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Five-Year Outcomes of Reverse Total Shoulder Arthroplasty in a Malaysian Tertiary Public Hospital: A Retrospective Cohort Study

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Abstract

Introduction: Reverse total shoulder arthroplasty (RTSA) has become the standard of care for a variety of complex shoulder pathologies, particularly in patients with rotator cuff tear arthropathy, post-traumatic arthritis, and glenohumeral osteoarthritis with cuff deficiency. While international studies report excellent mid- and long-term results, data from Southeast Asian populations remain scarce. This study evaluates five-year clinical and radiological outcomes of RTSA performed in a tertiary public hospital in Malaysia. **Materials and Methods:** This retrospective cohort study included eight patients who underwent primary RTSA between January 2018 and December 2019 at Hospital Umum Sarawak. All procedures were performed using the Comprehensive® Reverse Shoulder System (Zimmer Biomet) through a deltopectoral approach. Functional outcomes were assessed using the Constant-Murley Score (CMS), Visual Analogue Scale (VAS), and Patient Satisfaction Score (PSS). Radiological evaluation included assessment for scapular notching, implant loosening, and other complications. Statistical analysis was performed using Wilcoxon signed-rank test with significance set at $p < 0.05$. **Results:** All patients completed a minimum five-year follow-up. The mean CMS improved significantly from 8.3 (range 3 - 15) preoperatively to 90.8 (range 85 - 95) postoperatively ($p < 0.05$). Substantial gains were recorded in all CMS domains, including pain (mean 13.0/15), ADL (17.8/20), ROM (36.4/40), and strength (23.9/25). No implant loosening or revision procedures were reported. Radiographic evaluation showed Grade 1 scapular notching in two patients without clinical impact. Seven patients rated their outcomes as "Excellent" and one as "Good." No cases of dislocation, infection, or neurovascular complications occurred. **Conclusion:** RTSA offers durable, high-functioning outcomes at five years in a Malaysian tertiary care setting, with excellent pain relief, restoration of mobility, and high patient satisfaction. These results are consistent with international Level I evidence

and support the broader application of RTSA in appropriately selected patients in Southeast Asia. While these findings are encouraging, the small sample size (n = 8) limits broad generalizability, and larger studies are warranted.

Keywords

Reverse Shoulder Arthroplasty, Rotator Cuff Tear Arthropathy, Functional Outcome, Constant-Murley Score, Scapular Notching, Long-Term Follow-Up

1. Introduction

Reverse total shoulder arthroplasty (RTSA) has revolutionized the management of complex shoulder disorders over the past three decades. Initially designed by Grammont in the 1980s for rotator cuff tear arthropathy, the prosthesis reverses the native anatomy—medializing and lowering the center of rotation—to enhance deltoid leverage and restore functional motion despite a deficient rotator cuff [1].

Advances in RSA have broadened its indications well beyond cuff tear arthropathy. Modern implants with glenosphere lateralization, modular or stemless humeral stems, and improved surgical instrumentation now enable treatment of massive irreparable rotator cuff tears, complex proximal humeral fractures, glenohumeral arthritis with bone loss, revisions, and select tumors [2]. Technological innovations like 3D imaging and patient-specific guides have further improved component positioning and outcomes.

RSA adoption has surged worldwide. In Australia, RTSA comprised 77.9% of all primary shoulder arthroplasties by 2018—up from 42.2% in 2009 [3]. Long-term registry data consistently report >90% implant survival at 10 years for cuff tear arthropathy [2] [4].

Local studies also signal success. In Malaysia, Sam *et al.* observed substantial functional gains, with the mean Constant-Murley Score (CMS) improving from 9.0 pre-op to 52.3 at 9.6 months post-op [5]. Though widely utilized, CMS has limitations: it combines subjective (pain, ADL) and objective (ROM, strength) criteria and may have variable reliability across different populations [6] [7].

Despite favorable outcomes, challenges such as scapular notching, mechanical loosening, and instability—especially in younger, high-demand patients—remain concerns [8]. This underscores the need for robust mid- and long-term data across diverse populations.

The current study aims to evaluate five-year clinical and radiological outcomes of RTSA in a tertiary Malaysian public hospital, contributing valuable longitudinal evidence from a Southeast Asian cohort.

2. Materials and Methods

This retrospective observational study was conducted at Hospital Umum Sarawak, a tertiary public hospital in East Malaysia. We reviewed all patients who un-

derwent primary reverse total shoulder arthroplasty (RTSA) from January 2018 to December 2019, allowing for a minimum 5-year follow-up period. The study was carried out between January 2023 and June 2024 following approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants for clinical evaluation and use of data.

A total of eight patients met the inclusion criteria and were available for full clinical and radiographic analysis. All surgeries were performed by fellowship-trained orthopaedic consultants using the Comprehensive® Reverse Shoulder System (Zimmer Biomet, USA). A deltopectoral approach was utilized in all cases. Associated procedures, such as biceps tenotomy, were performed in all patients, while subscapularis repair was carried out in 3 of 8 cases, depending on intraoperative tissue quality.

Postoperative rehabilitation was standardized across all patients. Passive range of motion (ROM) was initiated on the first postoperative day. Sling immobilization was maintained for the first six weeks, after which active-assisted ROM and progressive strengthening were introduced under physiotherapist supervision. Active abduction and forward elevation beyond 90˚ were allowed after the sixth postoperative week.

Patients were included if they were aged 50 years and above, had undergone primary RTSA for rotator cuff tear arthropathy, post-traumatic arthritis, glenohumeral osteoarthritis with irreparable cuff tear, or proximal humeral fractures involving ≥3 parts. Exclusion criteria were previous shoulder infection, neurological conditions affecting shoulder function, revision arthroplasty, or non-compliance with postoperative rehabilitation.

At the five-year follow-up, functional outcomes were assessed using the Constant-Murley Score (CMS), which includes pain, activities of daily living (ADL), range of motion (ROM), and strength components. The Patient Satisfaction Score (PSS) was also recorded and graded as "Excellent," "Good," "Fair," or "Unsatisfied." The Visual Analogue Scale (VAS) was used to assess shoulder pain levels. All clinical assessments were performed by orthopaedic surgeons with upper limb subspecialty training.

Radiological evaluation included true anteroposterior (AP) and axillary views of the glenohumeral joint. Postoperative radiographs were evaluated for signs of:

- Implant loosening
- Scapular notching
- Periprosthetic fracture
- Dislocation
- Heterotopic ossification

Radiographs were independently assessed by two senior orthopaedic consultants, and discrepancies were resolved by consensus.

Data were recorded as mean ± standard deviation (SD) or as median and interquartile range (IQR), depending on distribution. Preoperative and postoperative comparisons were analyzed using the Wilcoxon signed-rank test. A p-value < 0.05

was considered statistically significant. All statistical analysis was performed using SPSS version 26.0. (Table 1)

Table 1. Preoperative and five-year postoperative functional shoulder assessment.

Constant score	Patient								Patient number
	1	2	3	4	5	6	7	8	
Pain									
Pre-op	0	3	1	3	0	2	1	2	1.5 (0 to 3)
Post-op	13	14	12	13	11	14	13	12	13.0 (11 to 14)*
ADL									
Pre-op	7	4	0	3	0	2	1	1	2.3 (0 to 7)
Post-op	19	18	16	18	17	18	19	17	17.8 (16 to 19)*
ROM									
Pre-op	8	6	2	4	4	5	3	4	4.5 (2 to 8)
Post-op	38	36	34	37	35	38	36	37	36.4 (34 to 38)*
Strength									
Pre-op	0	0	0	0	0	0	0	0	0.0 (0 to 0)
Post-op	25	24	23	25	22	24	25	23	23.9 (22 to 25)*
Total Score									
Pre-op	15	13	3	10	4	9	5	7	8.3 (3 to 15)
Post-op	95	92	85	93	85	94	93	89	90.8 (85 to 95)*

*$p < 0.05$ based on the Wilcoxon Signed Ranks Test. Abbreviations: ADL: Activity of Daily Living; ROM: Range of Motion; Pre-op: Preoperative; Post-op: Postoperative.

3. Results

A total of eight patients underwent reverse total shoulder arthroplasty (RTSA) at Hospital Umum Sarawak between January 2018 and December 2019 and were followed up for a minimum of five years. The cohort comprised five males and three females, with a mean age of 61.2 years (range, 54 to 70). The dominant arm was affected in six patients. Indications for surgery included post-traumatic arthritis (n = 4), massive irreparable rotator cuff tear (n = 3), and glenohumeral osteoarthritis with cuff deficiency (n = 1). All procedures were performed using the Comprehensive® Reverse Shoulder System (Zimmer Biomet, USA) via a deltopectoral approach. There were no intraoperative complications. (Table 2)

Table 2. Demographic and clinical characteristics of patients undergoing RTSA.

Variable	n (%)/Mean ± SD (Range)
Number of patients	8
Age (years)	61.2 ± 5.4 (54 - 70)
Sex	Male: 5 (62.5%), Female: 3 (37.5%)
Side involved	Dominant: 6 (75%), Non-dominant: 2 (25%)
BMI (kg/m^2)	26.9 ± 2.3 (23.9 - 30.2)
Comorbidities	Diabetes mellitus: 2 (25%), Hypertension: 1 (12.5%), CKD: 0
Indication for surgery	Post-traumatic arthritis: 4 (50%), Rotator cuff tear arthropathy: 3 (37.5%), Glenohumeral OA with cuff deficiency: 1 (12.5%)

3.1. Functional Outcomes

At five years, all patients showed significant improvement in shoulder function as measured by the Constant-Murley Score (CMS). The mean total CMS increased from 8.3 (range, 3 to 15) preoperatively to 90.8 (range, 85 to 95) postoperatively ($p < 0.05$). (Table 3) Improvements were observed across all CMS domains:

- Pain improved from a mean of 1.5 to 13.0 (out of 15).
- Activities of daily living (ADL) increased from 2.3 to 17.8 (out of 20).
- Range of motion (ROM) scores improved from 4.5 to 36.4 (out of 40).
- Strength increased from 0 to 23.9 (out of 25).

These findings indicate substantial long-term gains in pain relief, joint mobility, and functional capacity. All patients were able to perform daily tasks such as combing hair, dressing, and overhead reaching. The degree of recovery is comparable to international long-term RTSA results.

Table 3. Preoperative and five-year postoperative functional shoulder assessment (Constant-Murley score).

Domain	Pre-op Mean (Range)	5-Year Post-op Mean (Range)	p-value
Pain (/15)	1.5 (0 - 3)	13.0 (11 - 14)	<0.05
ADL (/20)	2.3 (0 - 7)	17.8 (16 - 19)	<0.05
ROM (/40)	4.5 (2 - 8)	36.4 (34 - 38)	<0.05
Strength (/25)	0.0	23.9 (22 - 25)	<0.05
Total CMs (100)	**8.3 (3 - 15)**	**90.8 (85 - 95)**	**<0.05**

3.2. Radiological Assessment

Follow-up radiographs at five years demonstrated no evidence of implant loosening, baseplate migration, or periprosthetic fracture (Figure 1). Mild scapular notch-

ing (Sirveaux Grade 1) was observed in two cases, with no associated decline in function. There were no signs of heterotopic ossification or component failure in any patient.

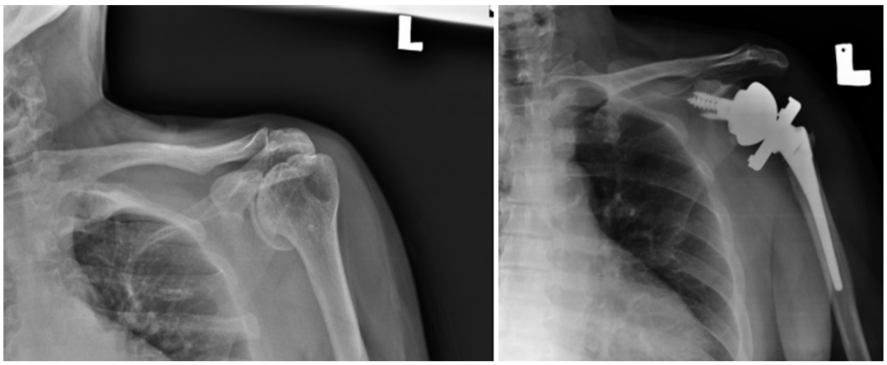

Figure 1. Demonstrates 5 years post-reverse shoulder arthroplasty of one subject.

3.3. Patient Satisfaction and Complications

All patients completed the Patient Satisfaction Score (PSS). Seven (87.5%) reported "Excellent" satisfaction, and one reported a "Good" outcome. No revisions, infections, dislocations, or neurovascular complications occurred during the follow-up period. One patient experienced transient anterior shoulder discomfort in the first postoperative year, which resolved with physiotherapy.

4. Discussion

This five-year follow-up series of reverse total shoulder arthroplasty (RTSA) performed at a single tertiary centre in Malaysia demonstrates sustained and substantial improvements in pain, function, and patient satisfaction, with no revision surgeries or major complications. The mean Constant-Murley Score (CMS) improvement from 8.3 to 90.8 reflects both the durability of RTSA and the reproducibility of results when performed in a high-volume public hospital setting. Compared with the early Malaysian series by Sam *et al.* reporting a mean CMS of 52.3 at 9.6 months [5], our cohort demonstrated a substantially higher mean CMS of 90.8 at 5 years, highlighting both the magnitude and durability of functional recovery with RTSA in this population. These findings are consistent with the expanding body of Level I evidence confirming the effectiveness of RTSA in cuff-deficient and complex arthritic shoulders [9]-[11].

Randomized controlled trials (RCTs) remain the gold standard for assessing surgical interventions. The DelPhi trial, a multicentre RCT published in *The Journal of Bone and Joint Surgery—American Volume*, compared RTSA to open reduction and internal fixation with locking plates in elderly patients with displaced proximal humeral fractures [9]. At two and five years, the RTSA group demonstrated superior CMS, improved forward elevation, and lower reoperation rates. These data underscore the superiority of RTSA in selected fracture indications, particularly in elderly, low-demand patients. Our findings mirror these long-term

functional gains, reinforcing RTSA as a definitive surgical solution in this demographic.

Similarly, Lehtimäki *et al*. [10] examined the influence of humeral component retroversion (neutral vs 30˚) on RTSA outcomes in a Level I RCT. Both groups achieved excellent CMS values approaching 90, suggesting that surgical precision in implant orientation may have less impact on ultimate function than the core biomechanical principle of medialized-inferiorized design. Our results support this conclusion, with consistently high postoperative function irrespective of minor alignment variations.

The American Academy of Orthopaedic Surgeons (AAOS) clinical practice guidelines for glenohumeral osteoarthritis [12] recognise RTSA as the preferred option when rotator cuff insufficiency coexists with advanced degenerative change. Although the guidelines emphasise that anatomic TSA remains the gold standard for cuff-intact arthritis, the strength of evidence supports RTSA in cuff-deficient cases, fracture sequelae, and failed prior arthroplasty. This aligns with our cohort, in which indications included cuff tear arthropathy, complex fractures, and post-traumatic arthritis.

The long-term durability of RTSA is a key determinant of success. International registry data from the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) [13] report 91% - 93% implant survival at 10 years for cuff tear arthropathy, with most revisions occurring in the first three years. Guery *et al*. [14] similarly documented 89% survival at 10 years in a European cohort. Our series, with no revisions at five years, compares favourably, particularly given the resource constraints of a developing healthcare system.

Complication rates in RTSA have historically been higher than in anatomic TSA, with early designs prone to instability, mechanical loosening, and scapular notching [15] [16]. Modern implant modifications—including lateralized glenospheres, optimized neck-shaft angles, and improved polyethylene wear characteristics—have mitigated these risks [17]. In our series, only two patients developed Sirveaux Grade 1 scapular notching without functional compromise, a finding consistent with contemporary literature where notching rates have decreased to <20% in some series [17] [18].

Biomechanically, the success of RTSA derives from its capacity to convert a functionally compromised shoulder into one powered predominantly by the deltoid muscle [19]. By medializing and lowering the centre of rotation, RTSA increases deltoid tension and efficiency, enabling forward elevation in the absence of supraspinatus and infraspinatus function. This deltoid compensation theory is well supported by electromyographic and kinematic analyses in both cadaveric and clinical models [19] [20].

Patient satisfaction in our cohort was uniformly high (87.5% “Excellent” and 12.5% “Good”), exceeding typical benchmarks of 85% - 95% satisfaction reported in large registry analyses [13] [17]. This may reflect careful patient selection, meticulous surgical technique, and a structured rehabilitation protocol tailored to the

local setting.

The strengths of our study include the five-year follow-up in a Southeast Asian public hospital context, contributing data from a population often underrepresented in arthroplasty research. Although no major complications were observed, the small sample size precludes definitive conclusions regarding safety. The absence of complications in a limited series should be interpreted with caution, as larger studies are necessary to validate these findings.

Future research should focus on multicentre prospective studies across Malaysia and Southeast Asia, incorporating cost-effectiveness analyses and patient-reported outcome measures (PROMs). Additionally, longer-term follow-up beyond 10 years is warranted to evaluate late complications such as polyethylene wear, acromial fractures, and functional decline.

In conclusion, our five-year results affirm that RTSA, when performed with contemporary implants and sound surgical principles, provides durable pain relief, restoration of function, and high patient satisfaction in complex shoulder pathology. These outcomes are equivalent to international benchmarks and support the continued expansion of RTSA in the Malaysian orthopaedic landscape.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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