthroplasties, respectively, followed a minimum of 2 years. However, a recent meta-analysis of four prospective randomized studies consistently demonstrated significantly better results in terms of pain, active elevation and motion when total shoulder arthroplasty is compared to hemiarthroplasty in patients with osteoarthritis.16 In our experience, most patients who receive a total shoulder arthroplasty for primary osteoarthritis experience complete pain relief and achieve more than 130° of active elevation and more than 60° of active external rotation, although final motion largely depends on preoperative motion.16 Data from our institution has also shown better long-term survivorship with total shoulder arthroplasty as compared to hemiarthroplasty in patients younger than 50 years.17

**Rheumatoid arthritis**

Shoulder arthroplasty is associated with pain relief in most rheumatoid patients; functional improvements have not been consistently reported in the literature. When a glenoid component can be safely implanted, total shoulder arthroplasty is associated with a better outcome than humeral head replacement. Likewise, when an associated cuff tear is found, concomitant cuff repair significantly improves postoperative clinical shoulder scores compared with patients in whom tears are not repaired.

The results of a multicenter prospective study were recently published.2 Thirty-six hemiarthroplasties and 25 total shoulder arthroplasties were followed for a mean on 3 years. The underlying diagnosis was rheumatoid arthritis in 53 shoulders and other inflammatory conditions in the remaining shoulders. Shoulder arthroplasty was associated with a significant improvement in pain and quality of life. Motion was also improved, to a mean of 90° with
Complications and failures

The main complications of shoulder arthroplasty include infection, instability and periprosthetic fractures. Infection after shoulder arthroplasty is difficult to diagnose preoperatively; many patients with deep infection have normal radiographs and laboratory parameters. Cultures from joint aspirates should be observed for a minimum of 7–10 days to allow identification of Propionibacterium acnes, a slow-growing microorganism commonly responsible for shoulder infections. Two-stage reimplantation is associated with a low rate of reinfection but is technically challenging and not always associated with a good clinical outcome.

Dislocation or subluxation is another relatively common complication of shoulder arthroplasty. Instability is usually related to inadequate soft-tissue balance and/or component malpositioning. Anterior instability is almost invariably associated with disruption of the subscapularis tendon repair. Posterior instability usually reflects excessive redundancy of the posterior soft-tissues and/or excessive combined glenohumeral retroversion. The outcome of revision surgery for instability after shoulder arthroplasty is very unpredictable. Subscapularis failure is best treated when identified early and addressed with prompt surgical repair. In the presence of an irreparable cuff tear or marked posterior soft-tissue redundancy, consideration should be given to revision to a reverse prosthesis.

Periprosthetic fractures may occur intraoperatively or postoperatively. Intraoperative fractures are more common in rheumatoid patients secondary to osteopenia, but may also occur in osteoarthritis with some long press-fit stems. When recognized intraoperatively, every effort should be made to achieve stable fixation of the fracture so that the physical therapy program does not need to be altered. As in other locations, the treatment of postoperative fractures is selected based on the location of the fracture and the fixation of the humeral components. Fractures distal to a well-fixed humeral stem may be treated nonoperatively; however, many displaced fractures require internal fixation if the humeral component is well-fixed or revision of loose humeral components with or without associated internal fixation.

Aseptic failure of the humeral component is rare and seldom symptomatic. On the contrary, several studies have documented various rates of radiographic radiolucent lines at the glenoid component interface. Some will progress to symptomatic aseptic loosening, which is the main mode of long-term failure in total shoulder arthroplasty. Interestingly, revision for painful glenoid erosion after hemiarthroplasty seems to be more prevalent than revision for glenoid loosening after total shoulder arthroplasty. The long-term outcomes of reverse shoulder arthroplasty in rheumatoid arthritis are largely unknown; mechanical failure of the glenoid component is expected to be the main failure mode of reverse shoulder arthroplasty.

References