

Design Implications

A 12 Year Review of a Lateralized Implant

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Disclosure

Dr. Frankle is a paid consultant for and receives royalties from DJO Surgical

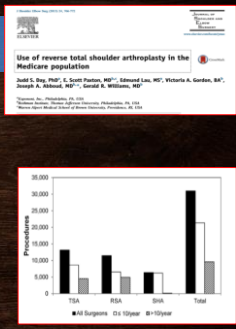
Background

- Reverse shoulder arthroplasty(RSA) was FDA approved in 2003 for treatment of cuff tear arthropathy (CTA)
- Indications continue to expand
 - CTA¹
 - 4 part fracture²
 - Type B2 glenoid³
 - Revision of failed arthroplasty⁴



Background

- Over 22,000 RSA performed in 2011
- Projected to grow to over 80,000 in 2020
- Revision rate and outcome following revision is unknown



Purpose

- To evaluate the rate of RSA revision as it is influenced by primary diagnosis & implant design features
- To discuss surgical management of failed Reverse Shoulder Arthroplasties
- To report outcomes following revision of patients with a minimum of 24 month follow-up

Study Design

PRIMARY INDICATIONS for RSA PERFORMED by M.A.F. 2000 - 2012	
Cuff Tear Arthropathy	649 (45.8%)
Failed Rotator Cuff Surgery	294 (20.7%)
Failed Hemiarthroplasty	251 (17.7%)
Failed Total Shoulder Arthroplasty	105 (7.4%)
Fracture (acute/malunion)	79 (3.8%)
Failed ORIF	14 (1%)
Other	26 (1.8%)
Total	1418

Of these, we identified 85 patients requiring removal or exchange of components

Study Design

For each of the 85 patients, we determined:

- Indication to reoperate
- Intraoperative management
- Outcome following revision surgery

Study Design

Indications placed into seven categories:

1. glenoid baseplate failure (35/85)
2. glenosphere dissociation (8/85)
3. humeral dissociation (10/85)
4. glenohumeral dislocation (6/85)
5. aseptic humeral loosening (4/85)
6. periprosthetic fracture (6/85)
7. infection (18/85)

*2 patients fit into two categories

Modes of Failure: Baseplate Failure

- Radiographic changes in the baseplate position over time combined with presence of broken screws (35/85)



- January 2000 – January 2004 (31/85)
 - 4 - 3.5mm non-locking peripheral screws (31/242)
- February 2004 – December 2012 (4/85)
 - 4 - 5.0mm locking screws (4/1176)

Modes of Failure: Glenosphere Dissociation

- Isolated failure of the Morse taper engagement to the baseplate (8/85)
 - January 2000 – August 2005 (5/85)
 - no central hole in glenosphere (5/381)
 - August 2005 – December 2012 (3/85)
 - central hole present in glenosphere (3/1037)



Modes of Failure: Humeral Dissociation

- Radiographic separation of metaphyseal shell from humeral stem (10/85)
 - January 2000 – June 2005 (8/85)
 - modular polyethylene socket (8/392)
 - June 2005 – December 2012 (2/85)
 - modular metal metaphyseal shell with a polyethylene insert (2/1026)



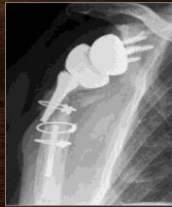
Modes of Failure

- Aseptic Humeral loosening
 - Radiographic grossly loose stem without signs of infection (4/85)



Modes of Failure

- Periprosthetic Fracture
 - Fractures requiring removal or exchange of the reverse prosthesis (6/85)



Modes of Failure

- Glenohumeral dislocation
 - Radiographic loss of articulation between the glenosphere and humeral socket (6/85)



Modes of Failure

- Elevated preoperative inflammatory markers (CBC, ESR, CRP)
- Physical exam (erythema, drainage, sinus)
- Intraoperative findings
- Pathology
 - Frozen section
 - Culture
- 18/85 patients



Indications categorized when at least 2/3 reviewers agreed upon the primary reason for revision

Methods: Surgical Management

Operative reports were reviewed to understand surgical strategies utilized by the senior author

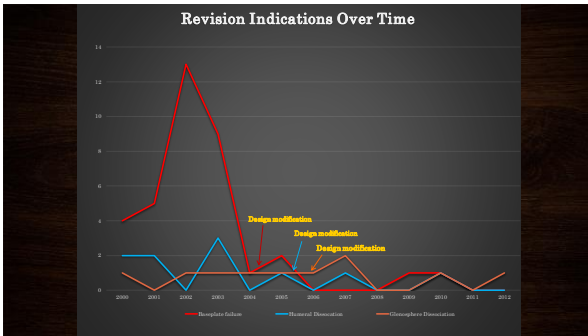
Methods: Outcome Measures

- ASES
- Simple Shoulder Test (SST)
- Range of Motion

Results

Indications for RSA performed by M.A.F. (2000 – 2012) Primary vs. Revisions

	Total (2000-2012)	Failed (2000-2012)
GENDER		
Female	853 (60.2%)	48 (56.5%)
Male	563 (39.7%)	37 (43.5%)
Age		
	69.8±10.3	66.7±10.7
PRIMARY DIAGNOSIS		
Primary CTA	649 (45.8%)	26 (4%)
Failed RCR	294 (20.7%)	18 (6.1%)
Failed HA	251 (17.7%)	26 (10.4%)
Failed TSA	105 (7.4%)	8 (7.6%)
Proximal Humerus Fracture	79 (3.8%)	3 (3.8%)
Failed ORIF	14 (1%)	0 (0%)
Other*	26 (1.8%)	4 (15.4%)
Total	1418	85

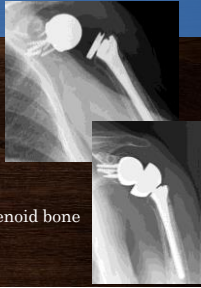


Results

Indication	Implant design iteration	Failed/Total	Percentage failed	p-value
Failed BP	non-locking screws	81/242	12.8%	p < 0.0001
	locking screws	4/1176	0.3%	
Humeral dissociation	all PE modular socket	8/381	2.1%	p = 0.000751
	metal metaphyseal shell modular socket with PE insert	2/1037	0.2%	
Glenosphere dissociation	without central hole	5/392	1.3%	p = 0.042309
	with central hole	3/1026	0.3%	

Results – Surgical Approach: Baseplate Failure

- Removal of glenosphere & baseplate.
 - Broken screws were left in the glenoid.
- A new baseplate with 5.0mm locking screws was implanted in **34/35** patients.
 - Glenosphere was exchanged for a larger size in **29/34** patients.
- **1** patient required conversion to HA due to glenoid bone loss



Results – Surgical Approach: Glenosphere Dissociation

- Isolated glenosphere exchange performed for **3/8** patients
 - 2/3 kept the same size, 1/3 got a smaller size



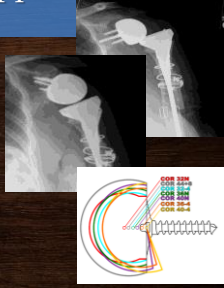
Results – Surgical Approach: Humeral Dissociation

- Exchanged to a new metal-backed socket



Results – Surgical Approach: Dislocation

- Glenosphere exchanged to larger sphere in **4/5** patients.



Results – Surgical Approach: Humeral Loosening

- All patients with humeral loosening had bone loss extending into the metaphysis.
- **3/4** patients received proximal humeral allograft secured with cerclage wires.
- A longer humeral stem was then cemented in place.



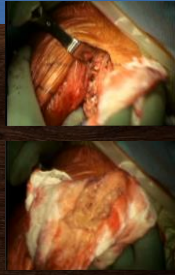
Results – Surgical Approach: Periprosthetic Fracture

- Removal of humeral component & placement of cerclage wires around fracture site.
- Longer cemented humeral stem was implanted.
- Proximal humeral allograft utilized in **3/6** patients.



Results – Surgical Approach: Infection

- 13/18 one-stage revisions
- 5/18 two-stage revisions
- 3 patients elected not to undergo second stage
- 1 patient had recurrent infection after single stage revision



Results: Outcomes

58/85 patients had ≥2 year follow up

	Pre-op	Post-op	p-value
ASES Total	45.6	52.9	0.047
FF	74	97	0.011
AB	71	91	0.013
ER	22	25	0.954
IR	2.6	3.3	0.126
SST Total	2.6	4.4	0.003

Conclusion

- Implant modifications have led to decreasing instances of baseplate failure, glenosphere dissociation, & humeral dissociation
- Patients exhibit significant clinical improvements following revision