



ISSN: 2395-1958
IJOS 2019; 5(2): 138-141
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www.orthopaper.com
Received: 12-02-2019
Accepted: 14-03-2019

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Does indication matter in the functional outcome of reverse shoulder arthroplasty? - A comparative retrospective study

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DOI: <https://doi.org/10.22271/ortho.2019.v5.i2c.26>

Abstract

Reverse Shoulder Arthroplasty is done for Cuff Tear Arthropathy (CTA) and other indications. We hypothesize that CTA patients and patients with other indications will have differing functional outcome following RSA.

We retrospectively studied 23 patients treated in our center between 2014 and 2017. The patients who were aged 60 and above with normal Deltoid function, normal cognition and a minimum follow-up of 12 months were included. Of the 23 patients, 16 had CTA and 7 had either a complex fracture dislocation, arthritis with malunion, excision arthroplasty or a chronic dislocation. We compared the functional outcome using Constant Shoulder Score at a mean follow up of 24.6 months.

The post-operative scores were significantly higher in the CTA group, but the magnitude of functional improvement from preoperative status following RSA was either comparable (absolute change) or even better (percentage change) in non-CTA patients compared to CTA patients. There were no significant differences in the complication rates between the two groups.

We conclude that one should not be discouraged by the lower values of functional scores in RSA done for non-CTA indications and be aware that the functional improvement following RSA in such complex cases is encouragingly better than that following RSA in CTA.

Keywords: Reverse Shoulder Arthroplasty, Cuff Tear Arthropathy, proximal humerus fractures, chronic shoulder dislocation, shoulder arthritis

1. Introduction

The pathoanatomy of Cuff Tear Arthropathy (CTA) was first described by Neer *et al.* ^[1], as the degeneration of Glenohumeral joint secondary to proximal migration of the humeral head. Total shoulder Arthroplasty (TSA) was done for this condition initially. As rotator cuff deficiency caused excessive and eccentric loading of the glenoid component along with superior migration of humeral component, TSA was a failure for this condition. This led to the development of Reverse shoulder arthroplasty (RSA). The first successful design was that of Paul Grammont *et al.* ^[2]. Clinical studies have shown good outcomes and a little higher complication rate with RSA for CTA. Recently the indications for RSA have extended beyond CTA, including complex fractures, fracture dislocations, malunions, chronic dislocations and advanced arthritis. Despite the high complication rate compared to TSA, the indications for RSA keep expanding due to lack of a better alternative. The outcome of the patients having RSA for other than original indications have not been documented well. We present comparison of RSA for CTA and RSA for other indications. We hypothesize that CTA patients and patients with other indications will have differing functional outcome following RSA.

2. Aim of the study

To compare the functional outcome of RSA in Cuff Tear Arthropathy versus RSA in other indications with objective validated scoring system.

3. Materials and methods

The study includes 23 patients [13 males (57%) and 10 females (43%)] with a mean age

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of 70.2 years (60 to 82) admitted and treated in our tertiary care center from 2014 to 2017, with a minimum follow up of 12 months. Of the 23 patients, 16 had Cuff Tear Arthropathy. Among the remaining 7 patients, there were 4 cases of complex fracture dislocations, 1 case of malunion neck of humerus, 1 case of excision arthroplasty and 1 case of chronic shoulder dislocation. The right side was affected in 10 (43%) cases and the left side in 13 (57%) cases. The average pre-operative Constant score was 16.3 (9 - 30). The comparison of patient demographics between the CTA and non-CTA groups is as shown in (Table-1). The two groups were comparable to each other in terms of their mean age, sex ratio and the side involved.

Table 1: Demographic and Pre-operative data

Parameter	CTA (n =16)	Non-CTA (n = 7)	P value
Mean age (range)	70.3 (60 – 82)	70 (60 – 77)	0.46
Sex - M:F	9 : 7	4 : 3	0.97
Side – Right : Left	8 : 8	2 : 5	0.34

4. Inclusion Criteria

1. Patients with Cuff Tear Arthropathy
2. Patients with complex fracture dislocations, chronic dislocations and other forms of secondary arthritis with poor rotator cuff function
3. Age 60 years and above
4. Non-institutionalised independent living status

5. Exclusion Criteria

1. Age < 60 years
2. Severe cognitive dysfunction or patients dependent on others for daily activities
3. Pathological fractures
4. Osteoarthritis with good rotator cuff function
5. Active sepsis and History of infection in the past

Dichotomous variables were analyzed using a chi-squared test. The paired T-test was used to assess the difference in Constant Score between the two groups. A p-value < 0.05 was considered statistically significant.

6. Surgical Technique

All surgeries were performed in a beach chair position using Deltpectoral approach. Either Evolutis or Exactech Reverse shoulder system was implanted in all the patients. The biceps tendon was tenodesed to the upper border of the pectoralis major in all cases. In complex fractures, after removal of the humeral head fragment, no. 5 ethibond sutures were placed through the infraspinatus and teres minor at the bone-tendon junction to control the greater tuberosity fragment and through Subscapularis to reattach the lesser tuberosity later around the prosthesis. The baseplate and glenosphere were then implanted in a standard fashion.

The humeral shaft is exposed and prepared with hand reamers until there is gentle cortical resistance. A humeral trial is then placed. Appropriate height of the humeral implant was determined based on the length of greater tuberosity fracture fragment. Humeral version was then set by placing the arm in a neutral position at the side and pointing the humeral component/tray toward the glenosphere. The humeral component was cemented in few and uncemented in some cases. Once the cement was set, a trial reduction was performed with a constrained polyethylene trial onto the humeral component to confirm satisfactory stability without

impingement during range of motion. The humeral component is then dislocated, and the final polyethylene liner is impacted into place. Before performing the final reduction, the ethibond suture limbs were cerclaged around the neck of the prosthesis. After reduction the sutures were tied while holding the tuberosities in anatomic position.

7. Postoperative care

All patients received Preop and Postoperative 3 doses of IV antibiotics. After surgery, the extremity was placed in a simple arm sling with the arm resting at the side. Immediate passive motion is started with flexion to 60° with minimal external rotation. After 4 weeks sling was discontinued and full passive forward flexion begun. Active assisted motion in all planes was initiated after 6 weeks and the use of arm for light home activities was allowed.

All patients were reviewed fortnightly until six weeks, after which they were permitted to mobilize without further restriction. Further clinical evaluation was done regularly at 3 and 6 months and then whenever needed. The Constant Score at final follow-up was taken into consideration for comparison between the two groups. Radiographs were taken at final follow up for evaluation (Fig. 1, 2).

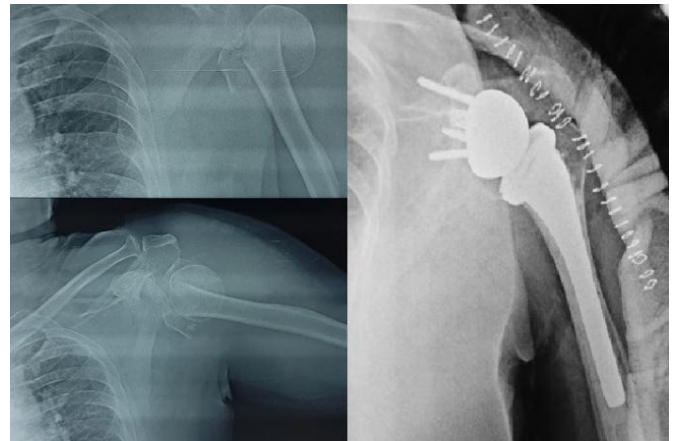


Fig 1: RSA in a 65 year old male with complex fracture dislocation of Left Shoulder



Fig 2: RSA in a 60 year old male with Left Shoulder excision arthroplasty

8. Results

The functional outcome was assessed in all the 23 patients using the Constant score at latest follow-up visit. Upon statistical analysis, both the pre-operative and post-operative Constant scores of the CTA group were significantly higher than those of the non-CTA group (Table 2). However there was no significant difference between the two groups in the difference between pre-operative and post-operative Constant scores (Table 2).

Table 2: Comparison of Constant scores

Score	CTA	Non-CTA	P Value
Pre-Op Constant Score	19.2 (9-30)	13.3 (9-19)	0.01
Post-Op Constant Score	77.4 (35-91)	68.4 (61-74)	0.04
Absolute Change	58.2 (26 - 67)	55.1 (44-63)	0.22
Percent Change	316 (177-433)	454 (259-700)	0.005

From these observations we infer that

- The pre-operative Constant score was significantly poor in the non-CTA group
- The post-operative Constant score was significantly better in the CTA group
- However there was no significant difference in the post-operative functional improvement (Post-operative score - Pre-operative score) between the two groups

There were no significant differences in the complication rates between the two groups (Table-3). None of our patients had deep space infection, deep vein thrombosis or Neurovascular injury. There were no radiological signs of loosening or heterotopic ossification in any of the groups until the latest follow-up.

Table 3: Complications

Complications	CTA	Non-CTA	P Value
Infection	0	0	---
Neurapraxia	0	1	0.3
Dislocation	0	1	0.3
Fracture	1	0	1
RSD	1	0	1
Total Complications	2	2	0.8

7. Discussion

RSA was introduced for the treatment of glenohumeral arthritis with an incompetent or irreparable rotator cuff. Initial designs met with unacceptably high complications and revision rates. Later, it was Grammont's work and design of a more medialised and lowered centre of rotation which led to promising results when utilised for cuff deficient arthritic shoulders [2]. Since then, the indications for RSA have expanded to include fracture sequelae, acute fractures, revision and tumour surgery. Some of the inherent problems with RSA have been addressed now, with better understanding and improvements in component design and biomechanics, as well as understanding of scapular morphology. The emerging indications for RSA include shoulder dysplasia [3], chronic glenohumeral dislocation [4], glenohumeral arthritis with severe glenoid bone loss [5], revision arthroplasty⁶ and displaced complex fractures or fracture-dislocations in elderly patients, who have pre-existing cuff pathology, or those in whom anatomic tuberosity healing is unlikely to occur [7].

For many years, Hemiarthroplasty (HA) has been considered the standard for treatment of complex, displaced proximal humeral fractures in the elderly. However, HA has its own technical challenges including proper prosthetic height, version, and tuberosity fixation, which are critical in achieving a satisfactory functional outcome [8]. Since RSA relies primarily on deltoid muscle function and minimizes the need for anatomic tuberosity healing/rotator cuff function, it has become an attractive option for treating displaced proximal humerus fractures in the elderly. Cuff DJ *et al.* compared the results of HA in 26 cases versus RSA in 27 cases for displaced fractures of the proximal humerus in

elderly and reported that patients who were treated with RSA had significantly better and more consistent results irrespective of tuberosity healing [9].

So far RSA has proved to be the beneficial in CTA, despite a higher complication rate. It has also proved to be superior to HA in complex proximal humerus fractures and fracture dislocations. However we are not sure if the functional outcome of RSA is the same in both CTA and non-CTA patients. The results of our study have shown that the pre-operative function of CTA patients is significantly better than that of non-CTA patients. Also the post-operative functional score following RSA in CTA group is significantly higher than that in non-CTA group. However there is no statistically significant difference between both the groups in the absolute change in Constant Score following surgery, though the absolute change in CTA group is marginally higher than the non-CTA group. Also the percentage change in Constant Score in non-CTA group is significantly higher than the CTA group. From these observations we infer that though the average post-operative score in non-CTA group is lower than the CTA group, the magnitude of functional improvement (absolute and percent change in Constant Score) following RSA in non-CTA group is comparable or even higher than the CTA group. Dislocation occurred in one of the non CTA patients which was eventually managed with fully constrained liner. None of the CTA patients had dislocation, but one had a fracture which was managed with circumferential wiring. Though the complications are not shown to be statically significant between two groups, one has to be wary about instability in non CTA group. Ideally we should be able to compare in larger numbers for individual types in non CTA group patients, but due to paucity of numbers one wouldn't be able to do it.

8. Conclusion

It is already proven that Reverse Shoulder Arthroplasty done for Cuff Tear Arthropathy performs very well functionally and clinically. There is not enough data in the literature comparing the outcome of RSA in CTA and other indications. From the results of our study we infer that the numerical value of functional score can be misleading in case of indications other than CTA. The magnitude of functional improvement following RSA is either comparable (absolute change) or even higher (percentage change) in non-CTA patients compared to CTA patients. So we conclude that one should not be discouraged by the lower values of functional scores in RSA done for non-CTA indications and be aware that the functional improvement following RSA in such complex cases is encouragingly better than that following RSA in CTA.

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