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Mini Review

Reverse shoulder arthroplasty in the young patient: A narrative review

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Statistics

Figures	00
Tables	00
References	07

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Abstract

Reverse Shoulder Arthroplasty (RSA) is typically reserved for older, infirm patients presenting with irreparable rotator cuff tear arthropathy and proximal humerus fractures. Over the past few decades, RSA has become increasingly popular and now accounts for a significant percentage of shoulder arthroplasty volume in the United States. RSA, which was traditionally taught mainly for patients over 70 years of age, is now becoming more common in younger patients. There is some variability in the definition of a young patient, but it is typically defined as a patient younger than 65 years. A patient's history will help frame the discussion and provide the surgeon with a list of potential differential diagnoses. A physical examination will help test and confirm the validity of these diagnoses as well as help determine the cause and severity of the illness. Emphasis should be placed on how illness affects a patient's life. Physical examination is another tool used to confirm the hypothesis of the surgeon and patient's story. Imaging can further confirm this diagnosis. Radiographs are used to provide an initial impression. Radiographs should be studied chronologically as a means to gauge symptom severity and progression and to correlate with the patient's story. Indications for RSA include osteoarthritis, revision arthroplasty, and rotator cuff arthropathy. Complications for RSA in young patients ranges from 16.5% to 39.1%. Some of the major complications associated with RSA include infection and instability. Outcomes for RSA are good with American Shoulder and Elbow Surgeons Shoulder Score improvements and increased shoulder range of motion.

Keywords: Reverse shoulder arthroplasty, Young, Patient, Outcomes, Complications

INTRODUCTION

Reverse Shoulder Arthroplasty (RSA) is typically reserved for older, infirm patients presenting with irreparable rotator cuff tear arthropathy and proximal humerus fractures. Over the past few decades, RSA has become increasingly popular and now accounts for a large percentage of shoulder arthroplasty volume in the United States [1]. This increase is partly due to the criteria for RSA expanding and increased acceptance of RSA among shoulder arthroplasty surgeons. RSA, which was traditionally taught mainly for patients over 70 years of age, is now becoming more common in younger patients. There is some variability in the definition of a young patient, but it is typically defined as a patient younger than 65 years.

RSA involves the replacement of the native glenohumeral joint with a prosthetic implant that consists of a metal ball and a plastic socket. Unlike a traditional shoulder replacement, the implant is designed to reverse the mechanics of the joint with a ball attached to the scapula and a socket to the humerus. This configuration allows the deltoid muscle to function as the primary stabilizer of the joint, not the rotator cuff.

The diagnosis of patients receiving RSA is usually very different from that of patients receiving TSA. A retrospective study of 66,485 shoulder arthroplasty procedures found that TSA was performed for osteoarthritis in 93% of cases and that RSA was performed for rotator cuff tear in 80% of cases and proximal humerus fracture in 10% of cases [1]. A retrospective chart review study of 1250 primary shoulder arthroplasties found that TSA was performed for osteoarthritis in 99% of cases meanwhile the primary diagnosis for RSA was rotator cuff arthropathy (35%) followed by massive cuff tear with osteoarthritis (29.8%), and osteoarthritis (20.5%) [2].

There is also a difference in the diagnosis between young and older shoulder arthroplasty patients. A study of patients with glenohumeral osteoarthritis found that 66% of patients in the older study group had primary degenerative joint disease, while it was only 21% of younger patients [3]. This study also found that proximal humerus fracture, avascular necrosis, rheumatoid arthritis, and post-traumatic sequelae were more common in younger patients. A study of 36 RSAs in patients aged < 60 years (mean age, 54 years) found that the most common diagnoses were sequelae of proximal humerus fracture, failed prior shoulder arthroplasty, and failed prior rotator cuff repair [4]. A retrospective, multicenter review of 66 patients (67 RSAs) younger than 60 years found that rotator cuff deficiency and massive rotator cuff tear with osteoarthritis were the most common diagnoses for RSA [5]. Additionally, 67% of patients had at least one prior surgery and 45% had multiple surgeries. The findings suggest that RSA is typically reserved for patients presenting with more complex diagnoses than for patients undergoing TSA. This combined with younger patients has higher functional demands, and multiple prior surgeries present challenges when performing RSA in a young patient. Furthermore, younger patients typically have a more complex pathology, multiple prior surgeries, lower preoperative baseline functional scores, higher activity demand, and longer life expectancy. A thorough physical examination and imaging are necessary for shared decision-making between the surgeon and the patient when deciding whether RSA is suitable for the patient.

PRIMARY ASSESSMENT

HISTORY

A patient's history will help frame the discussion and provide the surgeon with a list of potential differential diagnoses. A physical examination will help test and confirm the validity of these diagnoses as well as help determine the cause and severity of the illness. Emphasis should be placed on how illness affects a patient's life. The surgeon should understand how their patients use their shoulders each day and what activities they would like to perform again. This can provide valuable insights into a patient's desired functionality. This will allow the surgeon to develop a suitable plan that aligns with the patient's desired functional status, or may require the surgeon to counsel their patient and re-orient them towards a more realistic outcome [6,7].

PHYSICAL EXAMINATION

A patient's history will provide the surgeon with hypotheses regarding the cause and severity of the patient's shoulder injury. Physical examination is tool used to confirm the hypothesis of the surgeon and patient's story. Physical examination always begins with inspection. Compared with the normal side, the contour of the injured side may have more prominent bony landmarks, which are signs of muscle atrophy or a result of prior surgery or injury. Surgeons should note the location of surgical scars and any wounds that may affect the planning of future surgery. Intact firing along the contour and the bulk of the deltoid should be noted. Active and passive range of motion should also be noted. A mechanical block to both active and passive range of motion may be due to malunion from a proximal humerus fracture, prosthetic failure, or prosthetic mispositioning. Crepitus may be heard or palpated in patients with loose bodies or glenohumeral osteoarthritis. Loss of external rotation should be noted during physical examination. Chronic rotator cuff tears may present as atrophy of the posterior cuff musculature, limited external rotation, and loss of strength. Internal rotation and subscapularis weakness must also be noted on physical examination.

IMAGING

Imaging can further confirm this diagnosis. Radiographs are used to provide an initial impression. Radiographs should be studied chronologically as a means to gauge symptom severity and progression and to correlate with the patient's story. Advanced imaging can be used to further characterize soft tissue injuries and determine bone integrity. MRI allows for quantification of rotator cuff musculature and the level of fatty atrophy and CT can be used to assess glenoid and proximal humerus bone stock, glenoid symmetry, implant loosening, and malunions [8,9].

After confirming the patient's diagnosis with history, physical examination, and imaging, the surgeon and patient can engage in shared decision-making regarding appropriate treatment. As mentioned earlier, younger patients have an increased functional demand, which places an increased burden on the prosthesis.

INDICATIONS FOR RSA

OSTEOARTHRITIS

RSA should be offered to young patients with glenohumeral osteoarthritis and inadequate glenoid bone stock for fixation. Excessive posterior wear of the glenoid, retroversion, dysplasia, and posterior humeral head subluxation limits the available glenoid vault bone stock, which leads to difficulty in obtaining fixation of the glenoid component [10-12]. CT imaging is typically used to preoperatively evaluate glenohumeral osteoarthritis and inadequate glenoid bone stock. CT imaging can also be used to evaluate asymmetric posterior wear forming a biconcave glenoid, wear-associated retroversion with or without posterior humeral head subluxation, and glenoid dysplasia Contraindications for this procedure include deltoid dysfunction, active infection, and abuse of active substances. Similar to the prior discussion, an open conversation should be held between the patient and surgeon about the expected outcomes, risks, and potential complications. Young patients who meet these criteria can be treated with RSA.

REVISION ARTHROPLASTY

Patients presenting with the need for revision arthroplasty are typically dissatisfied because of shoulder pain and limited function. A detailed history and physical examination should be performed, as previously described. During physical examinations, emphasis should be placed on shoulder stability and muscle function. This is because subscapularis deficiency or massive rotator cuff tear can compromise the functionality of hemiarthroplasty or total shoulder arthroplasty. Signs of infection should be noted. Radiographs and CT should be ordered to determine if there is any component loosening or migration and signs of bone loss. Serial radiographs can aid in determining prosthetic migration, loosening, and changes in the bone loss.

RSA should be considered for young patients with previously failed arthroplasty due to glenoid component failure, rotator cuff deficiency, glenoid bone erosion or deficiency, or infection. RSA allows the surgeon to address glenoid bone deficiencies and can provide improved function in cases with rotator cuff deficiency compared to TSA. Infection should be ruled out preoperatively. Intraoperative signs of infection should also be considered by surgeons. Adequate soft tissue and scar release must be achieved, particularly in the sub deltoid space. Adhesions formed between the undersurface of the deltoid and the posterior rotator cuff can lead to excess posterior tightness and instability if not addressed. The old implant should be removed carefully to conserve as much proximal humeral and glenoid bone as possible. New RSA components should be placed based on preoperative CT planning and intraoperative findings.

ROTATOR CUFF TEAR ARTHROPATHY

Rotator Cuff Tear Arthropathy (CTA), osteoarthritis, and revision arthroplasty are some of the most common reasons for performing RSA. CTA is typically performed in the elderly population and is the main indication for performing RSA in elderly patients. Patients may complain of difficulty combing their hair, reaching up to grab something, or may require help to fasten their bras. CTA can also be performed for younger patients. Difficulty in elevating the arm and progressive shoulder pain are hallmarks of a patient presenting with CTA. If prior treatments fail along with conservative therapy, RSA shoulder should be considered. Physical examination shows posterior cuff atrophy. Active range of motion is usually less than 90 degrees of forward elevation and abduction. External rotation is also limited. Audible or palpable crepitus may present with worsening glenohumeral arthritis. Radiographic imaging will show different stages of glenohumeral arthritis, periarticular osteopenia, and superior humeral head migration. MRI is typically unnecessary for diagnosis, given a proper history, physical examination, and radiographs that are consistent with CTA. If the patient already had an MRI performed, it typically showed fatty infiltration of the rotator cuff muscles with medial retraction. The glenohumeral cartilage is worn. Computed tomography (CT) is routinely performed for patients with CTA. CT demonstrates superior glenoid wear with or, which demonstrates the expected severe fatty infiltration of the rotator cuff muscles. Glenoid bone stock and version are assessed on axial CT images to plan for fixation.

Patients presenting with findings consistent with CTA, as described above, understand the realistic expectations after surgery and are medically fit candidates who should be offered RSA regardless of age. Contraindications in this group include deltoid deficiency, active infection, or active substance abuse.

OUTCOMES

Multiple modalities exist for evaluating postoperative shoulder function and subjective satisfaction. Examples include the Constant-Murley Score (CS), Subjective Shoulder Value (SSV), American Shoulder and Elbow Surgeons Shoulder Score (ASES), Shoulder Severity Index (SSI), and the Simple Shoulder Test (SST). The dimensions of patient experience evaluated in these tests include range of motion, pain, function, stability, activity level, satisfaction, and strength [13]. Fonte et al. conducted a systematic literature review comparing various shoulder arthroplasty techniques, including Hemiarthroplasty (HA), Hemiarthroplasty with Glenoid Biological Resurfacing, (HABR) anatomical Total Reverse Arthroplasty (TSA), and RSA [14]. They found that patients who underwent RSA had the highest increase in CS (34.6, out of 100). However, when using the SSV to evaluate postoperative satisfaction, patients with HA and TSA had the highest scores. Sershon et al found that ASES scores increased from 31.4 to 65.8 (out of 100) after RSA [4]. They also found that the SST increased from 1.4 to 6.2 (out of 12) post-RSA. In their systematic review of RSA outcomes, Goldenberg et al found that ASES scores increased from 31.3 to 68.3 post-operatively and that SST improved from 2.0 to 6.7, both of which were significant [15]. The SSV values increased from 21.2 to 70.5 (out of 100). They also evaluated the changes in active forward elevation and active abduction. Active forward elevation improved from 70º to 123º, and active abduction improved from 62º to 118º, both of which were significant. Finally, Vancolen et al. performed a systematic review of RSA outcomes in those 65 years [16]. Across the studies included in the analysis, the average preoperative ASES score was 32 ± 9 and the average postoperative score was 67 ± 16, which was a significant increase. The average preoperative SSV was 24 ± 17 and the average postoperative SSV was 48 ± 27, which was also significant.

COMPLICATIONS

A systematic review by Chelli et al. found that the overall complication rate for RSA in young patients was 16.5%, with 11% of major complications (defined as any complication leading to a new surgical procedure) and 6% being minor complications [13]. This study found that the most common complications were instability (5%) and infection (3.6%) [17]. A systematic review by Fonte et al found that the overall complication rate for RSA was 19.4% in young patients (defined as less than 60 years of age) [14]. A study by Goldenberg et al found 40 post-operative complications in 215 shoulders [15]. This systematic review also found that the overall reoperation rate was 14.4% and the revision rate was 11.2%. A systematic review conducted by Bedeir et al. on reverse total shoulder arthroplasty in patients younger than 60 years found that the overall complication rate ranged from 15% to 39.1% [18]. Some of the main complications include dislocation, infection, periprosthetic fracture, and glenoid screw lucency.

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