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Original article

Reversed Shoulder Arthroplasty (Selection of cases and result of follow up)

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Abstract

Background: Reverse shoulder arthroplasty (RSA) is an effective treatment for cuff tear arthropathy and other glenohumeral joint pathology and complex traumatic injury**. Aim:** To evaluate the short-term clinical and radiologic outcomes of reverse shoulder arthroplasty on twenty patients with different pathologies, focusing on indications for the surgery and comparing results with literature. The study will use standard clinical and radiological methods. **Patients and methods:** This was prospective study was conducted on twenty consecutive cases who were candidates for RSA between July 2021 and April 2023.**Results:** The mean constant scores (CS) for all patients increased from 13.3±10.35 at preoperative evaluation to 67.50±14.29 at 1-year postoperative follow-up, with a high significant difference (p=0.000). At 1 year postoperatively, follow up by constant score show that the patients with proximal humeral fractures (PHF) group showed high improvement followed by fracture sequalae and cuff tear arthropathy (CTA) groups with a high significant difference. The neglected shoulder dislocation shows improvement in CS score but with no significant difference and the least improvement group was revision after hemiarthropathy with no significant difference **Conclusion:** The study shows satisfactory outcomes for RSA treatment in traumatic fractures and pathological diseases, with low incidence of notching and complication rate, despite the need for further research.

Key words: Reversed shoulder Arthroplasty; cuff tear arthropathy (CTA); proximal humeral fractures (PHF); Dislocation.

Introduction

RSA to become a commonly performed procedure managing cuff tear arthropathy (CTA) and extended to other various pathologies including Irreparable Massive Rotator Cuff Tears, Immunological Arthritis with Rotator Cuff Tears. Acute complex proximal humeral fractures, Fractures Sequelae, Neglected Chronic Glenohumeral Dislocation, Tumours, Glenoid Dysplasia and Revision Shoulder Arthroplasty [(1)].
The concept of RSA is not new. Several similar RSA devices were developed in the 1970s, when

Neer devised the initial design of a shoulder replacement with reversed polarity (Mark designs) that faeces major problems [(2)]. In 1985, Paul Grammont made an impressive change which transformed the historic reversed out-of-favour fixed-fulcrum prosthesis into the currently more successful designs of RSA. This revolutionised RSA design was based on 4 key concepts [I] Medialization of the centre of rotation, [II] Distalizing the humerus, [III] Constant centre of rotation leading to an inherently stable implant, [IV] Semi-constrained prosthesis with a larger arc of motion[(3)].

This design principles increases the deltoid lever arm and allows deltoid muscles to improved active abduction and forward flexion without depending on rotator cuff muscles for shoulder movement and stability [(4)]. Grammont style prosthesis had also developed some complications mainly scapular notching, impingement and reduced range of motion especially rotations. Several new models were developed based on Grammont s principles to overcome these complications by inferior position and tilting the glenosphere, increased glenosphere and humeral offset [(5)].

The aim of this study was to focus on indication for reversed shoulder arthroplasty, which patients are good candidate for this surgery & to evaluate prospectively on short term clinical & radiologic outcomes of using zimmer Biomet Trabecular Metal™ Reverse Shoulder on twenty potions. We include different pathologies that can be treated by reversed shoulder arthroplasty & evaluate them with standard clinical & radiological methods. Our results will be compared to literature.

Patients and methods

This was prospective study was conducted on twenty consecutive cases who were candidates for reverse shoulder arthroplasty in done in Benha university hospitals and Dar AlFoad hospitals, Informed written consent was obtained from all patients, who were fully briefed on the purpose of the study and assigned a confidential code number. The study was approved by the Research Ethics Committee, Faculty of Medicine, Benha University, and conducted within the period between July 2021 and April 2023. Approval was also obtained from the Institutional Review Board (IRB) before the study began. The study was further approved by the local Research Ethics Committee (Benha Faculty of Medicine Research Ethics Committee, approval number: {M.D 19.7.2021}

Inclusion criteria: Adult patients >50 years old, both sexes, cuff tear arthropathy (CTA), massive cuff tear without arthritis, shoulder arthritis either OA or RA with compromised rotator cuff functions ,comminuted 3 & 4-part proximal humeral fractures, head splitting, fracture dislocations unamenable for fixation, in elderly patients and Fracture sequela: osteoarthritis, avascular necrosis, malunion or stiffness ,revision surgeries: for hemiarthroplasty or total shoulder arthroplasty with compromised rotator cuff function (compromised rotator cuff function was defined as either massive irreparable tear or fatty infiltration grade three or four according to Goutellier classification), revision of failed RSA, revision form infection after resolution and neglected anterior or posterior dislocations. the full data record of preoperative and postoperative scores and assessments.

Exclusion criteria: Open fractures of proximal humerus, active infection of shoulder joint, axillary nerve injury of compromised deltoid function, lost or defective follow up data.

Methods

All patients were subjected to Clinical evaluation, radiological evaluation.

Implant used: Zimmer Biomet Trabecular Metal™ reverse shoulder which is minimally lateralized RSA (ML-RSA) design regarding to Werthel et al. design classification [6].

Operative Intervention

General anesthesia and neuromuscular paralytic agents are then given to all patients. An intravenous antibiotic was administered. A semi-beach chair positioning. Deltopectoral approach used. A standard exposure is performed, the residual subscapularis was liberated and marked for future repair. Identification of long head of biceps tendon at rotator interval then tenotomy of long head of biceps tendon humeral head dislocated by adduction of the arm with progressive external rotation and extension. A trocar tip of the reamer Placed just posterior to the bicipital groove and at the most superior point of the humeral head to allow straight reaming down the canal. Make a humeral head cut using Humeral Head Cutting Guide and to gauge the retroversion of the cut, insert Threaded Alignment Rods into the holes marked 0 degrees and 20 degrees. After removing bone block complete humeral reaming by using Conical Reamer to for proximal humerus.

Attach the appropriate humeral stem tray to humerus until finishing glenoid preparation.

In cases of proximal humerus fractures: Stay sutures are placed through the subscapularis tendon just medial to its osseous insertion on the lesser tuberosity. The humeral head is removed with locking forceps and kept on the sterile field for later use as bone graft material. Passing Stay sutures through the rotator cuff tendons just medial to their insertion on the greater tuberosity. One looped suture is passed at the junction of the supraspinatus and infraspinatus and the second one is passed at the junction of the infraspinatus and teres minor.

The proximal humerus is retracted posteriorly and inferiorly. Circumferential

exposure of the glenoid with labral excision. Inferiorly, the glenoid must be exposed to allow palpation of the inferior glenoid pillar and inferior positioning of the glenoid base plate. the Glenoid Scraper can be used to clean the glenoid face. Assemble the Base Plate Drill guide that should be placed so that the outer rim aligns with the inferior rim of the glenoid and is centred in the anterior/posterior direction. This will place the glenosphere at the edge of the inferior glenoid bone. Ream Glenoid Bone until the reamer face is completely flush with the prepared surface and the subchondral bone is exposed inferiorly. Carefully note and mark the inferior glenoid pillar insert the base plate into the prepared glenoid and fixed by Inverse/Reverse Screws, ensure all soft tissue is removed around the base plate to allow the glenosphere to completely seat. Insert the appreciate glenosphere which are available in either 36 or 40mm diameters. Place a poly trial liner on the humerus. Reduce the joint and perform a range of motion assessment to choose appropriate size.

Prepare the medullary canal for cementation and the humeral implant attached to the prosthetic holder is introduced into the humeral shaft to the appropriate version. The cement is allowed to fully cure, and all excess cement is removed. Place the desired Poly Liner onto the Humeral Stem.

In cases of proximal humerus fractures, autogenous bone graft fragment placed between the greater and lesser tuberosities and between the tuberosities and the humeral diaphysis. The tuberosities were mobilized utilizing the stay sutures previously inserted in attached tendons through six suture holes and proximal suture groove in stem.

Postoperative evaluation: Clinical evaluation: Every patient would be examined postoperatively and scored using constant score (CS), range of motion including flexion, abduction and external rotation of shoulder are assessed at 3, 6, 9 and 12 months postoperative.

Radiograph evaluation: Follow-up radiographs would be obtained to compare postoperative x-rays. All patients were evaluated radiologically regarding glenosphere position and tilting (inclination), stem position, radiolucent lines (RLL) and loosening, heterotrophic ossification and notching. The radiographs were obtained immediately after operation and sequentially during follow up [(7)].

Statistical analysis

Data were collected then statistically analyzed by computer using statistical package for social sciences (SPSS version 25.0) for windows (SPSS Inc., Chicago, IL, USA). Categorical data were expressed as numbers & percentages. numerical data were expressed as mean ± standard deviation. T-tests were used to compare normally distributed pre-operative & post-operative variables. When comparison involved more than two groups, analysis of variance (ANOVA) was used. Pearson Chi square test(X2) was used to assess relations between groups. P-value >0.05 was considered non-significant (NS), <0.05

significant (S), ≤ 0.01 highly significant (HS).

Results

Our study of 20 cases, including 12 (60%) and 8 (40%) women, found that hypertension and diabetes mellitus were the most common associated diseases. Most patients had right side affection, with 40% showing this as their dominant arm. Proximal Humeral Fracture (PHF) **(Figure A1, 2, and 3)** was the most common pathological diagnosis in 40% of cases, followed by Fracture sequelae (20%) **(Figure B1, 2 and 3)** and Rotator cuff arthropathy (20%) **(Figure C1 and 2)**. Two patients had neglected shoulder dislocation **(Figure D1 and 2)**, and two patients underwent revision after failed hemiarthroplasty.

All patients were classified according to the Walch classification, patients with PHF were classified according to Neer classification. While patients with fracture sequlae classifed as regard Boileau classification for fracture sequlae. patients with CTA were classified according to Hamada classification as showed in **(Table, 1)**

Table 1: Pathological classification for different diagnoses and distribution of the study groups.

		N	%
Neer classification for PHF	**4 part**	4	50%
	Fracture dislocation	4	50%
Boileau classification for fracture sequalae	**Type 1**	2	50%
	Type 2	0	0%
	Type 3	1	25%
	Type 4	1	25%
Hamada classification	**4A**	2	50%
	4B	1	25%
	5	1	25%
Walch classification	**A1**	6	30%
	A2	5	25%
	B1	1	5%
	B2	4	20%
	C	2	10%
	D	2	10%

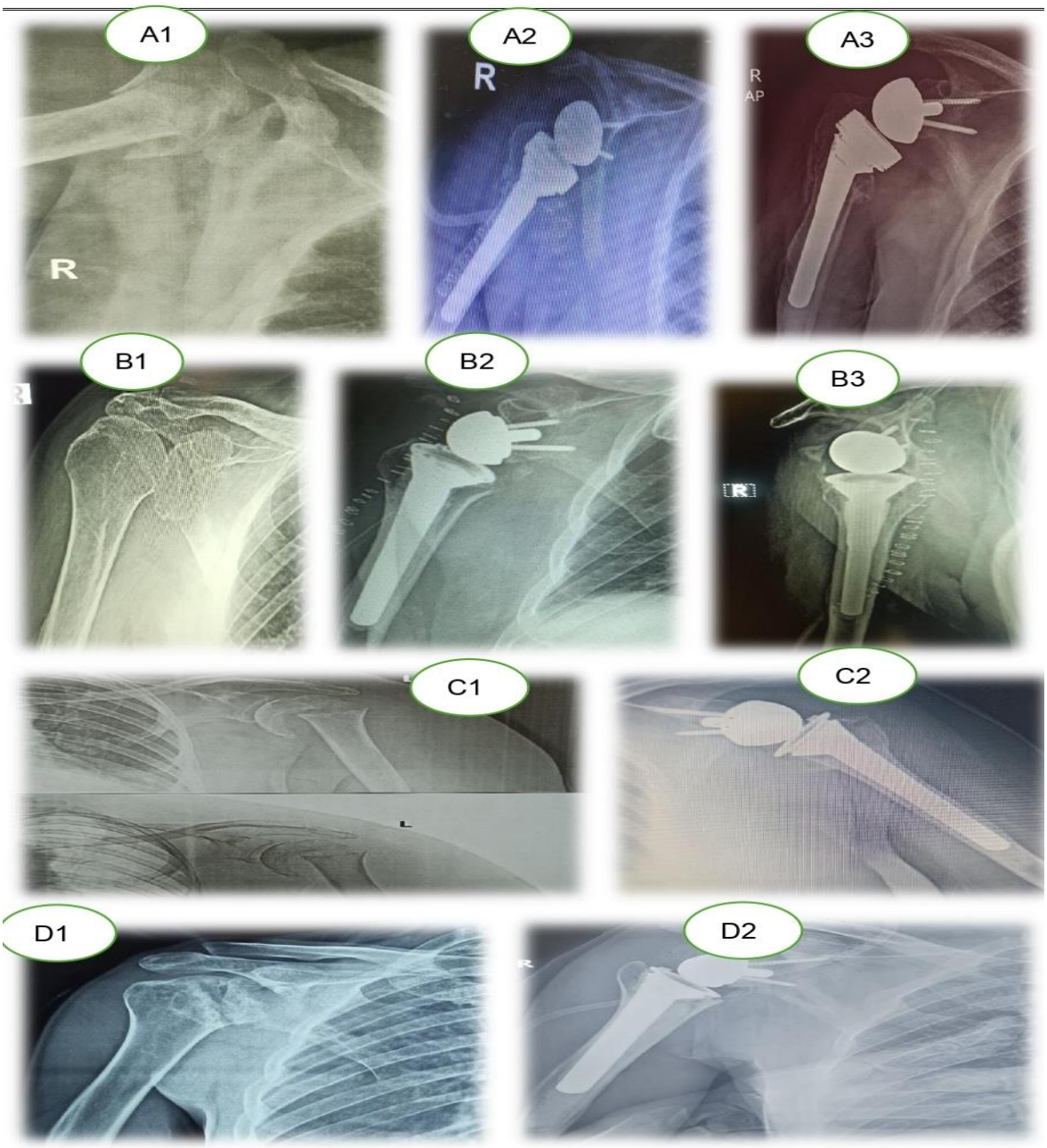

Figure 1: Pre-operative and post-operative x-ray for Reversed shoulder arthroplasty in different indications as show: [**A1]** PHF Preo-perative x-ray, **[A2 and A3]** PHF post-operative x-ray,**[B1]** CTA Pre-operative x-ray,**[B2 and B3]**CTA Preo-perative x-ray,**[C1]**fracture sequale Pre-operative x-ray,**[C2]** fracture sequale Post-operative x-ray,**[D1]** neglected posterior shoulder dislocation Pre-operative x-ray and ,**[D2]** neglected posterior shoulder dislocation Post-operative x-ray.

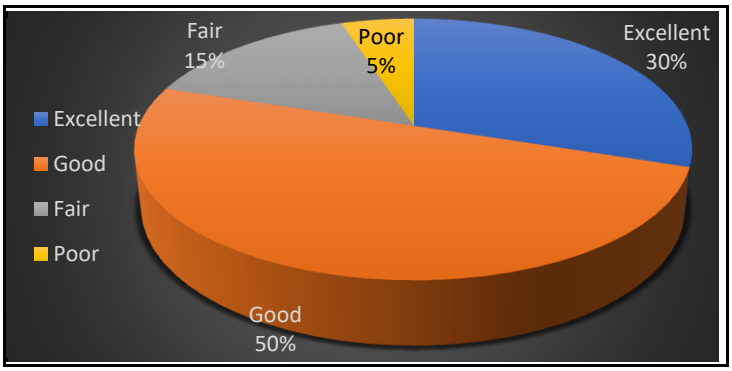

Figure 2: Pie chart showing study group regarding CS.

Most of the patients (ten patients 50%) showed good results with mean value of 72. While six patients (30%) showed excellent results with mean value 77 and Three patients (15%) showed fair results with mean value of 47.67. Only one patient (5%) showed poor results who did revision after hemiarthroplasty with mean value of 25. The mean *p*-value for all patients is 67.5 **(Figure, 2).**

Table 2: Follow up by CS scoring for all diagnoses:

	PHF			**Fracture sequalae**			**CTA**			**Neglected dislocation**			**Revision after failed HAS**			**All cases**		
	Mean	**SD**	**P**	**Mean**	**SD**	**P**	**Mean**	**SD**	**P**	**Mean**	**SD**	**P**	**Mean**	**SD**	**P**	**Mean**	**SD**	**P**
pre-operative	NA	NA		19.25	4.19		21.00	0.82		23.50	3.54		20.50	4.95		13.30	10.35	
3 months follow up	41.00	5.83		41.50	5.58		39.50	9.95		42.00	2.83		26.50	16.26		39.45	8.62	
6 months follow up	52.38	9.01		54.25	12.84		49.50	12.50		56.50	0.71		31.50	19.09		50.50	12.09	
9 months follow up	62.75	9.19		61.50	14.55		60.00	14.28		62.50	0.71		37.50	24.75		59.40	13.65	
12 months follow up	71.13	9.89	0.000 (HS)	69.75	13.40	0.006 (HS)	67.50	15.02	0.007 (HS)	71.50	2.12	0.152 (NS)	44.50	27.58	0.590 (NS)	67.50	14.29	0.000 (HS)

NS: Non Significant HS: Highly Significant

The mean constant scores for all patients increased from 13.3±10.35 at preoperative evaluation to 67.50±14.29 at 1 year postoperative follow-up, with a high significant difference. At 1 year postoperatively, follow up by constant score show that the patients with PHF group showed high improvement (from 41.00±5.83 at 3 months postoperative to 71.13±98.9) followed by fracture sequlae(from 19.25±4.19 at preoperative to 69.75±13.40) and CTA groups(from 21.00±0.82 at preoperative to 67.50±15.02) with a high significant difference. The neglected shoulder dislocation (from 23.50±3.54 at preoperative to 71.50±2.12) show improvement in CS score but with no significant difference and the least improvement group was revision after hemiarthropathy (20.50±4.95 at preoperative

to 44.50±27.58) with no significant difference **(table, 2)** N.B: The preoperative CS can't be assessed for those patients due to severe pain

Table 3: The Range of Motion (ROM) follow up for different patients' groups.

	PHF		Fracture sequalae			Cuff Tear Arthropathy			Neglected dislocation			Revision after failed HAS			All cases		
	Mean	SD	Mean	SD	P	Mean	SD	P	Mean	SD	P	Mean	SD	P	Mean	SD	P
Flexion Pre-op	NA	NA	17.2	4.3	0.003(HS)	22.0	2.1	0.004 (HS)	22.5	3.5	0.014(S)	19.0	8.4	0.427(NS)	12.0	10.60	0.000(HS)
Flexion Post-op	122.6	14.8	123.7	24.9		111.7	20.5		115.5	6.3		67.5	45.9		114.4	25.29	
Abduction Pre-op	NA	NA	14.7	3.4	0.001(HS)	18.0	2.4	0.002(HS)	19.0	2.8	0.029(S)	17.0	4.2	0.417(NS)	10.1	8.84	0.000(HS)
Abduction Post-op	105.1	11.5	102.5	16.5		98.2	15.7		97.5	3.5		60.0	42.4		97.9	20.12	
ER pre-op	NA	NA	9.0	2.5	0.018 (S)	13.2	3.3	0.015(S)	13.0	2.8	0.144(NS)	12.5	3.5	0.266(NS)	7.0	6.37	0.000(HS)
ER post-op	32.0	6.2	28.7	7.2		32.5	9.8		32.5	3.5		21.5	9.1		30.4	7.60	

*Paired samples t test

Regarding ROM for all patients showed statistically high significant increase in preoperatively to 1-year postoperative follow-up for forward flexion [from 12±10.60 to 114.4±25.29 (p=0.000)], active abduction [from 10.1± 8.84 to 97.9± 20.12 (p=0.000)], and ER [from 7.0 ± 6.37 to 30.4± 7.6 (p=0.000)]. As regarding patients with PHF, the means of post-operative ROM at final 1 year follow-up for forward flexion were 122.62 ± 14.85, abduction 105.13 ± 11.54, and ER 32.00 ±6.28

N.B: The preoperative ROM can't be assessed for those patients due to severe pain.

Regarding patients with fracture sequalae, they showed statistically high significant increase in forward flexion from 17.25±4.35 preoperatively to 123.75 ± 24.96 at the final 1 year follow-up (p=0.003). Also, active abduction for those patients showed statistically high significant increase from 14.75 ± 3.40 preoperatively to 102.50 ± 16.58 at final follow-up (p=0.001), while ER significantly increased from 9.0 ± 2.50 preoperatively to 28.75 ± 7.29 at final follow-up 1 year postoperative (p=0.018). For patients with CTA, a statistically high significant increase in forward flexion from 22.00 ± 2.16 preoperatively to 111.75 ± 20.55 at the final 1 year follow-up (p=0.004). Active abduction for patients showed statistically high significance and increased from 18.00 ± 2.45 preoperatively to 98.25 ± 15.78 at final follow-up (p=0.002), while ER for those patients significantly increased from 13.25 ± 3.30 preoperatively to 32.50 ± 9.81 at final follow-up 1 year postoperative (p=0.015). The mean ROM for patients with neglected shoulder dislocation showed significant increase in forward flexion from 22.50 ± 3.54 preoperatively to 115.50 ± 6.36 at the final 1 year follow-up (p=0.014). Active

abduction for patients showed also significant increase from 19.00 ± 2.83 preoperatively to 97.50 ± 3.54 at final follow-up (p=0.029). While ER for those patients increased from 13.00 ± 2.83 preoperatively to 32.50 ± 3.54 at final follow-up 1 year postoperative with no significant difference (p=0.144). On the other hand, for patients with revision after failed hemiarthroplasty, the mean ROM showed no statistically significant difference in forward flexion, active abduction or external rotation when compared preoperatively and at the final 1 year follow-up (p=0.427, p=0.417, p=0.266) respectively as illustrated in **(table, 3 and figure, 3)**

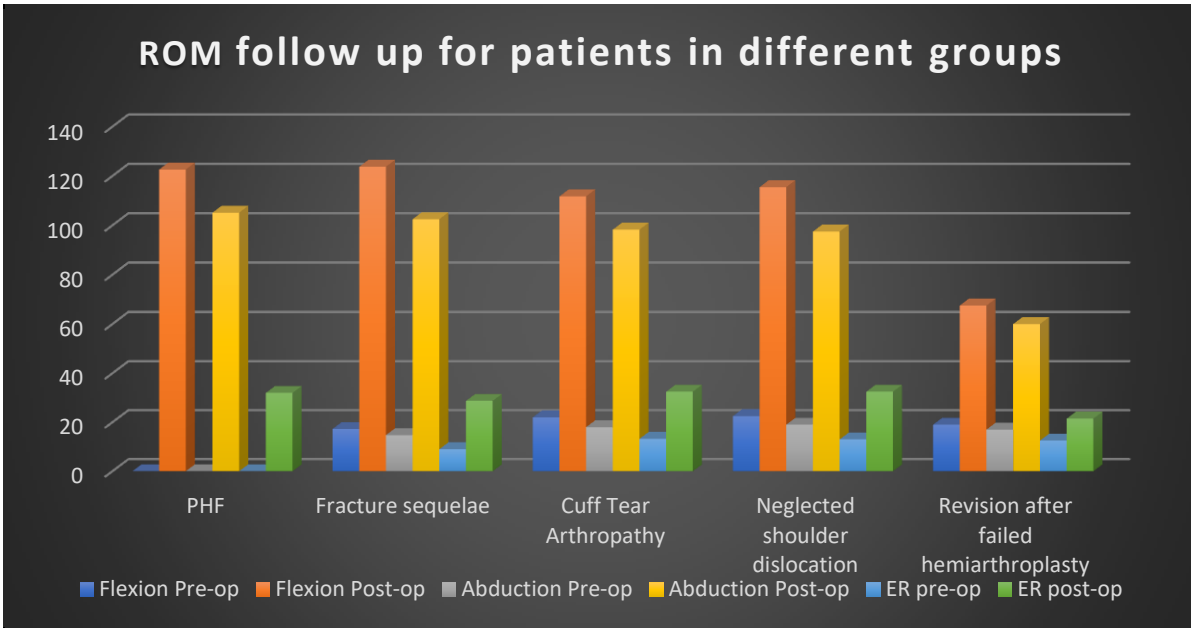

Figure 3: Column chart for ROM follow up for patients in different group

Table 4: Radiological evaluation in the study groups

			N		%
Glenosphere position	Central		7		35%
	Eccentric (Inferior)		13		65%
Glenosphere tilting	Superior		1		5%
	Neutral		5		25%
	Inferior		14		70%
Stem position	Central		17		85%
	Non-Centeral	Valgus	2		10%
		Varus	1		5%
Radiolucent lines (RLL)	Absent		14		70%
	Present		6	3 in zone 7 1 in zone 6 2 in zone 1	30%
Heterotrophic ossification	Absent		16		80%
	Present		4		40%
Notching	Absent		16		80%
	Present (Grade 1)		4		20%

Radiological Results:

All patients were evaluated radiologically regarding glenosphere position and tilting (inclination), stem position, radiolucent lines (RLL) and loosening, heterotrophic ossification and notching. The radiographs obtained immediately after operation and sequentially during period of follow up. Most of patients showed ideal inferior eccentric glenosphere position (65%) and inferior inclination (tilting) of glenosphere (70%). Most of patients had central humeral stem position (85%). RLL) appear in six patients (30%),three in zone 7, one in zone 6 and two in zone 1. RLL less than 2mm and not progress in follow up x-ray with no signs of loosening. Grade 1 heterotrophic ossification appeared in four patients (20%) and four patients (20%) only had grade 1 notching **(table, 4)**

Complications

Two patients (10%) (One was CTA and the other was PHF) showed superficial wound infection which responded effectively to antibiotics with no need for debridement and did not significantly affect shoulder function. Four cases (20%) with scapular notching grade one with no affection of ROM or functional score. Heterotopic Ossification: Four patients (20%) showed grade1 heterotrophic ossification which did not affect the functional score. Six patients (30%) had RLL, three in zone 7, one in zone 6 and two in zone 1. RLL was less than 2mm and not progress in follow up x-ray with no signs of loosening. Three patients (15%) showed non neutral stem position which had mild affection on functional score. Seven patients (35%) show central position of glenosphere but with no affection of functional score, five patients (25%) had neutral tilting with no affection of functional score and one patient (5%) had superior tiling that had mild affection no functional score. One case (5%) of revision after failed hemiarthroplasty developed postoperative axillary nerve injury due to massive dissection and difficulty of stem removal that resolve spontaneously after 3-4 months but affect strength and functional score with poor satisfaction of the patient. Two cases (10%) of dislocation was detected and open reduction done and plastic insert replaced with a larger retentive liner size that made the patient stable (one case was a fracture sequelea and the other one was revision after failed hemiarthroplasty).

Discussion

RSA was now a well-established treatment method to relieve pain & improve function for a variety of shoulder conditions by achieving a stable & medialization of center of rotation to provide functional restoration of shoulder joint depending only on functioning deltoid muscle [(8)]**.** In our study showed that, twenty patients were included, sixty% were males & forty% are females with a mean age of 64.9 ± 9.3. Cases were followed up for 1 year postoperative. Most of the studied patients showed right side affection (60%) which was the dominant arm in all of them. In our study, proximal Humeral Fracture (PHF) was found to represent the most common pathological diagnosis (40%), followed by fracture sequelae (20%) & cuff tear arthropathy (CTA) (twenty%).

The same implant (Zimmer Trabecular Metal RSA) was studied in a larger age group, with the mean age being 76 years in proximal humeral fracture (PHF) cases, showing almost the same improvement in our PHF cases. The mean ER (30) was similar to our study, but less improvement was observed in mean forward elevation (114 degrees) and mean abduction (96 degrees). Oxford Shoulder Score (OSS) was used for follow-up, and the score was 40.3 at 3 years postoperatively. Two patients had dislocations; one of them had post-injury axillary nerve palsy. Aseptic loosening of the stem was noticed in one patient three years after the operation. One patient had a peri-prosthetic fracture distal to the tip of the stem following a fall on the operated side, and one patient had a superficial infection [(9)].

Also, another study for the same implant (Zimmer Trabecular Metal RSA) in but in CTA patient in larger age group with mean age was 76 years with mean ROM improved in Flexion from 58.2° to 106.6°, Abduction from 54.7° to 96.3° and ER from 18.2° to 24.4°. The study had 6.4% (8 patients) revision; four for aseptic mechanical failure of the glenoid, two for dislocation, one for pain and one for deep infection and underwent a two-stage revision. In our study, one patient with scapular notching grade 1 and another patient with superficial infection in the same indication, one had heterotrophic ossification grade one and another one had RLL. Our better result may be our study more recent which helps us to use better techniques also our younger age average (64.9). [(10)]

Another study for the same implant and in CTA patients showed that the mean ROM improved in Forward Flexion from 52.5° to 110°, Abduction improved from 45° to 97.5° and External Rotation improved from 20° to 25° postoperative final follow up. The OSS from 16.5 to 43 [(11)]. This study reported a high incidence scapular notching 63.2% but most of them were grade 1 with no symptoms in all patients. Ten patients (5.2%) were revised. Six of them due to aseptic glenoid loosening, two due to peri-prosthetic infection, one due to instability and last one due to persistent pain with apparent radiological signs of loosening. In the latter case, only the bearing surfaces were exchanged as the glenoid baseplate was discovered to be well fixed during revision surgery with subsequent improvement in the symptoms and outcome scores. The more complication rate in this study is due to larger and longer than our study [(11)].

Another study used medialized design prosthesis Lima reverse shoulder for treatment of sequelae of a proximal humeral fracture patient. The mean CS increased from 28 to 58 (p\0.0001), the mean forward flexion from from forty to one hundred (p\0.0001), abduction from 41 to 95 (p\0.0001), and ER from fifteen to thirty-five (p 0.0001). Six prosthetic dislocations occurred (13.6%). There was one case of glenoid component loosening that was converted to a hemiarthroplasty [(12)].

Case study of rare neglected bilateral posterior shoulder dislocation presented by show improvement in CS from18 to 79, and ROM in forward flexion from less than 90◦ to 170 and external rotation was 45◦ after

18-month follow up, reported more better result than our study with grade 1 scapular notching for neglected bilateral posterior shoulder dislocation [13].

In contrast with our study for revision shoulder arthroplasty, interesting study reported better results in study seven cases underwent revision RSA after hemiarthroplasty in five cases, total shoulder replacement in one case, & reverse shoulder arthroplasty in one case by using medialized protheses designs the Aequalis system (Tornier, Montbonnot Saint Martin, France) and the Biomet system (Biomet, Warsaw, IN, USA). The mean CS improved from 44.8 to 57.1 ($p = 0.018$). ROM improved as mean active forward flexion (from 62.1° to 92.8°), abduction (from 70° to 87.1°), and external rotation (from 44.2° to 47.4°). Performance in 5 of 7 patients were satisfied with the results of revision surgery [14].

Another large comprehensive study examined same design of our study (Zimmer Trabecular Metal RSA) in 140 patients (60% women and 40% men) with pathological background was (63% Rotator cuff arthropathy, 15% Osteo-arthritis, 15% post-trauma, 2.4% revision from HAS, and 2.8% from surface replacement). This study had an older mean age at surgery 72 years compared to our 64.9 years, much longer mean follow up 72 months compared to our 14 months. In this study, mean CS increased from 12.4 to 68.1 ($p<0.05$) compared to ours increased from 13 to 67.5. The radiological outcome of this study found that the overall presence of notching was 3.57% showed radiographic signs of scapular notching at 72 months (grade 1in 4 patients (2.8%), and grade 2 in 1patient). 4.4% had Humeral stems RLL < 2mm. Compared to ours we had 4 patients with scapular notching grade 1 at 12 months follow up detected complications included two glenosphere dislocation, two stitch abscesses and two Acromial fractures in patients who had falls two years after the procedure. Compared to our study we had complications in two cases showing superficial wound infection, one case developed postoperative axillary nerve injury in revision after failed hemiarthroplasty shoulder that resolve spontaneously after 6 months, and two cases of dislocation was detected [15].

Our study has several limitations. These include the short follow-up period, small sample size with different indications, which could limit the accuracy of our study results. Additionally, no control group tasted, and all operations were undertaken in a short period, during which the surgical team and instruments did not change.

RSA has a promising prospect in treating shoulder pathology especially in old age and patient with rotator cuff pathology and tuberosities healing problems that affect rotator cuff function and movement by depending on deltoid function in shoulder movement. It is recommended that future studies need to be done on larger sample size, longer period of follow up and specification of one or two indications.

Conclusion

The study demonstrates that RSA treatment for traumatic fractures and pathological diseases, such as acute proximal humerus fracture, fracture sequalae, neglected

shoulder dislocations, and revision surgery, has shown satisfactory outcomes. Postoperative parameters improved with comparable results to published data, with patient satisfaction and low incidence of notching. The best outcomes after PHF and fracture sequelae were achieved with the best constant score at final follow-up. Revision RSA patients showed the least improvement in clinical outcomes due to more soft tissue release and manipulations. The design's innovation, implementing techniques to decrease notching, resulted in low incidence of notching, no loosening, and low complication rate. Medium-term and long-term results are needed to assess implant survival and detect changes in clinical outcomes over time.

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