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Survivorship of Reverse Shoulder Arthroplasty in Patients Younger Than 55 Years Old

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ABSTRACT

Historically, reverse shoulder arthroplasty (RSA) has been reserved for elderly patients. Patients younger than 55 requiring RSA are challenging as they live longer, place more stress and wear on implants, and have higher reoperation rates compared to patients older than 55 years of age. Our goal was to examine the survivorship and functional outcomes of patients younger than 55 years old undergoing RSA. Patients younger than 55 years old who underwent RSA with a minimum two year follow-up were retrospectively reviewed. We evaluated implant survivability, postoperative American Shoulder and Elbow Surgeons (ASES) score, etiology of surgery, and medical demographic data. 29 RSA were performed on 22 patients (7 were bilateral). 20 of the 29 shoulders (68.9%) had a minimum two year follow up and were included for data analysis. Indications for RSA in our patients included: cuff tear arthropathy (14), post-traumatic arthritis (7), rheumatoid arthritis (3), primary osteoarthritis (3), and irreparable rotator cuff repair (2). The average age of the patient at time of surgery was 52.6 years (range 45-54.9 years). Average post-operative ASES score was 80.9 (range 33.3-100.0). There was a statistically significant inverse correlation between number of surgeries on the ipsilateral shoulder and post-operative ASES score (r= -0.55, p= 0.02). No patients included in our data analysis required revision surgery. We conclude that in patients younger than 55 with complex pathology and limited treatment options, RSA provides a durable shoulder arthroplasty option without any early failures at 2-year follow-up.

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Introduction

Historically, reverse shoulder arthroplasty (RSA) has been reserved for patients older than 70 years old. In recent years, indications for RSA have grown with the requisite age decreasing for this procedure leading to increased rate of RSA in younger patients [1]. Patients younger than 55 years old place an inherent challenge to shoulder surgeons. They live longer, place more wear and tear on their prostheses, have lower satisfaction, and experience higher reoperation rates when compared to older populations [2-5]. Younger patients have reported decreased overall satisfaction with higher rates of mechanical failure and reoperation rates when compared to older patients [2-6]. Despite adverse outcomes, reverse shoulder arthroplasties in patients less than 55 years old have become an increasingly utilized treatment option for massive cuff tear arthropathy, post-traumatic arthritis, or rheumatic joint disease providing clinically significant improvement in objective range of motion and pain scores [2-7].

Recently, RSA has begun to be utilized in young patients [1]. Little is known about the longevity and outcomes of RSA in patients younger than 55 years old. Revision RSA is plagued by decreased functional outcomes, patient satisfaction, and further need for re-operation [2-6]. As more young people undergo RSA it is critical to evaluate for short term catastrophic failure, survivability, and functional outcomes. By doing so, we hope to increase patient satisfaction and identify any factors which necessitate revision surgery. The purpose of our study was to examine the survivorship and functional outcomes of patients younger than 55 years old who underwent reverse shoulder arthroplasty. We hypothesize patients less than 55 years old undergoing RSA will not require reoperation and achieve acceptable quality of life metrics with minimum 2 year follow up.

Materials and Methods

This study received institutional review board approval. A retrospective chart review was conducted to identify all patients younger than 55 years old who underwent primary reverse shoulder arthroplasty over a 3 year period with a minimum of 2 year follow up. The Current Procedural Terminology Code 23472 was used to identify patients who were treated with RSA.

All patients previously failed trials of no operative and conservative management entailing physical therapy, corticosteroid injections, and arthroscopic debridement procedures. Additionally, individual patients must have had radiographic evidence of either end stage arthritis, rheumatologic joint disease, or massive irreparable rotator cuff tears. The patients in our study were specifically indicated for RSA as final salvage operation. All other conservative or

arthroscopic treatments had failed or were contraindicated.

Patients were added to a password-protected Microsoft Excel document. A total of 29 RSA were performed on 22 patients. Patient demographics collected included age, sex, date of service, laterality, number of previous shoulder surgeries, postoperative ASES score, and etiology of the condition requiring RSA. Data obtained to determine the preoperative state of health included past medical history, past surgical history, body mass index, and Elixhauser score.

To be included in the study the patient had to be less than 55 years old and have undergone primary RSA. Follow up was ensured by one of two ways. Either the patient had two year follow up with the operative surgeon or he or she was contacted by phone to complete an oral ASES questionnaire. Patients were asked whether or not a revision surgery was either planned or had been undertaken. Exclusion criteria included revision shoulder arthroplasty and age younger than 18 years old.

Statistical Methods

Implant survivability was defined as either needing a revision surgery or follow up surgery after index operation. Continuous variables were listed in table format with mean, range, and mode calculated. Categorical variables were recorded and converted to a table format to be evaluated. Pearson regression analysis was run to evaluate the correlation between ASES score with the number of surgeries, Elixhauser score, and BMI. Because our data did not follow a normal distribution when comparing bilateral to unilateral surgery, a Wilcox Run test was run to evaluate statistical significance and correlation to ASES. Clinical significance was set as $p = 0.05$.

Results

Baseline Characteristics (Table 1)

Over the study period, 29 RSA were performed on 22 patients by 5 independent fellowship trained shoulder and elbow surgeons. 20 of 29 shoulders (68.9%) were able to participate in follow up. Average age at the time of surgery was 52.9 years old (range 45 to 54.9). There were 15 right shoulders, 8 left shoulders, and 3 patients with bilateral RSA (6 shoulders). Average BMI was 30.4 (range 21.6 to 46.0). Average Exlihauser score was 1.2 (range 0 to 5). 14 of 29 shoulders (48.3%) had previous shoulder surgery.

Table 1. Demographics of Representative Patients

Table I Baseline Demographic Characteristics	
Characteristics	**Values**
Age	52 years old (45 to 54)
Sex	
Male	14
Female	8
BMI	30.4(21.6 to 46.0)
Elixhauser	1.2 (0 to 5)
Laterality	
Right	15
Left	8
Bilateral	6 total
Previous shoulder surgery	14 (48.3%)

Survivorship and Functional Outcomes

The first and original aim of this paper was to determine the short-term survivability of RSA in a young patient population. None of our patients required revision or were planning a revision surgery at time of final follow up.

To assess function, postoperative ASES scores were collected. Average postoperative ASES score was 80.9 (range 33.3 to 100). Average preoperative visual analog scale was 7.2(range 3 to 10). Average postoperative VAS score was 2.9(range 0 to 7.4). We found a statistically significant inverse relationship between the number of surgeries and ASES score ($r = -0.55$, $p = 0.02$, regression confidence interval -0.81 to -0.12; figure 1). No relationships could be established between ASES score and Exlihauser score ($r = -0.04$, $p = 0.87$, regression confidence interval -0.48 to -0.42), postoperative VAS($r = -0.41$, $p = .12$, regression confidence interval -0.76 to 0.12), or BMI ($r = -0.18$, $p = 0.46$, -0.58 to 0.30). Mean ASES scores for unilateral versus bilateral RSA were 67.2 and 84.4, respectfully ($p = 0.20$, figure 2).

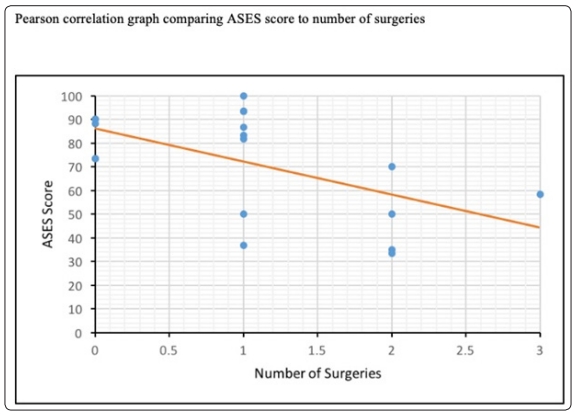

Figure 1

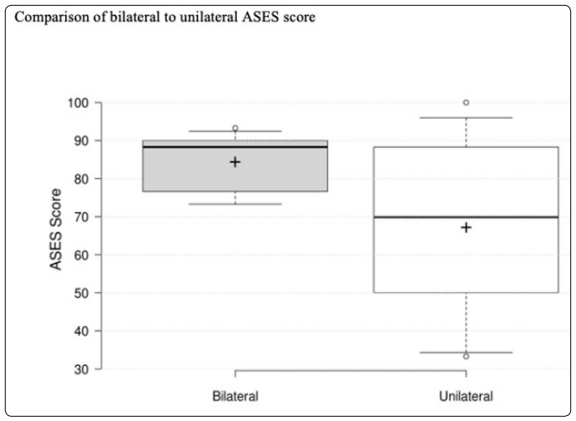

Figure 2

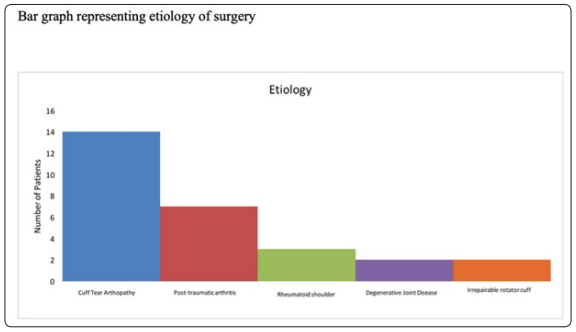

Figure 3

Etiology

Need for RSA was broken down by etiology (figure 3). In decreasing order etiologies included: cuff tear arthropathy (n = 14, 48.3%), post traumatic arthropathy (n = 7, 24.1%), rheumatologic disease (n = 3, 10.3%), degenerative joint disease (n = 3, 10.3%), irreparable rotator cuff tear (n = 2, 6.9%)

Adverse Outcomes

There was one mortality reported due to opiate induced drug overdose. The patient was opioid naïve prior to RSA.

Discussion

The purpose of our study was to evaluate for early failure in young patients (< 55 years old) undergoing RSA. As indications are being expanded and younger patients receive RSA it is imperative to understand the complication profile of the surgery. If an unacceptable rate of failure is seen than the operation should be discontinued in that population. Our study found 100% survivability for RSA in young patients at short term follow-up.

RSA can be a successful operation when performed for properly selected patients. However, it is not without risks of potential complications such as infection, periprosthetic fracture, and decreased function [8-11]. There is significant concerns regarding the survivability of any shoulder arthroplasty in the young population. Numerous studies have investigated the role of age, survivability, and function of anatomic operations in a more juvenile patient. Bartelt et. al investigated total shoulder arthroplasty(TSA) and hemiarthroplasty(HA) in patients younger than 55. When comparing HA to TSA, TSA patient had improved pain, range of motion, satisfaction and less need for revision surgery (72% versus 92%, respectfully) [12]. Sperling et al. published their results of 62 hemiarthroplasties and 29 total shoulders in patients younger than 50 [13]. While both reliably controlled pain and improved range of motion, the survivability of the HA was again less than TSA(82% versus 97% at 15 years).

Otto et. al reported the outcomes of patients younger than 55 years old undergoing both revision and primary reverse shoulder arthroplasty[4]. They found improvements in range of motion, ASES, and SST score for both primary and RSA. Furthermore, implants were retained in 94.3% of revisions and 87.5% in primary joints in a total of 67 patients with 2 to 12 year follow up. The only cause for revision of primary shoulder arthroplasty was infection. In a slightly older patient population than ours, Sershon et. al found 3 of 36 patients required revision surgery at a mean of 2.8 years follow up patients younger than 60 years old who underwent primary RSA [7]. The long-term survivability of RSA at any age is being worked on currently. In a series of 126 primary RSA, Bassens and colleagues had a survivorship of 97% at 8 years along with sustained improved Constant-Murley scores and VAS [14]. Our study adds to the survivability data on RSA. We found that patients younger than 55 years old at a two year follow up did not and were not planning revision surgery. This data supports that RSA is a stable surgical construct that can support the activities of young individuals without catastrophic failure in the short term.

Prior to considering RSA there are numerous nonoperative treatment modalities for patients with irreparable rotator cuff tears, post-traumatic arthritis, and rheumatologic shoulder disease. These include periscapular physical therapy, intra- and extracurricular corticosteroid injections, and manipulation under anesthesia. When these treatments fail, surgeons of young patients are understandably cautious when recommending surgery. One surgical option being increasingly utilized for massive irreparable rotator cuff tears without evidence of arthritis in young patients is the superior capsular reconstruction(SCR).(15) SCR places either a dermal allograft or fascia lata autograft in the location of the superior capsule and biomechanically restores the kinematics of the shoulder. Early works were promising with success rates ranging from 83-94.5% [16-17]. However, more recent reports note issues with high reoperation rates, persistent pain, poor function, and tendon healing of only 45% on MRI [17-18]. Regardless of the utility of the SCR, the patients in our study were not candidates for the surgery as they had evidence of arthritis, malunited fractures, or concomitant chronic and retracted subscapularis tears.

Although our survivability was 100%, patients did have varying degrees of function. We used postoperative ASES score as a metric to quantify postoperative function. When critically evaluating our results, we found as the number of previous shoulder surgeries increased, the ASES score decreased (figure 2). Decreased visual analog scale and subjective shoulder value scores have been reported to be lower following RSA for failed TSA in patients younger than 65 years old compared to primary RSA [19]. Similarly, RSA for failed open reduction internal fixation following proximal humerus fracture has shown inferior outcomes compared to RSA for proximal humerus fracture [20-23]. Similar to the above studies, in patients with complex shoulder pathology with limited treatment options, our finding suggests patients are potentially better served with primary RSA. Attempting to delay RSA due to patient age using lower reliability surgeries may simply subject the patient to more surgeries and worse long-term outcomes.

There was one adverse event identified in this study. An opioid naïve patient became addicted to opioid narcotics following RSA and subsequently overdosed on heroin 3 years following surgery. This serves as a poignant reminder of the current opioid epidemic and its effects on orthopedic patients. No surgically related adverse events occurred in this study demonstrating that RSA can be performed safely in young patients.

Strengths of our study include nearly 70% follow up. We were further able to confirm that short term catastrophic failure is rare in young patients undergoing RSA. Lastly, we identified patient demographics which correlate with function at two years follow up. Our results add clinical data and outcome statistics to a very narrow body of literature.

Limitations of this study include the retrospective nature of the data collection. However, due to the small cohort of young patients undergoing RSA we determined a retrospective study design would be best to answer our question. We did not evaluate radiographs, but the study was designed to identify catastrophic failure defined as revision surgery. This data is extremely important to confirm the safety of RSA in young patients. Additionally, our results were limited by only 2 year follow up. Long term follow up is needed before RSA in patients under 55 years old should be used as anything but salvage surgery.

Conclusion

We conclude that in young patients with complex pathology and limited treatment options, RSA provides a stable shoulder construct without any early failures at 2-year follow-up. Patient reported outcomes are good but notably worse in patients who have undergone prior surgery.

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