

**Current Concepts:
Proximal Humerus Fractures**

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CHRISTIANA CARE
HEALTH SYSTEM

Disclosures on AAOS website: None pertinent

Proximal Humerus Fractures

- Nomenclature
- The case for non-surgical management
- Fracture patterns worthy of surgical consideration
- The surgical options
 - ORIF
 - Reverse TSR
 - IM Rod
 - Hemiarthroplasty

**Proximal Humerus Fractures
My Strong Opinion #1**

The Reverse TSA for fracture is a technique that has come “of age” and should be in the wheelhouse of AN orthopaedic surgeon at every hospital



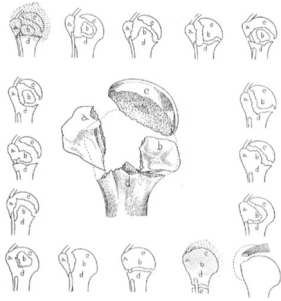
Proximal Humerus Fractures

My Strong Opinion #2

Use of Hemi-Arthroplasty for fracture is a technique that should only be attempted by an experienced, high volume shoulder fracture surgeon

Nomenclature

- Codman: 4 anatomical segments 1934



Nomenclature

- Neer

NEER'S CLASSIFICATION

Displacement defined as greater than 45 degrees of angulation or 1 cm of separation.










- 1-One part fracture – No displacement or angulation less than 45 degrees or separation less than 1cm
- 2-Two part fracture – Displacement of one fragment
- 3-Three part fracture – Displacement of two individual fragments from remaining humerus
- 4-Four part fracture – Displacement of all four segments
- 5-there is dislocation (anterior or posterior) regardless number of displaced segment

	2 part	3 part	4 part
Anatomical neck			
Surgical neck			
Greater tuberosity			
Lesser tuberosity			
Fracture dislocation anterior			
Fracture dislocation posterior			

ShoulderDoc.co.uk

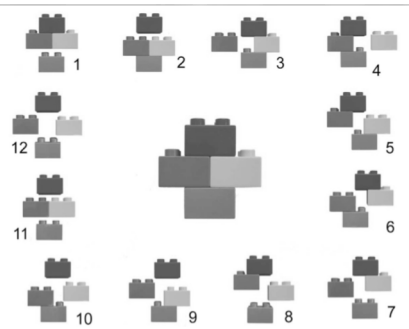
Nomenclature

- AO

Group A	Group B	Group C
 A1 tuberosity	 B1 w/ metaphyseal impaction	 C1 w/ slight displacement
 A2 impacted metaphyseal	 B2 w/o metaphyseal impaction	 C2 impacted w/ marked displacement
 A3 non-impacted metaphyseal	 B3 w/ GH dislocation	 C3 dislocated

Nomenclature

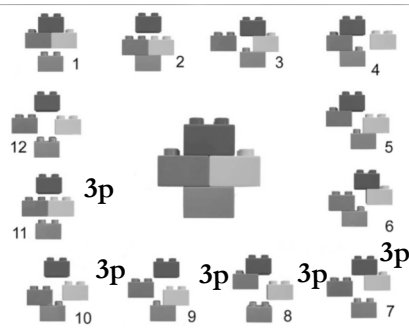
- Hertel



Diagrams 1-12 illustrating Hertel classification of acromioclavicular joint injuries. Diagrams 1-4 show various degrees of acromioclavicular joint separation. Diagrams 5-7 show coracoclavicular ligament injuries. Diagrams 8-12 show combinations of acromioclavicular and coracoclavicular ligament injuries.

Nomenclature


- Hertel



Diagrams 1-12 illustrating Hertel classification of acromioclavicular joint injuries, with '3p' labels indicating partial ligament tears. Diagrams 1-4 show various degrees of acromioclavicular joint separation. Diagrams 5-7 show coracoclavicular ligament injuries. Diagrams 8-12 show combinations of acromioclavicular and coracoclavicular ligament injuries, with '3p' labels indicating partial ligament tears.

Gerber, 2005

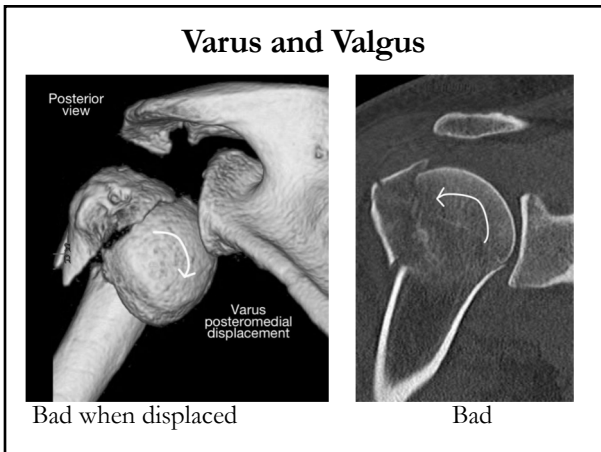
'Unfortunately, all these classification systems have failed to show that a fracture belonging to a particular group has a distinctly different prognosis, requires a different treatment, or has a different outcome.'



Nomenclature

- Mayo

Surgical Neck (SN)	Isolated	SN
	With fractured tuberosities	SN-GT, SN-LT, SN-BT
Tuberosity fractures	Isolated	GT
	In the setting of anterior dislocation	GT-A
	Isolated	LT
	In the setting of posterior dislocation	LT-P
Varus posteromedial	Intact tuberosities	VPM
	Fractured tuberosities	VPM-GT, VPM-LT, VPM-BT
Valgus	Intact tuberosities	VI
	Fractured tuberosities	VI-GT, VI-LT, VI-BT
Head fracture or dislocation	Head splitting	HS
	Head impaction	HI
	Head dislocation	HD



Nomenclature: Who wins?

- ICD-10

ICD10 Code	Description
S42.224D	2 part nondisplaced fracture of surgical neck of right humerus, subsequent encounter for fracture with routine healing
S42.224G	2 part nondisplaced fracture of surgical neck of right humerus, subsequent encounter for fracture with delayed healing
S42.224K	2 part nondisplaced fracture of surgical neck of right humerus, subsequent encounter for fracture with nonunion
S42.224P	2 part nondisplaced fracture of surgical neck of right humerus, subsequent encounter for fracture with malunion
S42.224S	2 part nondisplaced fracture of surgical neck of right humerus, sequela
S42.231A	3 part fracture of surgical neck of right humerus, initial encounter for closed fracture
S42.231B	3 part fracture of surgical neck of right humerus, initial encounter for open fracture
S42.231D	3 part fracture of surgical neck of right humerus, subsequent encounter for fracture with routine healing
S42.231G	3 part fracture of surgical neck of right humerus, subsequent encounter for fracture with delayed healing
S42.231K	3 part fracture of surgical neck of right humerus, subsequent encounter for fracture with nonunion
S42.231P	3 part fracture of surgical neck of right humerus, subsequent encounter for fracture with malunion
S42.231S	3 part fracture of surgical neck of right humerus, sequela
S42.241A	4 part fracture of surgical neck of right humerus, initial encounter for closed fracture
S42.241B	4 part fracture of surgical neck of right humerus, initial encounter for open fracture
S42.241D	4 part fracture of surgical neck of right humerus, subsequent encounter for fracture with routine healing

Surgical Care: Key Question

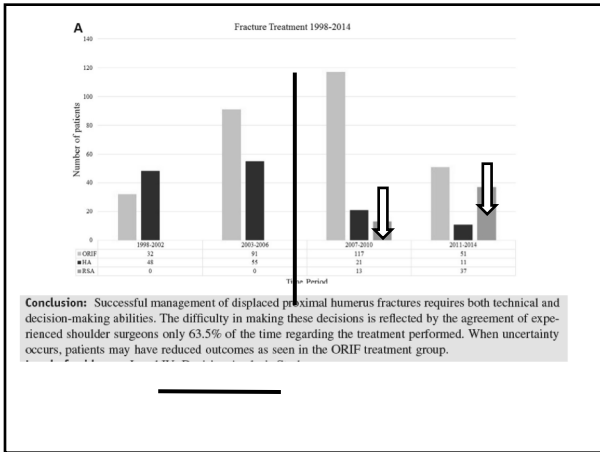
The pattern and the displacement of a given fracture in a given patient, guides the management decision

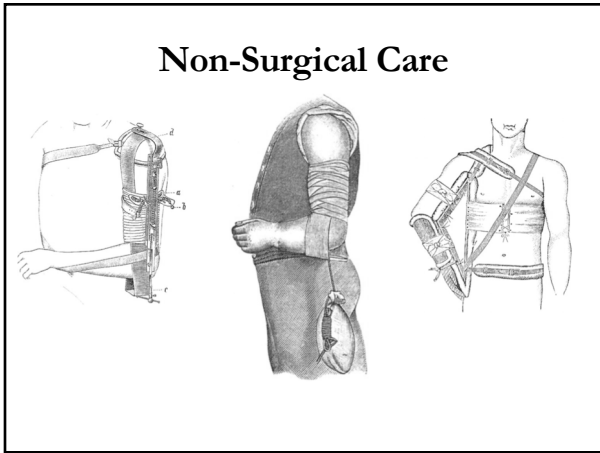


Difficulty in decision making in the treatment of displaced proximal humerus fractures: the effect of uncertainty on surgical outcomes

Joey LaMartina II, MD¹, Kaitlyn N. Christmas, BS², Peter Simon, PhD^{3,4}, Jonathan J. Streit, MD⁵, Jesse W. Allert, MD⁶, Jonathan Clark, MD⁷, Randall J. Otto, MD⁸, Adham Abdelfattah, MD⁹, Mark A. Mighell, MD⁹, Mark A. Frankle, MD^{9,*}

- 2 shoulder surgeons
 - 476 proximal humerus fx (1998-2014)
 - ORIF, HA, and Reverse
- Created 274 clinical Vignettes





Original Investigation JAMA Surgery

Surgical vs Nonsurgical Treatment of Adults With Displaced Fractures of the Proximal Humerus

The PROFHER Randomized Clinical Trial

Amar Rangan, FRCS(Tr&Orth), Helen Handoll, DPhil, Stephen Brealey, PhD, Laura Jefferson, PhD, Ada Keding, MSc, Belen Corbacho Martin, MSc, Lorna Goodchild, MSc, Ling-Hsiang Chuang, PhD, Catherine Hewitt, PhD, David Torgerson, PhD, for the PROFHER Trial Collaborators

CONCLUSIONS AND RELEVANCE Among patients with displaced proximal humeral fractures involving the surgical neck, there was **no significant difference** between surgical treatment compared with nonsurgical treatment in patient-reported clinical outcomes over 2 years following fracture occurrence. These results do not support the trend of increased surgery for patients with displaced fractures of the proximal humerus.

250 Randomized

125 Randomized to surgical group

- 109 Received surgery as randomized
- 16 Did not receive surgery as randomized
- 8 Patient changed mind
- 6 Patient unfit for surgery
- 2 Difference of opinion with treating surgeon

30 Centers performed surgery (median of 3 patients per center; IQR, 1-5 patients)

66 Surgeons (median of 1 patient per surgeon; IQR, 1-2 patients)

165 Physiotherapists (median of 5 sessions for each physiotherapist; IQR, 2-8 sessions)

125 Randomized to nonsurgical group

- 123 Did not receive surgery as randomized
- 2 Received surgery
- 1 Patient changed mind
- 1 Surgeon changed mind

27 Centers provided conservative treatment (median of 4 patients per center; IQR, 2-6 patients)

2 Surgeons (median of 1 patient per surgeon; IQR, 1-3 patients)

183 Physiotherapists (median of 4 sessions for each physiotherapist; IQR, 2-8 sessions)

Surgical Care: Key Question

'There is one very striking thing about fractures of the humerus, and that is that most cases eventually recover pretty good use of their shoulders in spite of any kind of treatment.' Ernest Amory Codman

Surgical Care: Key Answer



But what about the money?

	CPT	RVU	Pay	Ratio
Non-Op	23605	13.19	\$474.84	1.00
ORIF Prox Hum	23615	25.42	\$915.12	1.93
ORIF GT	23630	22.4	\$806.40	1.70
Hemi for fx	23616	35.76	\$1,287.36	2.71
TSR	23472	42.01	\$1,512.36	3.18

But what about the cost?

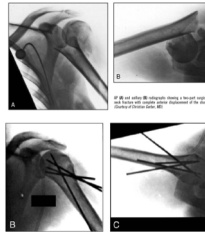
	Cost
Suture Anc	\$1,350
IM Rod	\$2,750
Plate/Screws	\$3,250
Fx Hemi	\$6,000
Fx RTSR	\$12,000

Percutaneous Pinning: (not me)

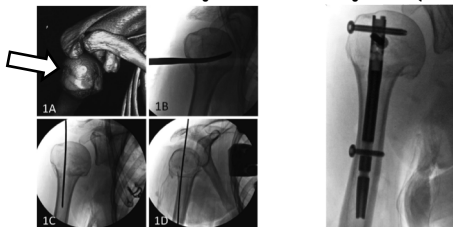
PERCUTANEOUS TREATMENT OF PROXIMAL HUMERUS FRACTURES

PETER J. MILLET, MD, MSc
JON J.P. WARNER, MD

- "Ideal Indication"
 - 2 part surgical neck fracture with **Marked** Displacement
- Contraindication
 - Osteopenia
 - Comminution
 - Unable to tolerate the post op immobilization



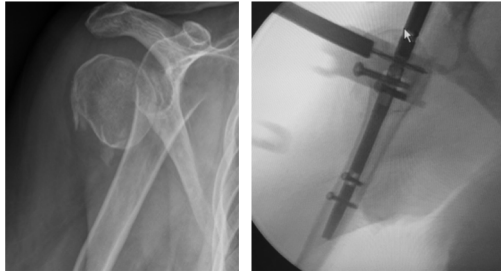
Intramedullary Nail: Maybe (not me)



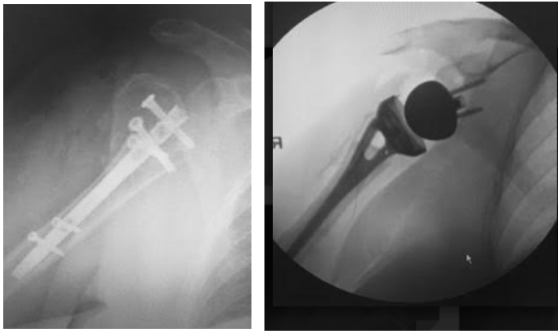
J Bone Joint Surg. 2011 Dec;93B(12):1241-7. doi: 10.1016/j.jbs.2010.12.010. Epub 2011 Mar 21.
Surgical treatment of displaced proximal humerus fractures with a short intramedullary nail.
Millet PJ¹, Warner JJ, Warner JM, Warner JP.
© Author information

- 18 patients
 - 50% had malunions, FF 118, 7 patients had reoperation

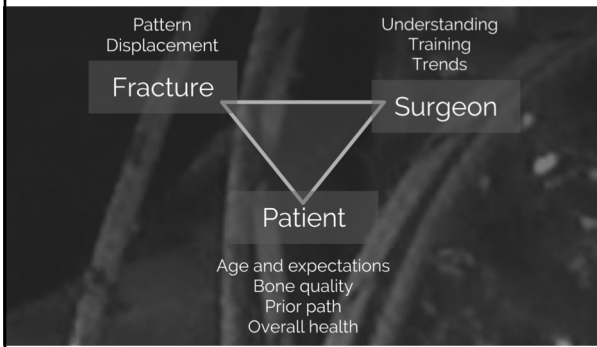
Intramedullary Nail: Maybe (not me)

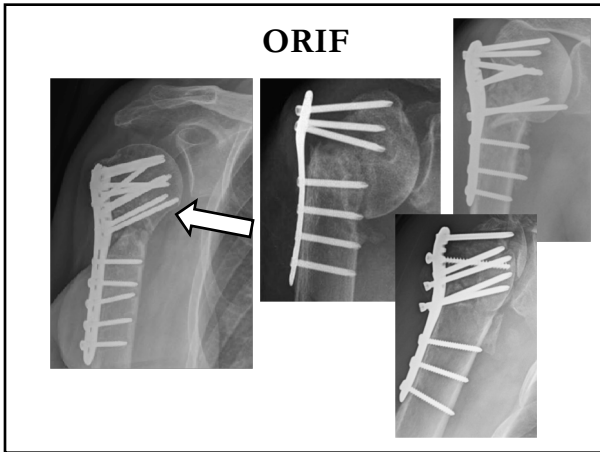


Intramedullary Nail: Maybe (not me)



ORIF





Humeral Augmentation

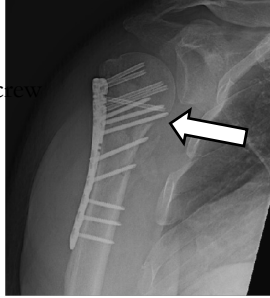
- Fibula strut: Out of favor due to difficulty with revision

Humeral Augmentation

- Fibula strut: Out of favor due to difficulty with revision
- ICBG: Go for the gold

Humeral Augmentation

- Fibula strut: Out of favor due to difficulty with revision
- ICBG: Go for the gold
- Injectables through the scapula



Complications after ORIF

Complications Associated with Locking Plate of Proximal Humerus Fractures

[Venkat Kavuri](#), [Blake Rowden](#), [Neil Kumar](#), and [Doug Cervink](#)

Department of Orthopaedic Surgery, Drexel University College of Medicine, Hahnemann University Hospital, Philadelphia, PA, USA

Address for correspondence: Dr. Venkat Kavuri, Department of Orthopaedic Surgery, Drexel University College of Medicine, Hahnemann University Hospital, 245 N. 15th St. M.S. 420, Philadelphia, PA 19102, USA. E-mail: vkavuri@vcmail.com

Intraarticular screw penetration (9.5%)

Varus collapse (6.8%)

Subacromial impingement (5.0%)

Avascular necrosis (4.4%)

Reoperations (13.8%)

HA vs Reverse TSR

J Shoulder Elbow Surg, 2013 Jan;22(1):32-7. doi: 10.1016/j.jse.2012.03.006. Epub 2012 May 29.

Functional outcomes of reverse shoulder arthroplasty compared with hemiarthroplasty for acute proximal humeral fractures.

Boyle MJ¹, Youn SM, Frampton CM, Ball CM.

CONCLUSIONS: Patients with acute proximal humeral fractures who undergo RSA appear to achieve superior 5-year functional outcomes compared with patients who undergo hemiarthroplasty.

J Shoulder Elbow Surg, 2014 Oct;23(10):1419-26. doi: 10.1016/j.jse.2014.06.035. Epub 2014 Jul 30.

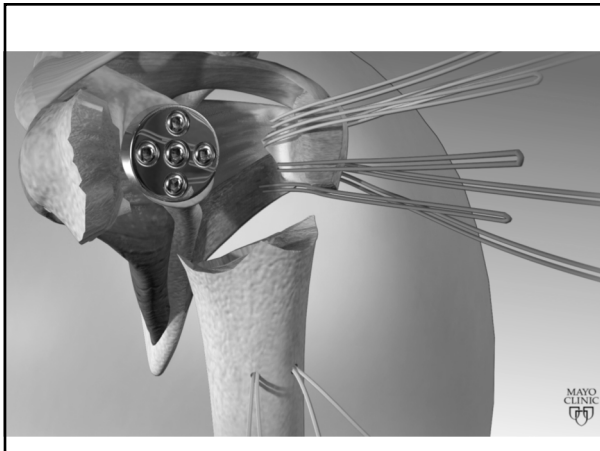
Reverse shoulder arthroplasty versus hemiarthroplasty for acute proximal humeral fractures. A blinded, randomized, controlled, prospective study.

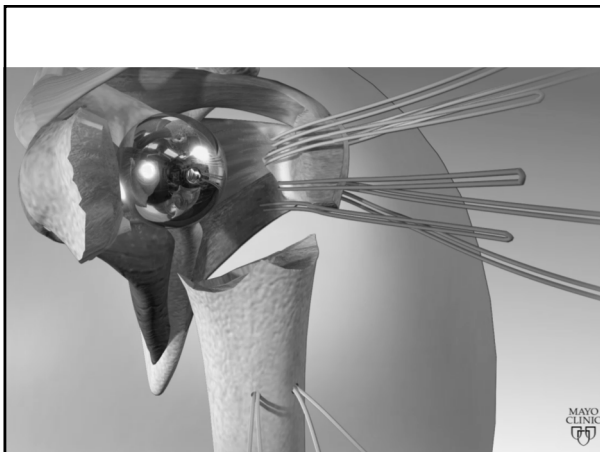
Sebastião-Fernandes R¹, Gabriel-Gómez R¹, Linares-Utrilla A², Gil-Quillón V².

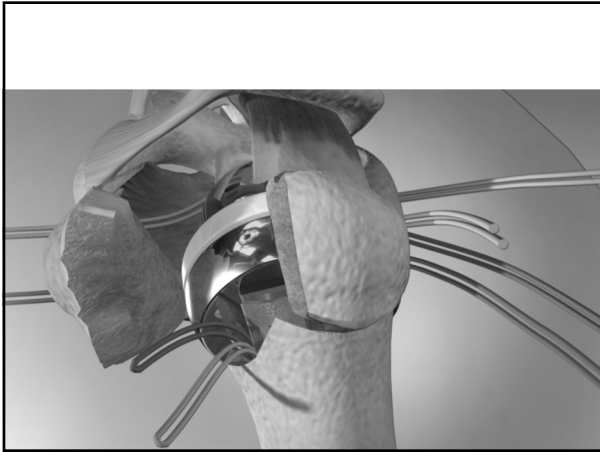
¹ Instituto de Rehabilitación y

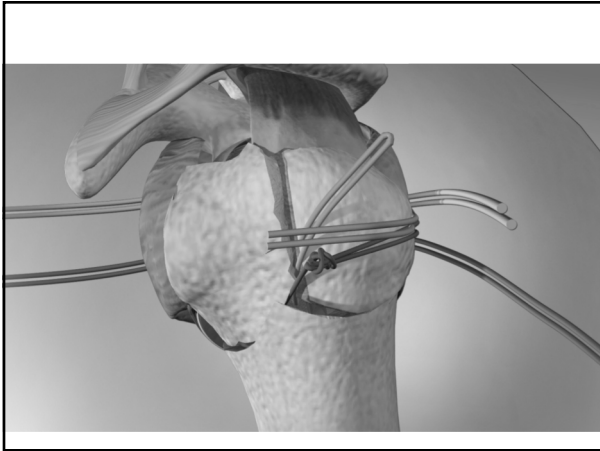
CONCLUSION: RSA resulted in better pain and function and lower revision rate. Revision from HA to RSA does not appear to improve outcomes.

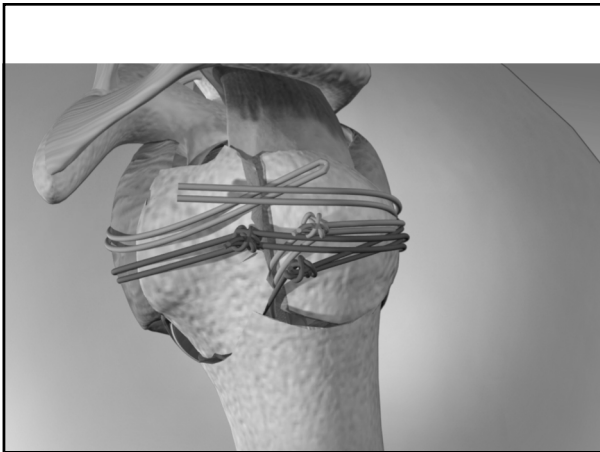




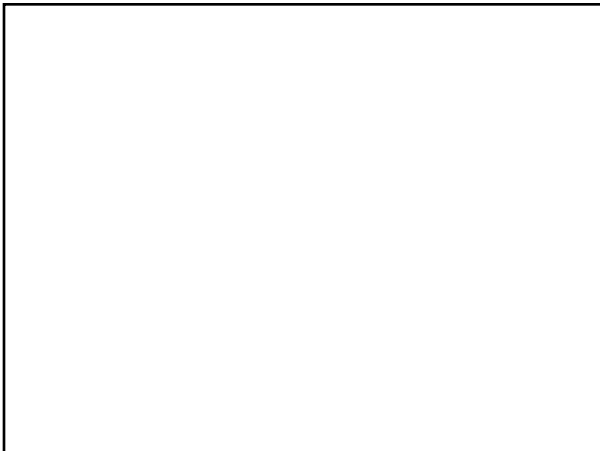












Summary

- Majority Non Op
- Surgery
 - Fx Dislocation 2 Part
 - Translation >100%
 - Smoker
 - Lives Alone/Independent
- No perfect option (Surgery)
 - Reverse

Two X-ray images of a shoulder joint. The left image shows a shoulder with a large, white, circular component (likely a humeral head) and a smaller, white, circular component (likely an acetabular cup). The right image shows a similar view, but with a different configuration of components, possibly representing a reverse total shoulder arthroplasty. Both images are in grayscale and show the bony structures of the shoulder.