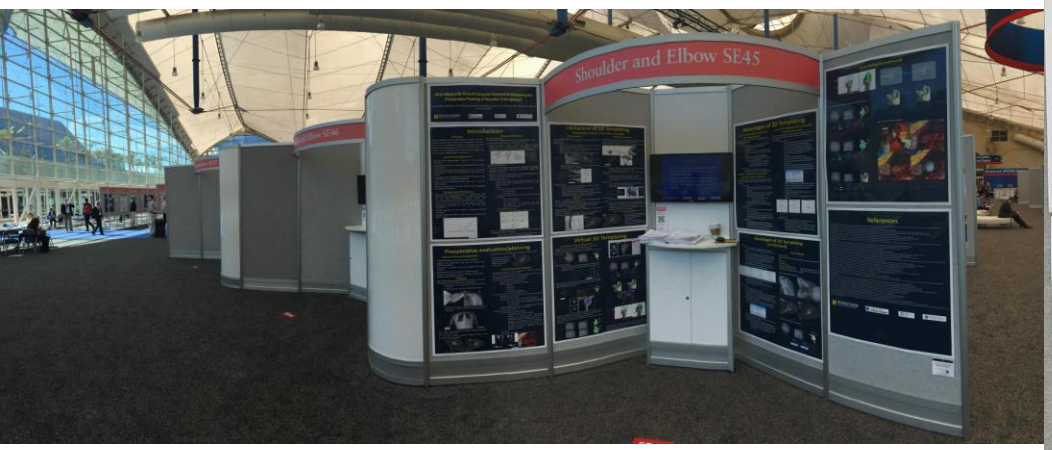
AAOS Shoulder Scientific Exhibits & Poster Highlights With commentary (JPW)

Democracy must be something more than two wolves and a sheep voting on what to have for dinner.
-- James Bovard, Civil Libertarian (1994)

A government big enough to give you everything you want, is strong enough to take everything you have.
-- Thomas Jefferson

Look for My Key Take-home points



Congratulations To Bedi et al for Their Scientific Exhibit

SE45: What is the Role of Computer-Assisted 3D Modeling for Preoperative Planning of Shoulder Arthroplasty?

Jacob M. Kirsch MD, Ryan A. Mlynarek MD, Amit Nathani MD, Joshua S. Dines MD, Jon JP Warner MD, Gilles Walch MD and Asheesh Bedi MD

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Introduction

Purpose

New technology has been developed to improve the pre-operative assessment of complex glenohumeral (GH) anatomy. The purpose of this exhibit is to present a comprehensive and evidenced-based evaluation of the clinical role for computer-assisted three-dimensional (3D) preoperative imaging and implant templating for shoulder arthroplasty.

Educational Objectives

- Review basic glenohumeral anatomy in the arthritic shoulder
- Understand the basic concepts of templating for shoulder arthroplasty
- Understand the typical mechanisms for failure in shoulder arthroplasty and how 3D templating may reduce the risk of failure
- Understand the role and limitations of two-dimensional (2D) imaging (XR, CT) in shoulder arthroplasty
- Learn how 3D templating works and why it may be advantageous
- Review current clinical literature evaluating 3D templating for shoulder arthroplasty

Background Information

- Total Shoulder Arthroplasty (TSA)[9,34,42] and Reverse Total Shoulder Arthroplasty (RTSA)[11,17,32] are effective procedures for end stage glenohumeral arthritis, rotator cuff arthropathy and comminuted proximal humerus fractures
- There has been a steady increase in the volume of shoulder arthroplasty performed in the U.S. over the past decade[8,30,44]
- Glenoid geometry can be complex in advanced arthritic conditions
- Glenoid component failure is the most common reason for failure[2,16,20,48]

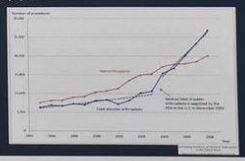


Figure 1. Graph representing the increase in shoulder arthroplasty volume

Relevant Anatomy

Normal Anatomy

- Normal humeral neck-shaft angles range from 130°-150°
- Humeral head retroversion is typically 20°-30°
- Glenoid anatomy is highly variable. Mean glenoid version ranges from 10° of retroversion to 2° of anteversion. Mean inclination is from neutral to 10° of superior inclination.

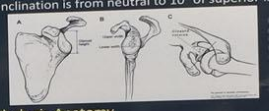


Figure 2. Parameters of glenoid anatomy include glenoid height (A), glenoid width (B), and glenoid version (C)

Pathologic Anatomy

- Features of GH osteoarthritis include: thinning of articular cartilage, subchondral sclerosis, subchondral cysts and inferior osteophytes
- Glenoid retroversion and posterior humeral subluxation is common secondary to asymmetric wear
- Walch Classification[1,45]
  - Defined osteoarthritic glenoid anatomy according to three general types based on glenoid deformity, bone loss and pattern of erosion.
  - Types:
  - A: Concentric wear without humeral head subluxation
    - A1: Minor erosion
    - A2: Major erosion
  - B: Asymmetric posterior glenoid wear with posterior humeral subluxation
    - B1: Uniconcave glenoid
    - B2: Biconcave glenoid
    - B3: Uniconcave with posterior wear and retroversion of ≥ 15° and/or ≥ 70% posterior humeral head subluxation
  - C: Glenoid Retroversion > 25°
  - D: Glenoid Anteversion with anterior subluxation < 40%

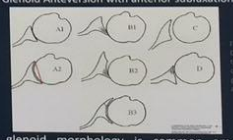


Figure 3. Demonstration of the Walch classification of glenohumeral arthritis

- Abnormal glenoid morphology is common among patients undergoing shoulder arthroplasty
  - Almost 40% of patients undergoing RTSA have evidence of glenoid erosion and abnormal glenoid morphology[12]

Preoperative evaluation/planning

History/Physical Examination

- A thorough history and physical exam is essential
- Insidious and progressive pain, loss of function and stiffness is common
- Assessment of quality of life and disability with daily activities
- Assessment of active and passive range of motion
- Rotation cuff integrity must be evaluated if planning an anatomic shoulder arthroplasty

Imaging

- Plain radiographic evaluation for TSA typically consists of AP, Scapular Y and Axillary Lateral radiographs
  - Axillary lateral is used to asses glenoid version and glenoid wear pattern
  - True AP (Grashey) is used to assess glenoid inclination
- Glenoid version can be assessed according to Friedman's line[14]
- CT allows for assessment of the glenoid vault to evaluate the capacity of glenoid component containment

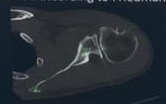


Figure 7. Glenoid version of 22° as measured by Friedman's line

Critical Decision Making

- Ideal glenoid position[10,13,26,32] and fixation[7-19] is essential to optimize implant survival and functional outcomes
- Optimal intraoperative placement of the glenoid component can be challenging, particularly in cases of severe deformity
- Why are there issues with glenoid malpositioning?
  - Difficulty defining normal anatomy
  - Difficulty assessing the degree of pathology
    - Bone Loss
    - Retroversion

Rotator Cuff Repair: An Opportunity for Improved Efficiency, Cost-Effectiveness and Ultimately, Cost Savings

Zimmer ZR[1], Chona D[2], Kuntz A[1], Huffman GR[1], Glaser D[1].
[1]Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, PA
[2]Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA

Introduction

- Approximately 150,000-200,000 rotator cuff repairs performed each year in U.S.[1]
- Health care costs projected to reach $4.6 trillion by 2020[2]
- Surgeons and hospitals are increasingly urged to be cost-effective and efficient in their delivery of patient care
- Factors associated with increased cost and decreased efficiency must be clearly identified

Objectives

- Determine significance of surgeon experience and surgical setting on overall cost of rotator cuff repairs at an academic institution
- Identify modifiable and non-modifiable factors associated with increased procedural cost to allow for possible cost-savings in the future

Materials and Methods

- Retrospective review of all rotator cuff repairs performed by 7 fellowship-trained surgeons over 11-month period. Data collected and analyzed include:
  - Equipment costs
  - Surgeon experience
  - Surgical time
  - Outpatient vs Hospital Setting
  - Surgeon yearly volume
- Retrospective review of all rotator cuff repairs performed by the same surgeons over 3-month period. Data collected analyzed include:
  - Overall procedural costs
  - Concomitant procedures
  - Tear size/location
  - Outpatient vs Hospital Setting
  - Compared equipment costs between the ten most-expensive and ten least-expensive single-tendon repairs

Results

- Between July 1, 2014 and May 31, 2015, a total of 441 rotator cuff repairs were performed
  - The average cost per surgery was $1532.15 ($1167.55 - $1953.00)

Fig 1 – Surgical Duration vs Post-Graduate Surgical Experience

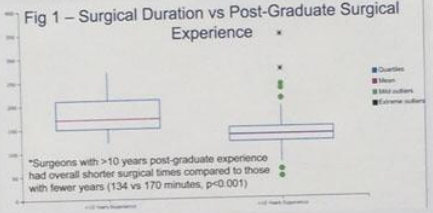
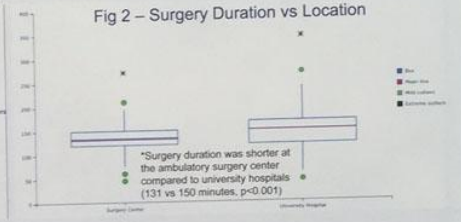


Fig 2 – Surgery Duration vs Location



- Between July 1, 2015 and September 30, 2015, a total of 84 rotator cuff repairs were performed

Fig 3 - Average Procedure cost vs. Surgeon Experience

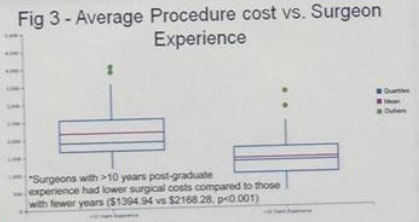


Fig 4 - Average Procedure cost vs. Surgical Location

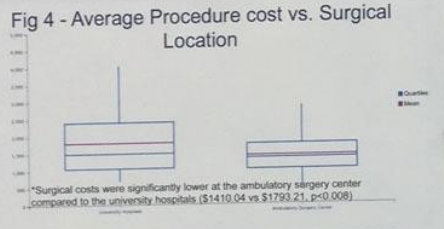


Fig 5 - Average Procedure Cost vs. Number of Tendons Torn

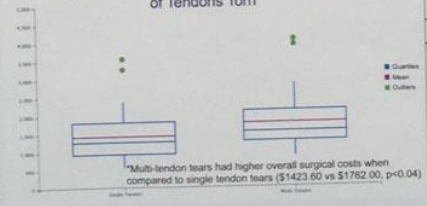


Table 1 - Surgical Equipment Cost Comparison Between Ten Most-Expensive and Ten Least Expensive Single-Tendon Rotator Cuff Repairs

Equipment	Most-Expensive (Mean)	Least Expensive (Mean)	P-value
Suture	$169.90	$30.34	<0.001
Surgical Tools	$365.59	$91.01	<0.001
Cannulas	$42.62	$21.28	0.024
Solution	$28.55	$10.30	0.015
Tubing	$31.48	$39.14	0.261
Surgical Sets/Drape Packs	$196.55	$100.75	<0.001
Gloves	$3.24	$2.38	0.237
Burr	$73.41	$13.05	<0.001
Implants	$486.51	$244.45	<0.001

Discussion

- Increased costs of rotator cuff repairs are associated with multi-tendon tears, less post-training surgical experience, and a university hospital setting
- Significant differences in costs of various surgical equipment between the most and least-expensive rotator cuff repairs
- Encouraging surgeons to be conservative in their use of surgical equipment and efficient in the operating room can provide significant opportunities for cost savings in rotator cuff repairs

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Equipment costs	Surgeon experience
Surgical time	Outpatient vs Hospital Setting
Surgeon yearly volume	

- Retrospective review of all rotator cuff repairs performed by the same surgeons over 3-month period. Data collected analyzed include:

Overall procedural costs	Concomitant procedures
Tear size/location	Outpatient vs Hospital Setting

  - Compared equipment costs between the ten most-expensive and ten least-expensive single-tendon repairs

Surgical Experience Vs Cost in an AMC

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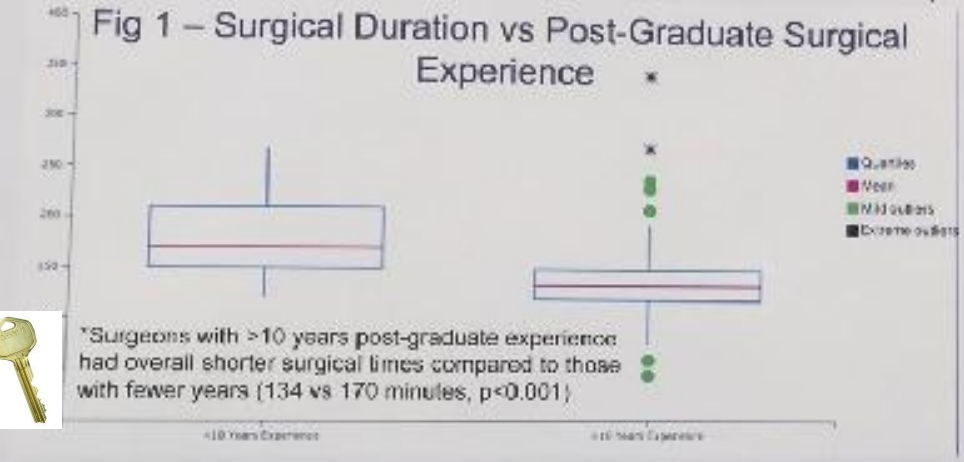
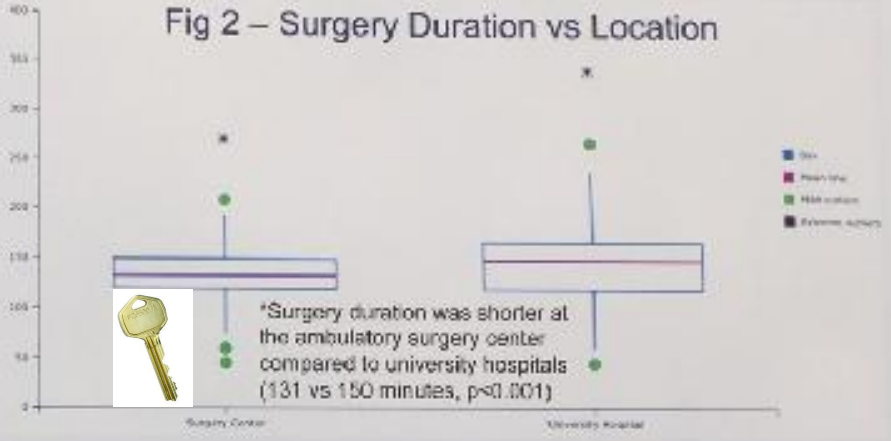


*Surgeons with >10 years post-graduate experience had overall shorter surgical times compared to those with fewer years (134 vs 170 minutes, p<0.001)

Fig 2 – Surgery Duration vs Location



*Surgery duration was shorter at the ambulatory surgery center compared to university hospitals (131 vs 150 minutes, p<0.001)

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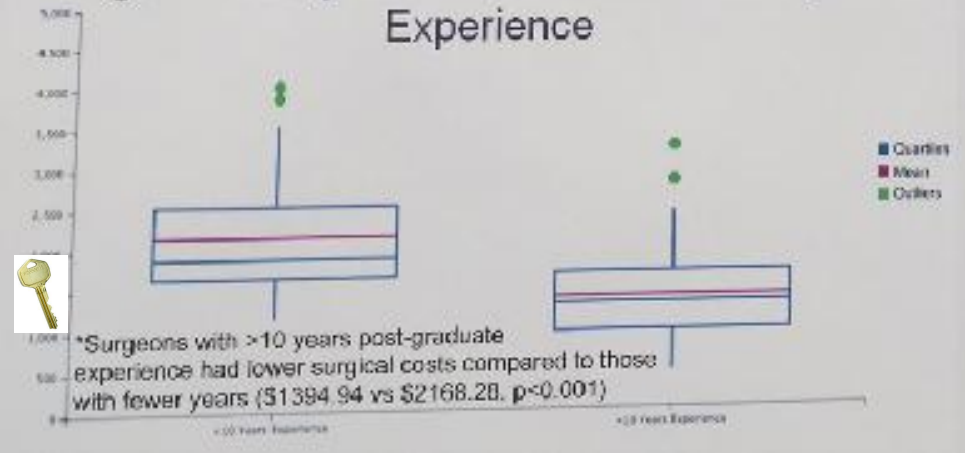
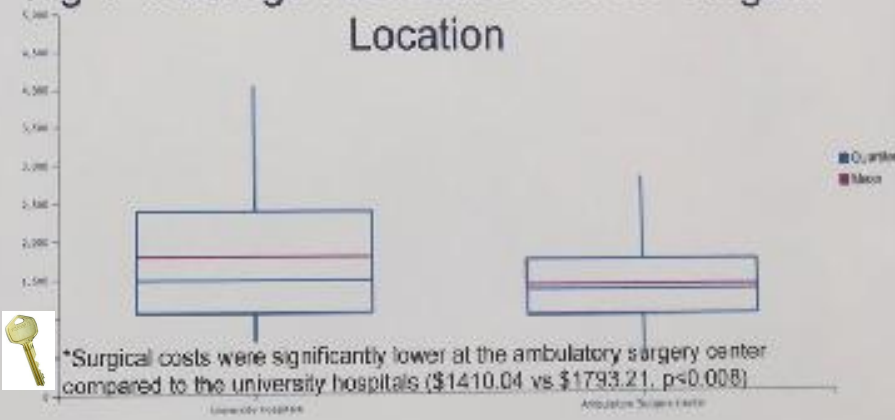


*Surgeons with >10 years post-graduate experience had lower surgical costs compared to those with fewer years ($1394.94 vs $2168.28, p<0.001)

Fig 4 - Average Procedure cost vs. Surgical Location



*Surgical costs were significantly lower at the ambulatory surgery center compared to the university hospitals ($1410.04 vs $1793.21, p<0.008)

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A Cost-Analysis of Treatment for Comminuted 3 and 4 Part Proximal Humerus Fractures in the Elderly: A Comparison of Conservative and Operative Management Approaches

Herman Johal MD MPH FRCSC PhD(cand)[1], Bill Ristevski MD MSc FRCSC[1], Krishan Rajoratnam MD FRCSC[1], Matthew Denkers MD FRCSC[1], Jaydeep Moro MD FRCSC[1], Mohit Bhandari MD PhD FRCSC[1]

Division of Orthopaedic Surgery, McMaster University

Funding Disclosure: None

BACKGROUND

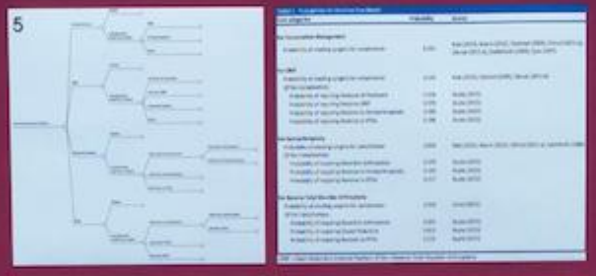
- Comminuted proximal humeral fractures in the elderly remain a treatment challenge with variable and frequently unsatisfactory outcomes.
- A 2015 randomized controlled trial[1] as well as several meta-analysis[2,3] comparing operative (ORIF or hemiarthroplasty) to non-operative treatment for proximal humerus fractures indicate no difference in functional outcomes.
- Reverse total shoulder arthroplasty (RTSA) in the acute fracture setting has potential to yield improved outcomes given its positive outcomes among the rotator cuff deficient elderly population; however, higher associated treatment costs has fueled opponents' arguments against its routine use. The purpose of this study was

OBJECTIVE

From a single payer perspective, to compare the cost-utility of non-operative management (figure 1) to operative management with open reduction internal fixation (ORIF, figure 2), hemiarthoplasty (figure 3) or reverse total shoulder arthroplasty (RTSA, figure 4) for elderly patients with displaced proximal humerus fractures, over a 1-year time horizon.

METHODS

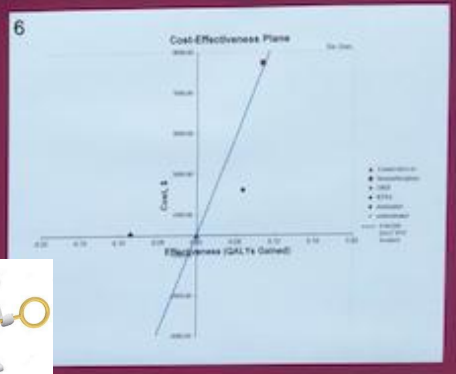
- A decision-analysis model (figure 5) was constructed to estimate the cost-effectiveness of conservative and operative management options for the treatment of comminuted proximal Humerus fractures in the elderly (>65years old).
- A single payer perspective was taken, with a 1 year time horizon.
- Model inputs including clinical outcome probabilities (table 1), and health utility values, were derived from a review of the literature.[3-11]
- Treatment costs were obtained from the local healthcare system and regional healthcare authority.
- Threshold sensitivity analyses were performed to evaluate the impact of implant costs, and complication rates, and patient outcomes on the cost-effectiveness of the treatment strategies.



RESULTS

- Compared to non-operative management:
  - Patients receiving Hemiarthoplasty had and incremental increase in costs of $8,464.78, with a moderate improvement in Quality Adjusted Life-Years (QALYs) of 0.08 (Table 2)
  - Patients receiving ORIF had an incremental increase in costs of $8,538.29 over conservative management, and did not result in any increase in QALYs (Table 2)
  - Patients recieveing RTSA had an incremental cost of $10,683.46, and resulted in 0.15 QALYs gained compared to non-operative management (Table 2).

- When assessing overall cost effectiveness, ORIF was dominated by the other treatment strategies, Hemiarthoplasty resulted in an incremental cost-effectiveness ratio (ICER) of $100,946.33/QALY gained and RTSA resulted in an ICER of $37,924.64/QALY gained (Table 2).
- Whether a threshold of $50,000 or $100,000/QALY gained is used, RTSA is a cost-effective option while ORIF and Hemiarthoplasty are not (Figure 6).
- Sensitivity analysis revealed that hemiarthroplasty could only be made a cost effective option is the index treatment and implant costs were reduced by 35%. Model results were robust for RTSA, as long as index treatment and implant costs remained below $15,758.99.



DISCUSSION & CONCLUSION

- The cost-effectiveness of treatment options for comminuted, displaced 3 and 4 part proximal Humerus fractures in the elderly is dependent on the cost of the implant, and the associated complications relative to conservative management. Our findings show that, compared to conservative management, hemiarthroplasty and ORIF are not cost-effective approaches, while RTSA may result in improved outcomes with an acceptable increase in up-front and 1-year treatment costs.

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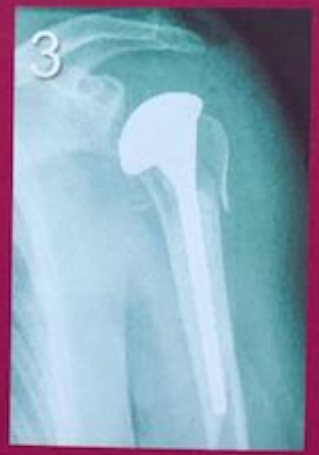

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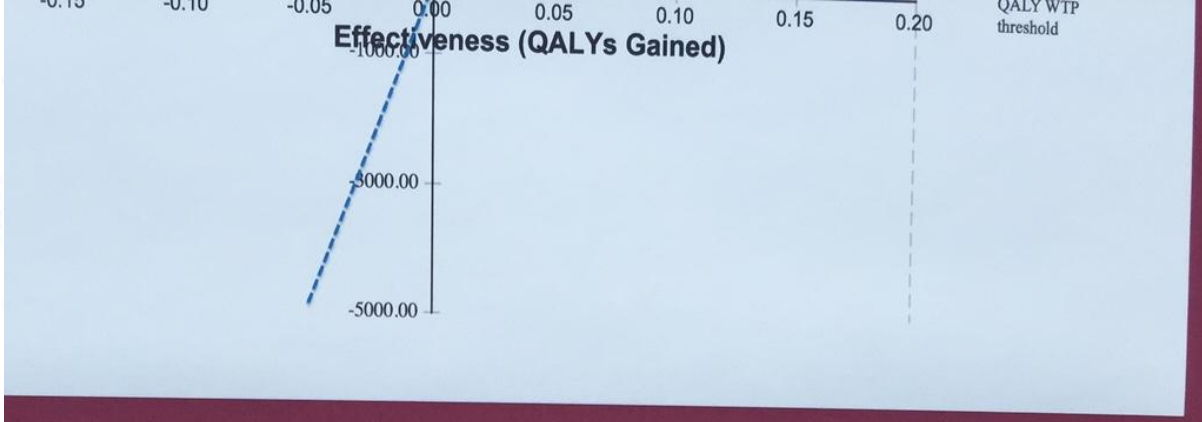
- Patients recieveing RTSA had an incremental cost of $10,683.46, and resulted in 0.15 QALYs gained compared to non-operative management (Table 2).

TABLE 2 Cost Effectiveness (Utility) Analysis for Proximal Humerus Fracture Treatment Strategies

Strategy	Cost	Incremental Cost	Effectiveness (QALYs)	Incremental Effectiveness (QALYs)	Cost/Effect (C/E)	ICER	
Using Conservative tx as reference							
Conservative Management	$ 1,948.51	-	0.508	-	$ 3,835.98		
ORIF	$ 10,413.28	$8,464.78	0.592	0.084	$ 17,595.68	$100,946.33 per QALY gained	
Hemiarthroplasty	$ 10,486.79	$8,538.29	0.507	-0.001	$ 20,685.78	-$8,553,570.32 per QALY gained	Dominated
Reverse Total Shoulder Arthroplasty	$ 12,631.97	$10,683.46	0.650	0.142	$ 19,424.49	$75,047.12 per QALY gained	
In Order of increaseing C/E							
Conservative Management	$ 1,948.51	-	0.508	-	$ 3,835.98		
ORIF	$ 10,413.28	$8,464.78	0.592	0.084	$ 17,595.68	$100,946.33 per QALY gained	
Reverse Total Shoulder Arthroplasty	$ 12,631.97	$2,218.69	0.650	0.059	$ 19,424.49	$37,924.64 per QALY gained	
Hemiarthroplasty	$ 10,486.79	-$2,145.18	0.507	-0.143	$ 20,685.78	-$8,553,570.32 per QALY gained	Dominated

- When assessing overall cost effectiveness, ORIF was dominated by the other treatment strategies, Hemiarthoplasty resulted in an incremental cost-effectiveness ratio (ICER) of $100,946.33/QALY gained and RTSA resulted in an ICER of $37,924.64/QALY gained (Table 2).
- Whether a threshold of $50,000 or $100,000/QALY gained is



DISCUSSION & CONCLUSION

- The cost-effectiveness of treatment options for comminuted, displaced 3 and 4 part proximal Humerus fractures in the elderly is dependent on the cost of the implant, and the associated complications relative to conservative management. Our findings show that, compared to conservative management, hemiarthroplasty and ORIF are not cost-effective approaches, while RTSA may result in improved outcomes with an acceptable increase in up-front and 1-year treatment costs.

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REFERENCES

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NewYork-Presbyterian

Columbia University Medical Center
Department of Orthopedic Surgery

Peri-Operative Complications and Quality Measures Between Inpatient and Outpatient Shoulder Arthroplasty Across a National Sample

Manish S. Noticewala, David P. Trofa, Robert L. Parisien, Christopher S. Ahmad, Charles M. Jobin, William N. Levine

Investigation performed at the Department of Orthopedic Surgery, NewYork-Presbyterian/Columbia University Medical Center, New York NY

Introduction

Shoulder arthroplasty is a highly effective treatment option with excellent long-term survivorship. Although traditionally performed as an inpatient procedure, advances in surgical technique and peri-operative analgesia have made same-day discharge possible.

Purpose

To compare differences in 30-day peri-operative complication, readmission, and re-operation rates between patients undergoing inpatient shoulder arthroplasty versus outpatient arthroplasty.

Methods

- The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database was retrospectively queried according to Current Procedural Terminology codes to isolate all shoulder arthroplasties performed between 2005-2014.
- After application of exclusion criteria, 6815 shoulder arthroplasty cases were available for analysis:
  - 344 outpatient
  - 6471 inpatient
- For each case, baseline data recorded included: gender, age, body mass index (BMI), and various comorbidities.
- Operative variables collected included anesthesia type and operative time.
- Post-operative outcomes were categorized as:
  - Any complication,
  - Minor complication (wound dehiscence, pneumonia, renal insufficiency, and/or urinary tract infection),
  - Major complication (surgical site infection, blood transfusion, thromboembolism, nerve injury, cardiac arrest, myocardial infarction, need for airway support, acute renal failure, stroke, coma, sepsis, and/or shock),
  - Readmission following discharge
  - Return to operating room
- Univariate and multivariate analyses were done to compare differences between the two cohorts and determine whether admission status was a risk factor for complications, readmission, or re-operation.

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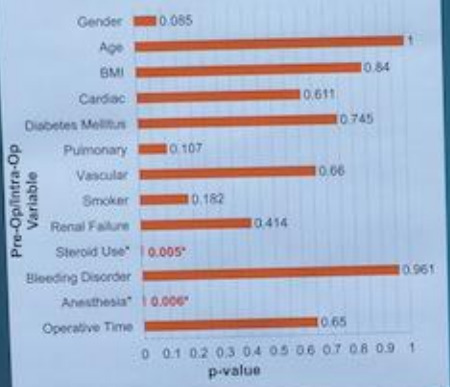
GRAPH 1 **Baseline Differences**



Baseline Differences: Notes

- Steroid use was increased in the inpatient cohort (4.96% vs 1.45%, p<0.005); otherwise, there were no differences in demographics or comorbidities.
- For operative characteristics, there was increased utilization of non-general anesthesia among the outpatient cohort (7.27% vs 4.06%, p<0.007).

Aggregate Analysis of Complications: Notes

- Overall, there were no differences between the rates of minor (1.44% inpatient vs 0.6% outpatient, p=0.231) or major (5.55% inpatient vs 3.49% outpatient, p=0.129) complications.
- There was a trend towards a higher rate of any complication in the inpatient shoulder arthroplasty cohort in univariate analysis (6.57% vs 3.78%, p=0.052)

Univariate Analysis of Complications: Notes

- There were no significant differences with respect to the rates of each of the individual complications described between the two cohorts.

GRAPH 3 **Aggregate Analysis of Complications**

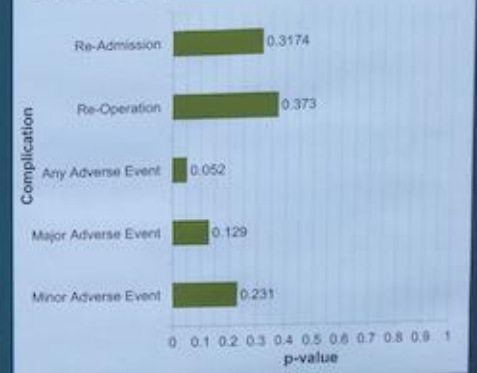


TABLE 1 **Univariate Analysis of Complications**

Results

- Multivariate analyses did not demonstrate admission status as being a risk factor for a minor adverse event, major adverse event, nor any adverse.
- Furthermore, multivariate analyses did not demonstrate steroid use or anesthetic type as being a significant risk factor for minor, major, or any complication types.

Discussion and Conclusions

- An analysis of a nationwide, prospective quality improvement registry demonstrates similar rates of peri-operative morbidity between inpatient and outpatient shoulder arthroplasty.
- With appropriate pre-operative patient risk stratification, surgeons can consider performing shoulder arthroplasty in an ambulatory setting.
- The decreased length of stay associated with outpatient shoulder arthroplasty would enable surgeons to meet demands for delivery of more efficient and lower cost care for operative shoulder pathology.

Acknowledgments

ACS NSQIP and the hospitals participating in the ACS NSQIP are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

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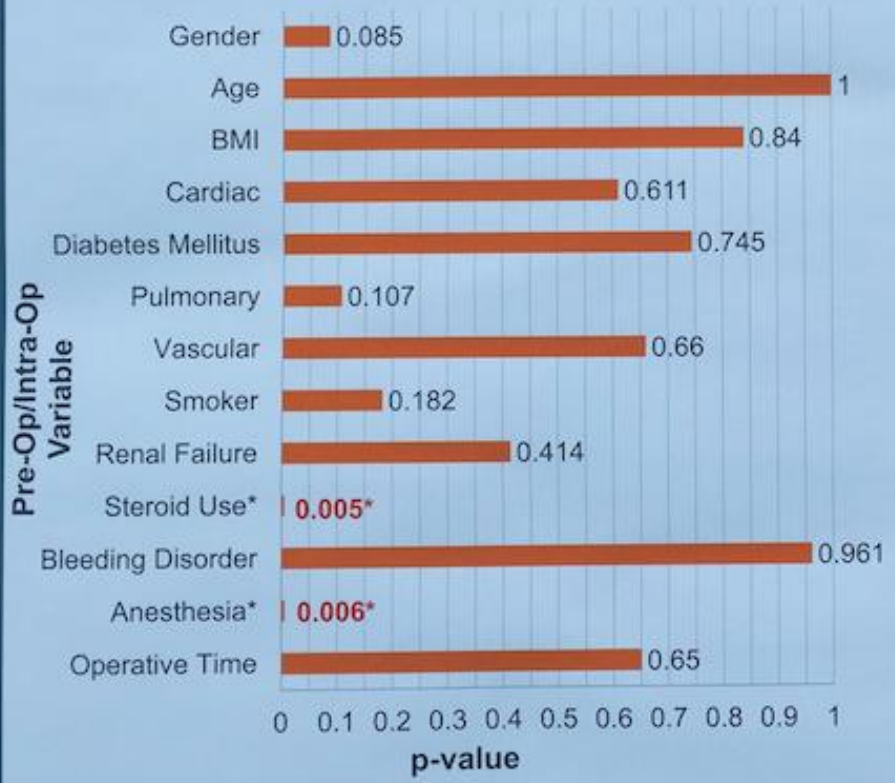

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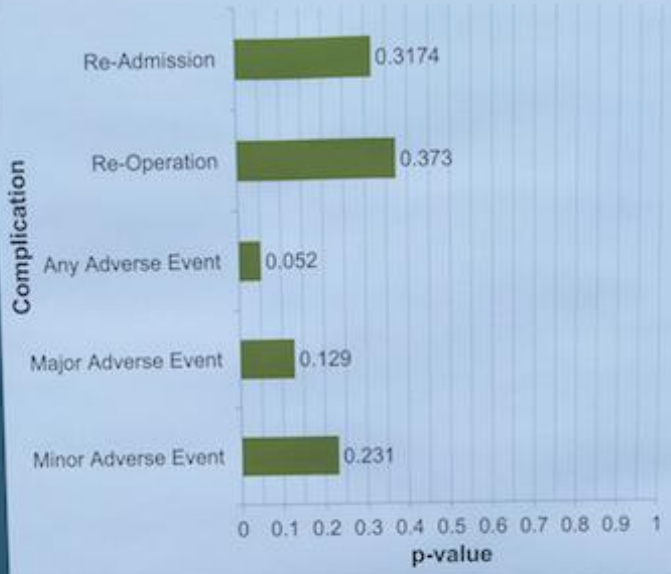

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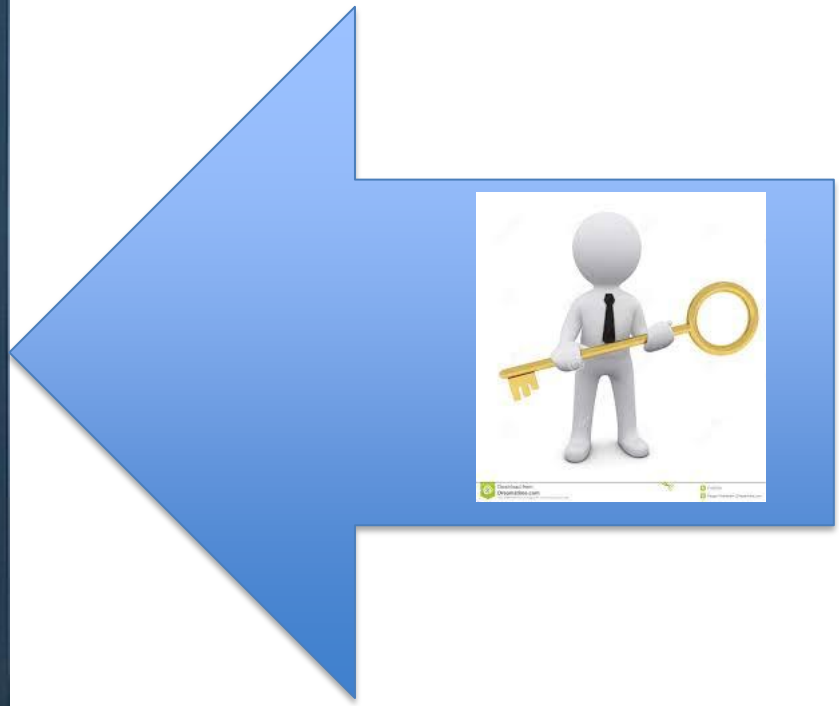


Immediate and Early Complications of the Open Latarjet Procedure

A Large Consecutive Case Series

Gary M. Gartsman, MD; Wame N. Waggenspack, Jr, MD; Daniel P. O'Connor, PhD; Hussein A. Elkousy, MD; T. Bradley Edwards, MD

Background

The Latarjet procedure is a well-described treatment for recurrent anterior shoulder instability in patients with glenoid bone loss or after failed soft-tissue stabilization procedures. While longer-term complications such as recurrent instability, osteoarthritis, and graft nonunion are better defined, there is little literature focused on complications associated with the procedure itself. Most reports are retrospective in nature, composed of heterogeneous patient populations (including other coracoid transfer or stability procedures), and only briefly mention intra-operative or immediate complications or not at all.

Purpose

Report the immediate and early complications of the Latarjet procedure in a large consecutive series of patients performed by three surgeons (2 shoulder-fellowship trained, 1 sports-fellowship trained) at a single high-volume institution.

Patients and Methods

- Retrospective chart review was performed of 416 consecutive open Latarjet procedures in 400 patients (16 patients had bilateral procedures) performed by the three senior surgeon authors from October 2002 to July 2015 at a single institution.
- Demographic data and complications including neurologic injury, wound complications and infection, and hardware problems were collected.
- Patient age and history of prior arthroscopic (ATS) and/or open stabilization procedure were evaluated as risk factors for increased complications in our population.

Surgical Technique

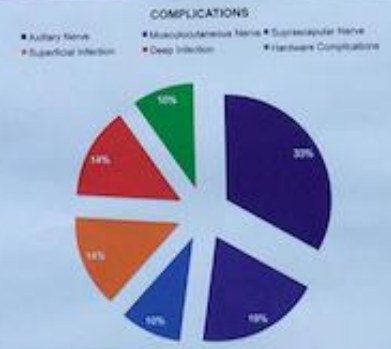
- Three surgeons all utilize the same basic surgical technique previously described[1] with variations listed below:
  - Arthroscopic evaluation of the glenohumeral joint and subacromial space at the discretion of the treating surgeon
  - One author (TBE) uses 4.5mm malleolar screws and freehand drills the glenoid
  - Other two authors (GMG, HAE) use 3.75mm cannulated screws with a parallel drill guide

[1] Edwards BT, Walch G. The Latarjet Procedure for Recurrent Anterior Shoulder Instability: Rationale and Technique. Oper Tech Sports Med 2013;20:177-84. http://dx.doi.org/10.1053/j.otsm.2013.07.007.

Results

- Mean patient age 29.6 ± 7.3 years
- Average follow-up 7.8 months
- Prior Open/ATS Stabilization in 121 patients (29.1%)
- Complication Rate 5.0% (21 in 19 patients in 416 procedures)
  - 2 patients had combined neurologic injury
- Increased age was associated with a higher complication rate.
- Prior stabilization surgery was not associated with increased complications.

Complications



- **Neurologic Injury: 13 in 11 patients (3.1%)**
  - **7 Axillary**
    - 1 complete, 2 incomplete palsies – all resolved
    - 4 sensory only – 3 of 4 resolved
  - **4 Musculocutaneous**
    - 3 incomplete palsies – all resolved motor, 1 patient with persistent LABCN hyposthesia
    - 1 sensory only – resolved
  - **2 Suprascapular**
    - 2 incomplete palsies – resolved
- **Infection: 6 patients (1.4%)**
  - **3 Superficial infections**
    - Treated with oral antibiotics only
  - **3 Deep infections**
    - Treated with I&D, antibiotic beads, long-term intravenous antibiotics
- **Early Hardware Problems: 2 pts (0.05%)**
  - **1 Intra-operative coracoid fracture**
    - Retained inferior portion of graft with no post-op complications
  - **1 Screw loosening due to early graft fracture**
    - Patient on chronic steroids, treated by screw removal and excision of fragment with no further post-op complications

Mean Age by Complication Group

Complication (n)	Mean Age (SD)	p value
Infection		
Yes (6)	34.5 years (SD 5.2)	0.110
No (410)	27.4 years (SD 10.9)	
Neurologic Injury		
Yes (13)	27.4 years (SD 7.1)	0.956
No (403)	27.5 years (SD 10.9)	
All Complications		
Yes (21)	32.4 years (SD 11.8)	0.031
No (395)	27.2 years (SD 10.7)	

Complication Group by Prior Surgery

Complication (n)		p value
Infection	6 / 416 (1.4%) Total	
Prior Surgery	2/ 121 (1.7%)	0.561
No prior surgery	4 / 295 (1.4%)	
Neurologic Injury	13 / 416 (3.1%) Total	
Prior surgery	7 / 121 (4.1%)	0.317
No prior surgery	12 / 295 (2.7%)	
All Complications	21 / 416 (5.0%)	
Prior surgery	8 / 121 (6.6%)	0.336
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Conclusions

- Latarjet procedure is an effective treatment option for recurrent anterior shoulder instability.
- We found a lower rate of neurologic complication than previously reported in our large case series.
- Similar to prior studies, increased age was associated with a higher complication rate.
- Meticulous attention to technique and a thorough understanding of the relevant surgical anatomy are important for optimal results.

Fondren Orthopedic Group L.L.P
Texas Orthopedic Hospital
Baton Rouge Orthopaedic Clinic

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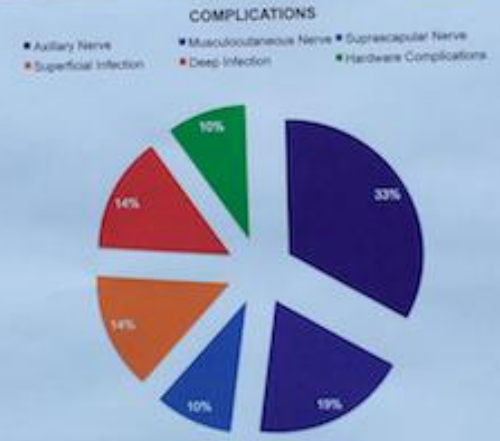

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BATON ROUGE ORTHOPAEDIC CLINIC

Neurologic inj = 3%
Prior surgery = 4%

CRAZY for SHOULDERS
Yeosu Baek Hospital

Latissimus Dorsi Transfer for Irreparable Subscapularis Tendon Tears

Chang Hee Baek, Sang Won Mun, Seung Hoon Yi, Ji Young Kim
Department of Orthopeadics, Yeosu Baek Hospital

I (and my co-authors) have nothing to disclose

BACKGROUND

- **Reconstructive options for irreparable Ssc tear**
  - Pectoralis major transfer
  - Pectroalis minor transfer
  - Latissimus doris transfer
- **Pectoralis major transfer**
  - Most commonly used procedure
  - Variable outcomes
  - Unsatisfactory active mobility & strength recovery
  - Lift off & belly-press tests remain positive in many patients
  - Inability to replicate biomechanics of the Ssc
- **Recently, an LD transfer has been attempted**

The orientation of the PM muscle fiber is almost 90° angle to the humeral insertion of the subscapularis tendon

The line of pull of the LD muscle is similar to that of the subscapularis muscle

- LD muscle functions as an internal rotator of the shoulder and has a higher excursion
- In cadaveric study, demonstrated that LD transfer was feasible, with no risk for nerve compression.

"LD replicates the biomechanics of Ssc function"

PURPOSE

To introduce an LD transfer technique for irreparable subscapularis tears and evaluated its clinical outcomes

METHODS

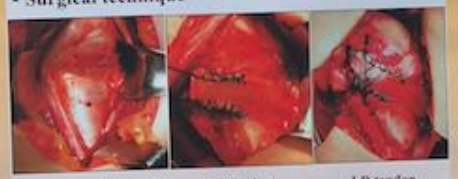
- **Patients**
  - Jan. 2013 – Feb. 2015, 24 patients
- **Inclusion criteria**
  1. Irreparable Ssc tear
     - Goutallier stage III, IV
     - Retracted to glenoid level
     - Irreparable Ssc in open technique
  2. Age <65
  3. Intact or reparable other rotator cuff tear
  4. Intact deltoid function
- **Exclusion criteria**
  1. Advanced glenohumeral arthritis
  2. Partial repair or irreparable posterosuperior cuff tear
  3. Brachial plexus or other nerve injuries

32 patients (2013.1~2015.2)
- Irreparable Ssc tear (preoperative MRI)

26 patients
- 6 patients excluded (open Ssc repair)

24 patients
- 2 patient excluded (partial Ss repair)

- **Clinical assessments**
  - **Follow up**: 27.8 months (range, 24-32 mos)
  - **Radiologic evaluation:** MRI (12 months)
- **Clinical evaluation**
  - ROM (FF, ER at side, IR), VAS for pain
  - Constant score, ASES score
  - Belly-press & Lift-off tests
- **Surgical technique**



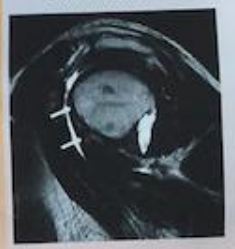
Deltopectoral approach & LD exposure | LD tendon preparation | LD tendon transosseous fixation

RESULTS

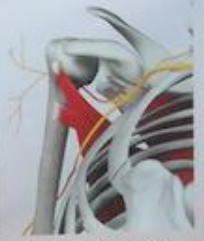
- **Clinical outcomes**

Variables	Preoperative	Final follow-up	p value
VAS for pain	6.5±0.5	2.2±1.3	.006
Forward flexion (°)	135.5±17.2	166.0±15.8	.016
External rotation (°)	51.5±7.9	68.0±7.9	.062
Internal rotation	L5	L1	.010
ASES	40.2±3.5	70.4±5.4	.008
Constant score	46.5±6.6	69.8±5.2	.008
Belly – press test (+)	24	6	
Lift-off test (+)	20	4	
Concomitant posterosuperior cuff tear	17	4(retear)	

- **Complications**
  - No axillary & radial N. complications
  - No other complications (hematoma, infection)
  - No transferred LD tear



Intact integrity of the transferred LD tendon (white arrow)



No axillary & radial N. impingement

CONCLUSION

LD transfer could be an effective and safe treatment option for irreparable subscapularis tendon tears

- Improvement in pain relief, functional outcomes and active range of motion
- Replicate biomechanics of Ssc fuction
  - Comparatively high recovery of internal rotation strength
  - Relatively low re-tear rate after repair of concomitant posterosuperior cuff tears
- No serious complications such as axillary & radial N. impingement

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Nice Logo above!

BACKGROUND

- **Reconstructive options for irreparable Ssc tear**
  - Pectoralis major transfer
  - Pectroalis minor transfer
  - Latissimus doris transfer

- **Pectoralis major transfer**
  - Most commonly used procedure
  - Variable outcomes
  - Unsatisfactory active mobility & strength recovery
  - Lift off & belly-press tests remain positive in many patients
  - Inability to replicate biomechanics of the Ssc

- **Recently, an LD transfer has been attempted**

The orientation of the PM muscle fiber is almost 90° angle to the humeral insertion of the subscapularis tendon

The line of pull of the LD muscle is similar to that of the subscapularis muscle

- LD muscle functions as an internal rotator of the shoulder and has a higher excursion
- In cadaveric study, demonstrated that LD transfer was feasible, with no risk for nerve compression.

"LD replicates the biomechanics of Ssc function"

Recycling ElHassan's Original Concepts & Biomechanical Work

PURPOSE

To introduce an **LD transfer technique** for irreparable subscapularis tears and evaluated its **clinical outcomes**

METHODS

- **Patients**
  - Jan. 2013 ~ Feb. 2015, 24 patients
- **Inclusion criteria**
  1. Irreparable Ssc tear
     - Goutallier stage III, IV
     - Retracted to glenoid level
     - Irreparable Ssc in open technique
  2. Age <65
  3. Intact or reparable other rotator cuff tear
  4. Intact deltoid function
- **Exclusion criteria**
  1. Advanced glenohumeral arthritis
  2. Partial repair or irreparable posterosuperior cuff tear
  3. Brachial plexus or other nerve injuries

32 patients (2013.1~2015.2)
- Irreparable Ssc tear (preoperative MRI)

26 patients
- 6 patients excluded (open Ssc repair)

24 patients
- 2 patient excluded (partial Ss repair)

- **Clinical assessments**
  - **Follow up**: 27.8 months (range, 24-32 mos)
  - **Radiologic evaluation:** MRI (12 months)

- **Clinical evaluation**
  - ROM (FF, ER at side, IR), VAS for pain
  - Constant score, ASES score
  - Belly-press & Lift-off tests

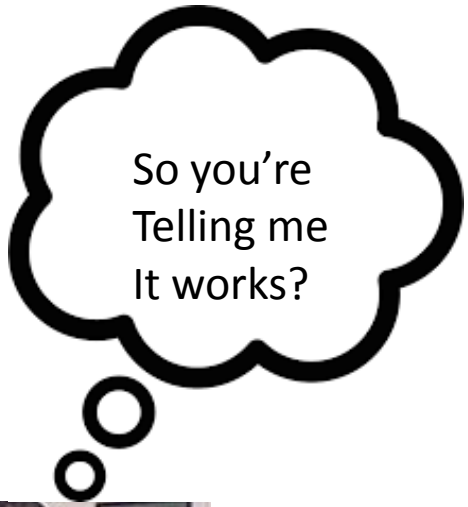
- **Surgical technique**

Deltopectoral approach & LD exposure | LD tendon preparation | LD tendon transosseous fixation

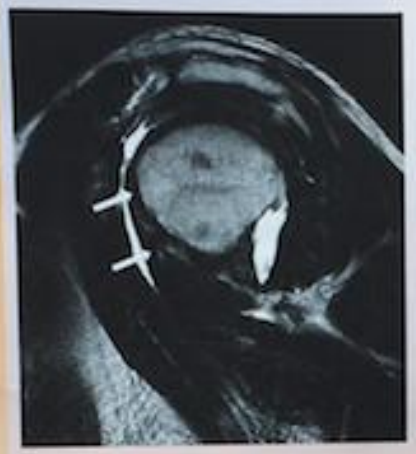
RESULTS

- **Clinical outcomes**

Variables	Preoperative	Final follow-up	p value
VAS for pain	6.5±0.5	2.2±1.3	.006
Forward flexion (°)	135.5±17.2	166.0±15.8	.016
External rotation (°)	51.5±7.9	68.0±7.9	.062
Internal rotation	L5	L1	.010
ASES	40.2±3.5	70.4±5.4	.008
Constant score	46.5±6.6	69.8±5.2	.008
Belly –press test (+)	24	6	
Lift-off test (+)	20	4	
Concomitant posterosuperior cuff tear	17	4(retear)	



- **Complications**
  - No axillary & radial N. complications
  - No other complications (hematoma, infection)
  - No transferred LD tear



Intact integrity of the transferred LD tendon (white arrow)

No axillary & radial N. impingement

CONCLUSION

LD transfer could be an effective and safe treatment option for irreparable subscapularis tendon tears

- **Improvement in pain relief, functional outcomes and active range of motion**
- **Replicate biomechanics of Ssc fuction**
  - **Comparatively high recovery of internal rotation strength**
  - **Relatively low re-tear rate after repair of concomitant posterosuperior cuff tears**
- **No serious complications such as axillary & radial N. impingement**

Cleveland Clinic

Efficacy of Preoperative Aspirates in Periprosthetic Joint Infections of the Shoulder

Nicholas Gajewski, MD (n); Salvatore J. Frangiamore, MD (n); Joseph P. Iannotti, MD, PhD (1 – Depuy Synthes, Integra, Tornier, Zimmer; 2, 3B – DJ Orthopaedics; 4 – Custom Orthopaedic Solutions; 7 – Wolters Kluwer Health); Eric T. Ricchetti, MD (2, 5 – Depuy Synthes; 3B – DJ Orthopaedics; 9 – AAOS, ASES)
The Cleveland Clinic, Orthopaedic and Rheumatologic Institute

Introduction

- Shoulder periprosthetic joint infection (PJI) can be both a diagnostic and therapeutic challenge, due to the indolent nature of the commonly cultured organisms:
  - *Proprionibacterium acnes* (*P. acnes*), the most common pathogen, represents approximately 2/3 to 3/4 of positive cultures
  - Coagulase-negative *Staphylococcus* species (CNSS), the next most common pathogen
- Established diagnostic tests for hip and knee PJI are often negative in the shoulder despite the postoperative growth of intra-operative cultures:
  - Preoperative aspiration often low volume due to the indolent organisms.
  - Limited data available regarding: (1) rate of successful preoperative aspiration and (2) its efficacy in diagnosis of shoulder PJI.

- **The purpose of this study was to:**
  1. Determine the rate of successful preoperative aspiration.
  2. Determine the utility of preoperative aspiration in the diagnosis of infection in revision shoulder arthroplasty.

Methods

- A retrospective chart review was performed on 202 cases evaluated for painful shoulder arthroplasty:
  - All cases with attempted in-office preoperative joint aspiration were identified.
  - All in-office aspirations were performed by two shoulder surgeons (JPI, ETR) without image-guidance.

- Cases with aspirate fluid that went on to revision shoulder arthroplasty surgery were evaluated for intraoperative culture results.

- Preoperative fluid aspirate as a predictor of shoulder PJI was evaluated using sensitivities, specificities, positive and negative likelihood ratios, and positive and negative predictive values.
  - **These diagnostic test characteristics were determined using a definition of infection based on Musculoskeletal Infection Society (MSIS) criteria: two or more positive intraoperative cultures (fluid or tissue) of the same organism at the time of revision surgery.**

Results

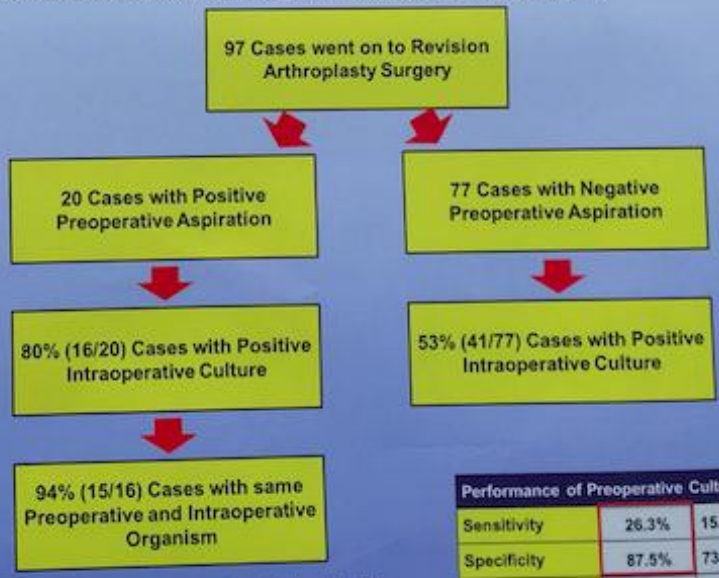
Rate of Successful Preoperative Aspiration:

- Preoperative joint fluid was not obtained in 20% of attempted aspirations, therefore, 80% of cases of attempted

Results

Intraoperative Culture Results:

- Intraoperative cultures were positive in 59% (57/97) of cases that went on to revision surgery:
  - *P. acnes* was the most commonly cultured organism at revision surgery (43/57, 75%).
  - From the intraoperative culture results, 41% (40/97) of cases met MSIS criteria for PJI.



Diagnostic Utility of Preoperative Aspirate in Shoulder PJI:

- Diagnostic test characteristics of preoperative fluid aspirate as a predictor of shoulder PJI are shown in Table 1.
  - When *P. acnes* was isolated preoperatively, positive intraoperative cultures with the same organism grew 64% of the time (7/11 cases).

- Cases with a positive preoperative aspirate culture were

Performance of Preoperative Culture		
Sensitivity	26.3%	15.5-39.7%
Specificity	87.5%	73.2-95.8%
Positive Likelihood Ratio	2.11	0.83-5.32
Negative Likelihood Ratio	0.84	0.69-1.02
Positive Predictive Value	75%	50.9-91.3%

Introduction

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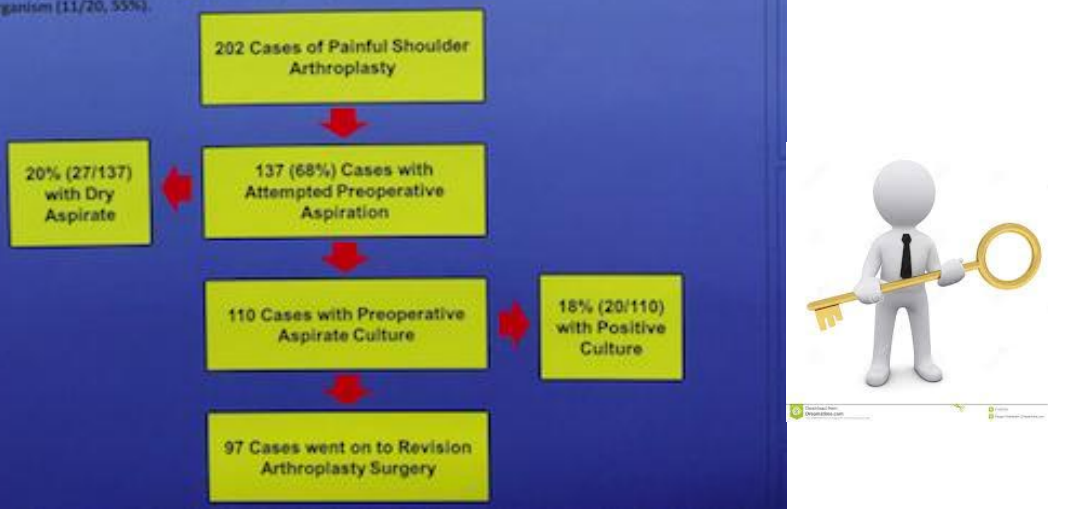
Results

Rate of Successful Preoperative Aspiration:

- Preoperative joint fluid was not obtained in 20% of attempted aspirations, therefore, 80% of cases of attempted aspiration had a fluid sample obtained and sent for culture.
  - **18% (20/110) of preoperative aspirates grew a positive culture, with *P. acnes* the most commonly isolated organism (11/20, 55%).**



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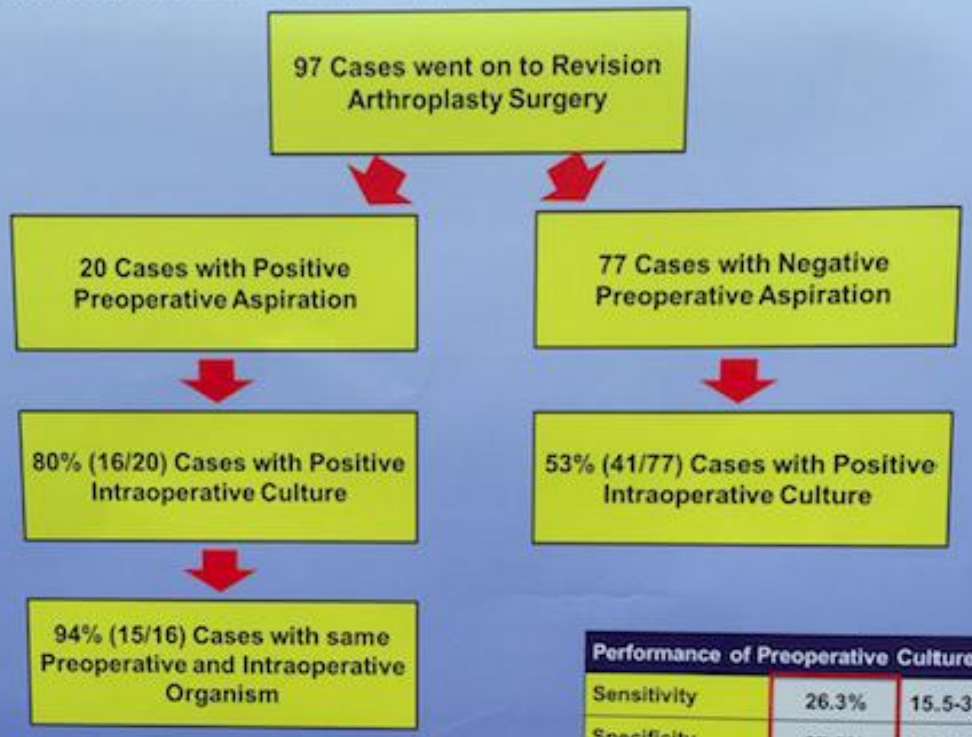

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- Diagnostic test characteristics of preoperative fluid aspirate as a predictor of shoulder PJI are shown in **Table 1**.
  - When *P. acnes* was isolated preoperatively, positive intraoperative cultures with the same organism grew 64% of the time (7/11 cases).

- **Cases with a positive preoperative aspirate culture were significantly more likely to have greater than 50% positive intraoperative cultures (p=0.002):**
  - Positive preoperative aspirate culture: 75% (15/20) of cases had more than 50% positive intraoperative cultures (average percentage positive cultures per case = 70%)
  - Negative preoperative aspirate culture: 34% (26/77) of cases had more than 50% positive intraoperative cultures (average percentage positive cultures per case = 36%)

Performance of Preoperative Culture		
Sensitivity	26.3%	15.5-39.7%
Specificity	87.5%	73.2-95.8%
Positive Likelihood Ratio	2.11	0.83-5.32
Negative Likelihood Ratio	0.84	0.69-1.02
Positive Predictive Value	75%	50.9-91.3%
Negative Predictive Value	45.5%	34.1-57.2%

*95% confidence intervals

Table 1. Diagnostic test characteristics for preoperative synovial fluid aspiration as a predictor of shoulder periprosthetic joint infection (PJI) using a definition of PJI based on Musculoskeletal Infection Society (MSIS) criteria, with two or more positive intraoperative cultures of the same organism representing infection.

Discussion

- In patients presenting with a painful shoulder arthroplasty, preoperative joint fluid was obtained in 80% of cases of attempted aspiration.
- Preoperative aspiration displayed a high false negative rate, therefore, this finding should not exclude infection as a potential cause of painful shoulder arthroplasty.
  - **Newer synovial markers, such as α-defensin (sensitivity 63%, specificity 95%), may have better diagnostic utility than culture (26% sensitivity, 88% specificity) if only one test can be sent on a low volume sample.**
- A positive preoperative aspirate was highly specific for the presence of positive intraoperative cultures at revision surgery, and was significantly associated with having more than 50% positive intraoperative cultures.
- PJI identified prior to revision surgery may significantly impact treatment decision-making, such as the decision to proceed with one- or two-stage exchange.

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1. Aspiration is associated with high False Negative rate for infection
2. Positive culture at Aspiration makes infection very likely as determined by biopsy
3. α- Defensine may be more accurate than culture
4. This determines if 1-stage or 2-stage is best approach in painful TSA

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Arthroscopic Tissue Culture for the Evaluation of Periprosthetic Shoulder Infection

Matthew F. Dilisio, MD, Lindsay R. Miller, MPH, Jon J.P. Warner, MD, and Laurence D. Higgins, MD

Investigation performed at the Boston Shoulder Institute, Brigham and Women's Hospital/Massachusetts General Hospital/Harvard Medical School, Boston, Massachusetts

Background: Periprosthetic shoulder infections can be difficult to diagnose. The purpose of this study was to investigate the utility of arthroscopic tissue culture for the diagnosis of infection following shoulder arthroplasty. Our hypothesis was that culture of arthroscopic biopsy tissue is a more reliable method than fluoroscopically guided shoulder aspiration for diagnosing such infection.

Methods: A retrospective review identified patients who had undergone culture of arthroscopic biopsy tissue during the evaluation of a possible chronic periprosthetic shoulder infection. The culture results of the arthroscopic biopsies were compared with those of fluoroscopically guided glenohumeral aspiration and open tissue biopsy samples obtained at the time of revision surgery.

Results: Nineteen patients had undergone arthroscopic biopsy to evaluate a painful shoulder arthroplasty for infection. All subsequently underwent revision surgery, and 41% of those with culture results at that time had a positive result, which included *Propionibacterium acnes* in each case. All arthroscopic biopsy culture results were consistent with the culture results obtained during the revision surgery, yielding 100% sensitivity, specificity, positive predictive value, and negative predictive value. In contrast, fluoroscopically guided glenohumeral aspiration yielded a sensitivity of 16.7%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 58.3%.

Conclusions: Arthroscopic tissue biopsy is a reliable method for diagnosing periprosthetic shoulder infection and identifying the causative organism.

Level of Evidence: Diagnostic Level I. See Instructions for Authors for a complete description of levels of evidence.

Peer Review: This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

Periprosthetic joint infection can be a devastating complication of arthroplasty, with substantial associated morbidity and cost[1,2]. With the projected increase in the number of joint arthroplasties performed in the United States over the next twenty years[3], the societal burden of prosthetic joint infections will likely increase. The evaluation of a painful prosthetic joint routinely involves a patient history, physical examination, and inflammatory markers in peripheral blood if infection is in the differential diagnosis. Joint aspiration is routinely performed to evaluate the synovial fluid for evidence of infection[4,5].

Although a reliable algorithm for the evaluation of chronic infection in a prosthetic joint has been established in the total knee and hip arthroplasty literature, the same is not true for shoulder arthroplasty. The biologic milieu of the shoulder differs from that of the hip and knee, as evidenced by the bacteria that are commonly identified in periprosthetic shoulder infections[6].

Disclosure: None of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of any aspect of this work. One or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

A commentary by Joaquin Sanchez-Sotelo, MD, PhD, is linked to the online version of this article at jbjs.org.

Matt Dilisio's study is
Relevant to the last poster….

…Arthroscopic biopsy is the most
Accurate method of detection

Effectiveness of intra-articular local infiltration analgesia compared to interscalene block in the early postoperative pain control after total shoulder arthroplasty. A comparative randomized non-inferiority trial.

M Ferrand[1], S Klouche1, J Sicard[2], JC Auregan[1], N Billot[3], F Lespagnol[4], N Solignac[3], C Conso[5], S Poulain[6], P Hardy[1].

[1] Hôpital Ambroise Paré, Boulogne (France). [2] Hôpital Mignot, Le Chesnay. [3] Claude Bernard Private Hospital, Ermont. [4] Clinique Jules Verne, Nantes. [5] Institut Montsouris, Paris. [6] Clinique du Plateau, Bezons.

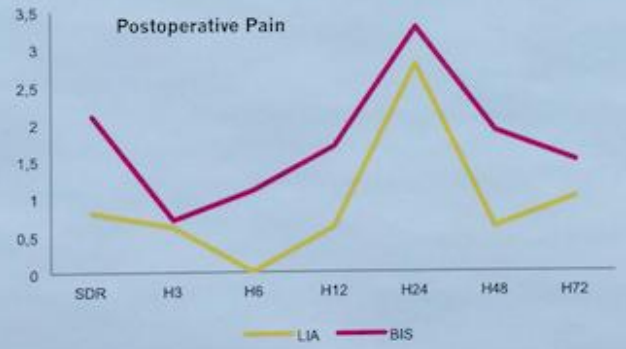
Introduction

Postoperative pain after shoulder surgery was reported from moderate to severe in 70% of patients(1). Ultrasound guided InterScalene Block (ISB) is the gold standard in postoperative pain management of shoulder procedures(2), but has adverse effects(3-4). Local Infiltration Analgesia (LIA) was reported as an efficient alternative to femoral block with comparable results for postoperative analgesia of hip and knee surgery(5-6). The effectiveness of LIA was reported in arthroscopic procedures of the shoulder(7) but never in total shoulder arthroplasty.

We designed a randomized prospective comparative multicentric study to compare the effectiveness of Local Infiltration Analgesia to the gold standard, the Interscalene Block.

Material and methods

A prospective randomized controlled study was conducted between 2014 and 2016 in 4 orthopedic surgery centers. All patients who underwent surgery for either anatomic or reverse TSA for any degenerative cause were included. Trauma cases, because of the particular presentation, were excluded. In ISB group, patients received interscalene block with perineural catheter insertion before induction of general anesthesia under ultra-sound guidance and continue infusion of ropivacaïne 0.2% during 48h. In LIA group, the surgeon injected 110ml of ropivacaïne 0.2%, ketoprofen 30mg and epinephrine 0.5mg next to the glenoid and in soft tissues around the shoulder and inserted a catheter into the glenohumeral joint before wound closure. For a more convenient and a more efficient infiltration, the injection was made just before putting the implants, giving a good access to the posterior capsule that can absorb a lot of local analgesia directly in contact with the prosthesis. The next morning, the surgeon reinjected 10 ml of ropivacaïne 0.2%, ketoprofen 30 mg and epinephrine 0,5mg through the catheter and removed it. The drain was stopped during 2 hours to allow proper diffusion of the local analgesia and prevent absorbtion through the drain.



Postoperative analgesic protocol was the same in both groups. Patients' pain was assessed using a Visual Analogic Scale (VAS) from 0 to 10. The primary outcome was the mean pain during the 48h after surgery (recovery room, H3, H6, H12, H24, H36, H48). Secondary outcomes were mean postoperative opioid consumption from the recovery room to H72, pain during early mobilization from the first to the third postoperative day, and postoperative complications. The sample size was calculated with a non-inferiority margin of 0.5/10. The population in the 2 groups was reproducible and comparable (Table 1). The study was approved by an institutional review board and was declared in a clinical trial register.

Results

99 (50 LIA/49 ISB) patients were included, mean age 72±9.6 years, 35 men and 64 women, 36 anatomic TSA and 63 reversed TSA. No significant difference was found between the LIA group (mean NRS score, 1.4±0.9) and ISB group (mean NRS score, 1.7±1) for mean 48-hour postoperative pain (p=0.19) but LIA group had significantly less pain in the recovery room (0.6±1 vs 1.5±1.7, p=0.003). The mean pain during mobilization at the second postoperative day was lower in LIA group (2.6±1.4 vs 3.2±1.3, p=0.03). Total consumption of opioids was similar (p=0.27) except at recovery room where LIA group has consumed significantly less opioid (p=0.01). No complications occurred in both groups. 100% of patients in the ISB group had a motor block with paresthesia versus none in the LIA group (p=0.0001).

Conclusion

This study has shown that the local infiltration analgesia is not less effective than the interscalene block in the early postoperative pain control after total shoulder arthroplasty. LIA appears to be a safe alternative to the ISB, particularly in cases of contraindication to the loco-regional anesthesia.

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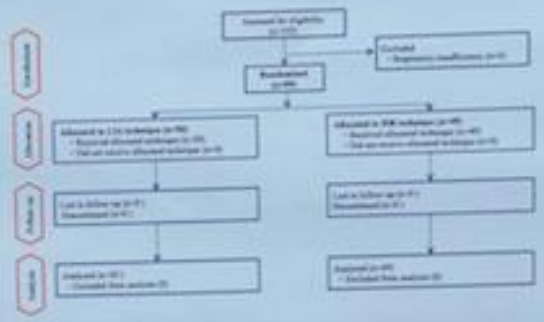
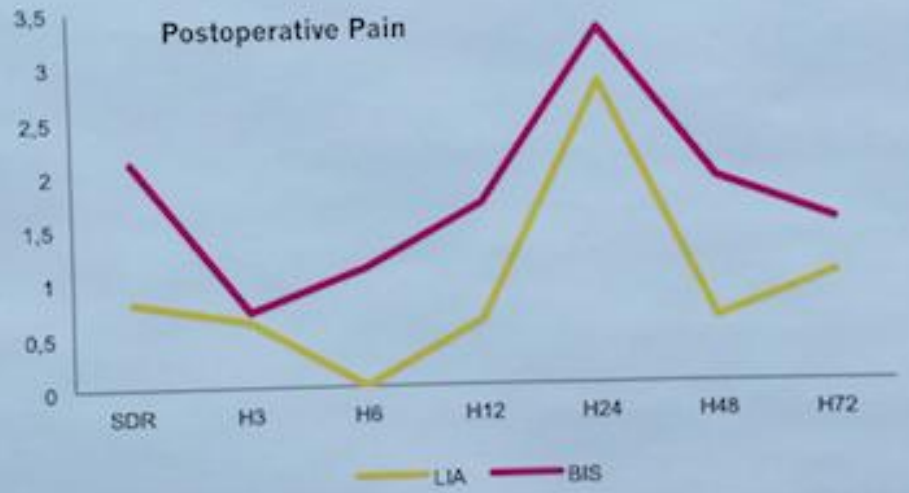
1. Prospective, Randomized study
2. TSA & Reverse Prosthesis
3. 4 Orthopaedic Centers
4. Trauma cases excluded
5. ISB (Interscalene Block Group)
6. LIA (Local Infiltration Anesthesia)
7. LIA given next morning by surgeon as well

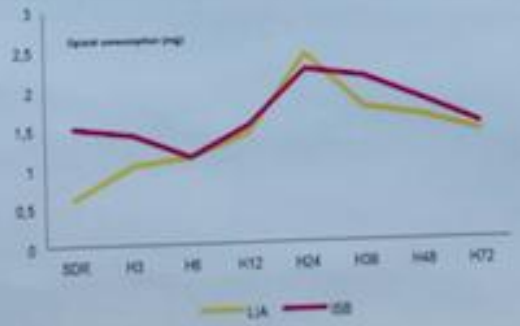
Randomization

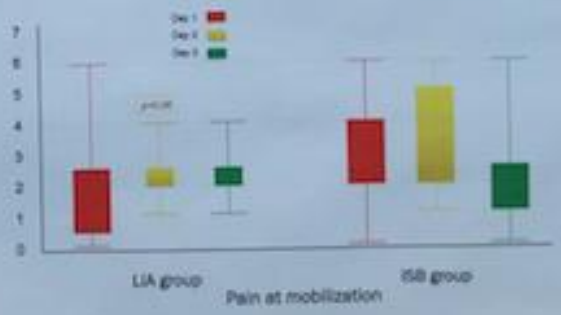
ISB group
- Ultrasound guided continuous interscalene block (catheter)
- 30ml ropivacaine 0,2% (40mg) perioperatively
- Ropivacaine 0,2% 5ml/h during 48h

LIA group
- Injection 110ml of ropivacaine 0,2% (220mg)
- 30mg of ketoprofene + 0,5mg adrenaline in the soft tissues around the shoulder by the surgeon before placing the implants
- Intra-articular catheter placed at the end of the surgery
- Injection in the catheter at day 1: 10ml









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Local Infiltration Anesthesia
Is a reliable alternative
To ISB

Introduction

The incidence of rotator cuff tears increases with age and many patients undergo surgical repair. Retear is the most common complication, with recent studies suggesting that the retear rate varies between 9% and 36%. Advanced patient age has been associated with higher rates of retear, however the relationship between age and the chance of rotator cuff retear has not been thoroughly explored. Patient age may also increase patients' chances of having other factors that increase their likelihood of retear, such as preoperative tear size and thickness of the tear.

The objective of this study was to analyse the relationship between patient age and rotator cuff retear following rotator cuff repair surgery and to explore the relationships between age and other factors impacting on retear rate to provide further understanding of the impact patient age has on healing after rotator cuff repair surgery.

Methods

This was a retrospective cohort study of prospectively collected data of patients who underwent rotator cuff repair surgery by a single surgeon between August 2005 and December 2014 to determine the relationship between patient age and the integrity of rotator cuff repair at 6 month follow-up using ultrasound.

Patients were excluded if they had (1) failed to returned for a follow-up with ultrasound at 6 months, (2) had revision surgery, (3) had irreparable tears, (4) had tears that were only partially repaired, (5) had rotator cuff repairs using a synthetic patch, and (6) had concurrent surgery at the time of rotator cuff repair.

All surgeries were performed by a single surgeon using an arthroscopic single row knotless inverted mattress construct. Undersurface (articular surface) repairs were generally performed; however in some cases a bursal-side repair was required. The anteroposterior and mediolateral dimensions of the tear were measured intraoperatively and the thickness of the tear was estimated.

Patients followed a 6 month postoperative rehabilitation program. In the earlier years of the study, passive range of motion exercises began immediatelyand active range of motion exercises were introduced at 8 days postoperation. The intensity of active exercises was increased at 6 weeks and active resistance was commenced at 3 months. Later in the study the approach changed to include immobilization of the shoulder using an abduction sling (Ultrasling, DJO Normahurst, NSW, Australia) for the first 6 weeks.

At 6 months, patients had an ultrasound by 1 of 2 experienced musculoskeletal sonographers. These were performed with a General Electric Logiq 9 or Logiq E9 machine (General Electric, Sydney, NSW, Australia) with a 12MHz linear transducer as per a previously described technique. A retear was deemed to have occurred if there was any defect, either full or partial thickness, visible on ultrasound, irrespective of its size.

Rotator Cuff Repair & Retear vs Age, George Murrell et al Australia

1. Retrospective study
2. Single row repair by one surgery
3. Ultrasound at 6 months
4. Inconsistent postop rehab with some patients Beginning Passive ROM immediately vs others who were immobilized after surgery

Results

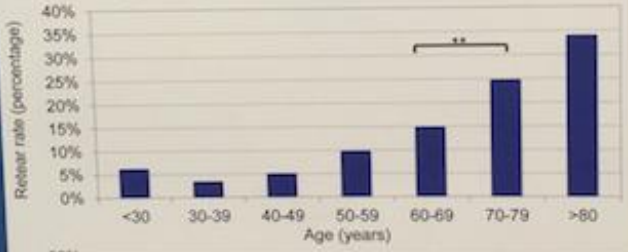
Demographics

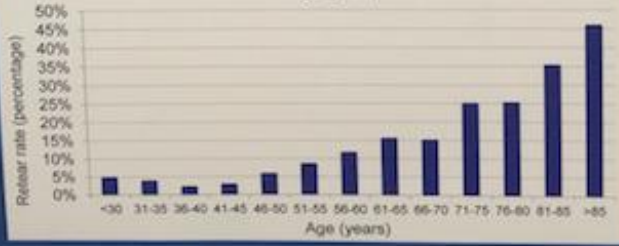
There were 1388 intact rotator cuff repairs and 212 retears identified on ultrasound examination at 6 months post-surgery, giving an overall retear rate of 13%. The retear group were on average 7 years older than the intact group. The ratio of males to females in the intact group was approximately 1:1, while in the retear group it was almost 2:1. The mean preoperative tear size in the retear group was approximately 2.5 times greater than in the intact group. This coincided with an average of 3 anchors used in surgery in the retear group, while an average of only 2 anchors were used in the intact group. The mean operating time for the retear group was 7 minutes longer than in the intact group. No significant difference was found in the numbers of right and left shoulders between the two groups.

	Intact (n=1388)	Retear (n=212)	P-value
Mean age (years)	58 ± 0.3 (17-91)	65 ± 0.8 (15-88)	p<0.0001
Males:Females	751:637	135:77	p<0.01
Right:Left	825:563	125:87	NS (p=0.94)
Full:Partial	673:492	154:17	p<0.0001
Anchors	2 ± 0.02 (0-6)	3 ± 0.1 (1.0-6.0)	p<0.0001
Tear size (cm^2)	2.95 ± 0.11 (0.04-54.00)	7.57 ± 0.57 (0.25-64.00)	p<0.0001
Op time (mins)	21 ± 0.3 (4-110)	28 ± 1.0 (4.5-106)	p<0.0001

Age and Retear

In order to evaluate the relationship between patient age and rotator cuff retear rate, patients were ordered by age at time of surgery and divided into increments of 10 years and 5 years, and the retear rate for each group was calculated. The largest increase in retear rate occurred between the 60-69 years and 70-79 years groups (p=0.001). The odds ratio between these two groups was 1.89, meaning that patients aged 70-79 years were almost twice as likely to retear compared to patients aged 60-69 years.

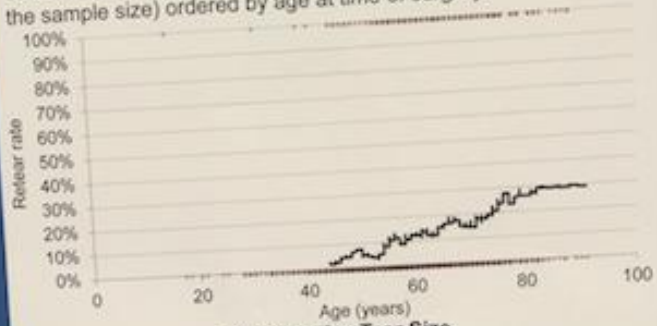




1. Retear Rate at 6mo = 13%
2. Retear group were older & had larger RCT

Retear according To age

A moving average analysis was performed to further evaluate the relationship between patient age and retear. This was done by calculating the retear rate for increments of 160 patients (1/10th of the sample size) ordered by age at time of surgery.

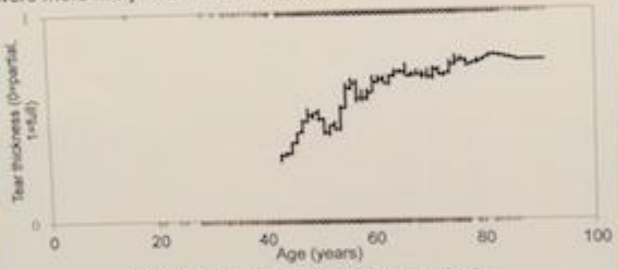


Preoperative Tear Size

There was a positive relationship between preoperative tear size and retear. Larger preoperative tear size was associated with an increase in postoperative retear ($r=0.3$, $p<0.0001$). A weak positive correlation was also found between preoperative tear size and patient age ($r=0.19$, $p<0.0001$), indicating that older patients were more likely to have larger tears preoperatively. There was a strong correlation found between larger preoperative tear size and larger retear size ($r=0.46$, $p<0.0001$); however no relationship was found between patient age and retear size.

Preoperative Tear Thickness

A moving average analysis was conducted to evaluate the relationship between patient age and preoperative tear thickness. This was done with increments of 160 patients (1/10th of the sample size) ordered by age. It demonstrates a trend that patients were more likely to present with full thickness tears as patient age increased. Of the 827 full thickness tears in the cohort, 154 (19%) went on to retear after surgery while only 17 (3%) of the 509 partial thickness tears went on to retear, showing that full thickness tears were more likely retear after surgery.



Multiple Logistic Regression Analysis

Preoperative tear size was the independent variable most strongly correlated with retear (Wald statistic = 41.37, $p<0.001$), followed by patient age (Wald statistic = 28.64, $p<0.001$) then tear thickness (Wald statistic = 23.52, $p<0.001$). Results from this regression demonstrated that older patient age was a significant independent variable for higher rotator cuff retear rate. Gender also had a weak relationship (Wald statistic = 7.86, $p=0.005$), with males being more likely to retear.

Discussion

This study evaluated the relationship between patient age and healing after rotator cuff repair surgery. We found a strong association between age and the rate of healing, and the major finding was that the retear rate increased at different rates as patient age increased. In patients aged under 50 years the retear rate was low (5%) and changed minimally with age. In patients aged 50-70 years, the retear rate increased linearly by 5% each decade. Finally, over the age of 70 years the retear rate rose exponentially to 46% over the age of 85 years.

Interestingly, the cohort in this study was normally distributed in terms of age. As rotator cuff tears become more common with age, we expected that the number of patients over the mean age of 59 years would clearly outweigh the number of patients younger than 59 years. The ages of the retear cohort were also normally distributed, but with a higher mean age of 65 years. Given the strong increase in retear rate as age increases, this was similarly unexpected.

In this study multiple logistic regression analysis showed that advanced patient age is an independent factor strongly related to increasing retear rate. The exact mechanism by which age leads to retear has not been clearly established. There is some evidence to suggest that a loss of structural organisation in collagen in the tendon occurs as patient age increases, leading to decreased tendon integrity and therefore higher chance of retear after surgery.

We found that patient age and retear also had relationships with preoperative tear size and preoperative tear thickness. Larger preoperative tear size had a weak correlation with advanced age ($r=0.19$, $p<0.0001$), and larger tears were more likely to retear ($r=0.3$, $p<0.0001$). Similarly, full thickness tears became more common as age increased (shown in the moving average of age and tear thickness), and the retear rate was higher among patients with full thickness tears (retear rate of 19% for full thickness tears versus retear rate of 3% for partial thickness tears).

The relationship identified in this study between increasing age and increased incidence of full thickness tears has not been previously described to our knowledge. The mechanism by which age leads to a greater chance of full thickness tear preoperatively is unknown. It is possible that it occurs due to decreased tendon integrity in ageing tendons, as described above, or due to selection bias.

Conclusions

The major finding of this study was that the rate of retear following arthroscopic rotator cuff repair increased minimally in patients below 50 years of age; In patients aged 50-70 years the rate of rotator cuff retear increased linearly; and over 70 years the retear rate increased exponentially. Preoperative tear size and patient age at time of surgery were the strongest independent factors for retear following rotator cuff repair surgery.

After Age 70yo Retear rate increases exponentially
(Beware of operating on non-traumatic tears in elderly)

Outcomes of Trabecular Metal Glenoid Components in Total Shoulder Arthroplasty

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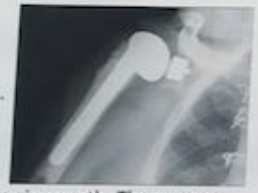
HAWKINS FOUNDATION

GREENVILLE HEALTH SYSTEM

Introduction

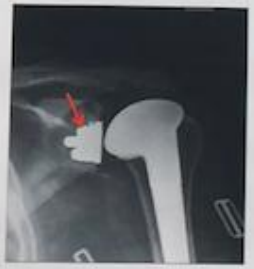


Glenoid failure has been recognized as one of the primary causes of failure of anatomic Total Shoulder Arthroplasty (TSA). Trabecular metal-backed glenoid components have become a popular choice due to the highly porous design which facilitates bony ingrowth. The current design of the trabecular metal-backed glenoid component was released in 2009. Although over 10,000 of these have been implanted worldwide, evidence on either the intermediate or long-term survival of trabecular metal-backed glenoid components in anatomic TSA is very limited. The purpose of this study is to report the early results, survival, and patient-reported outcomes of this anatomical TSA system utilizing trabecular metal-backed glenoid components. The primary outcome was implant survival, defined as no revision surgery for glenoid component failure within 2 years.

Operative Technique

In this case series, a Zimmer Anatomic Total Shoulder with a Trabecular Metal ™ backed glenoid component was implanted in all cases. All but 3 glenoid components were implanted with an uncemented press-fit technique. Cemented technique was utilized in these 3 cases due to poor bone quality. The deltopectoral approach and a subscapularis peel technique was used to access the glenohumeral joint and repaired with transosseous sutures. Humeral preparation was carried out in standard fashion with press-fit stem placement in 20-30

Results



Forty-seven patients received a trabecular metal-backed glenoid component in the study period. Five patients (11%) were revised at an average of twelve months postop due to pain and subscapularis failure. Two patients were deceased prior to 2 years post-op. 12 patients (30%) were lost to follow-up.

Twenty-eight of the patients met the inclusion criteria for clinical, radiographic and patient reported outcomes.

Demographics	
Age	66.4 years (50-85)
Gender	14 Male 14 Female
Average time of final follow up	34.1 months (23-61)

Complications	
Osteolysis	3
Metal Debris	4

Four patients had radiographic evidence of metal particulate debris. Three of these patients were asymptomatic. The patients were followed with serial radiographs, which showed no change in the "debris" position at the time of final follow-up. A CT arthrogram was performed on one patient and showed no signs of

Failure

The fourth patient with metal particulate debris suffered a traumatic fall, resulting in obvious glenoid loosening. At the time of revision, significant metallosis and polyethylene component fracture were observed. There was substantial posterior glenoid osteolysis and cystic formation, although the trabecular metal keel was ingrown and stable.

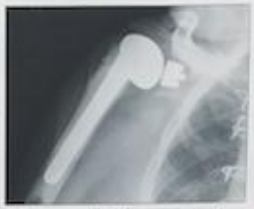
Clinical Results

VAS scores significantly improved an average of 4.4 points ($p<0.01$) per patient between preoperative and final follow-up. Range of motion improved an average 74° for forward elevation ($p<0.01$), and 46° for external rotation ($p<0.01$).

By final follow-up, there was an average reduction in pain of 83.0%, along with an 87.2% increase in elevation and a 354.2% increase in external rotation.

Patient Reported Outcomes at Final Follow-up

Introduction



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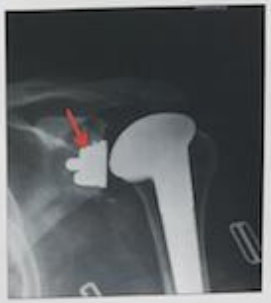
Methods

An Institutional Review Board approved retrospective review was conducted on all patients undergoing TSA during the study period. Patients 18 years of age or older with a trabecular metal-backed glenoid component were included. Patients were excluded if they did not have at least 2 years clinical and radiographic follow-up and patient reported outcome measures. Radiographs were reviewed for signs of loosening or metal debris. Clinical notes were reviewed for Visual Analog Scale (VAS) scores and range of motion. The American Shoulder and Elbow Surgeons Shoulder score (ASES), Penn Shoulder Score (PSS), and the Single Assessment Numeric Evaluation (SANE) score patient-reported outcome measures were collected from the final follow-up.

1. Retrospective study
2. 2-year Minimum Follow-up

Results

Forty-seven patients received a trabecular metal-backed glenoid component in the study period. Five patients (11%) were revised at an average of twelve months postop due to pain and subscapularis failure. Two patients were deceased prior to 2 years post-op. 12 patients (30%) were lost to follow-up.



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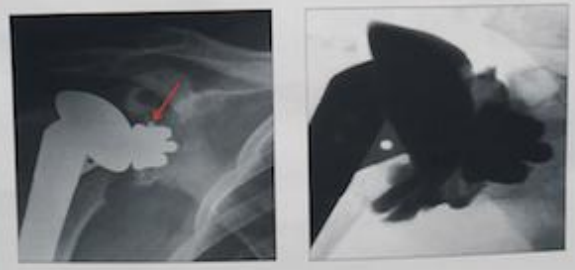

Radiograph and CT arthrogram of an asymptomatic patient with evidence of metal debris without evidence of loosening.

FDA Disclosure

The FDA has not cleared all medical devices for the use described in this poster. Press-fit technique is off label use for TM glenoid components.

1. 47 Patients received TM glenoid
2. 5/47 (11%) revised in 2 months due to pain
3. 30% of patients lost to F/U
4. 4/47 (9%) had radiographic evidence of Metal particulate debri

Failure

The fourth patient with metal particulate debris suffered a traumatic fall, resulting in obvious glenoid loosening. At the time of revision, significant metallosis and polyethylene component fracture were observed. There was substantial posterior glenoid osteolysis and cystic formation, although the trabecular metal keel was ingrown and stable.

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By final follow-up, there was an average reduction in pain of 83.0%, along with an 87.2% increase in elevation and a 354.2% increase in external rotation.

Patient Reported Outcomes at Final Follow-up	
SANE	72.4 (21-100)
PENN	70.4 (7-95.8)
PENN Satisfaction Score	7.5 (0-10)
ASES	69.2 (1.7-96.7)

Outcome scores were similar in the 7 patients with osteolysis or metal debris with mean SANE score 76.7, PENN 71.1, PENN satisfaction 7, and ASES 70.2.

Conclusions

At a minimum 2-year follow-up, trabecular metal-backed glenoid components demonstrated a substantial rate of radiographic metal debris and osteolysis. There were no cases of implant loosening and the implant appears to provide adequate fixation in a press-fit fashion. However, when complications did occur they were severe. These patients should therefore be followed closely and this style of implant should be used with caution.

Metal Particulate Debri is a concern and complications, when they occurs, were severe

J Bone Joint Surg Am. 2016 Jun 15;98(12):1023-9. doi: 10.2106/JBJS.15.00410.

Early Debris Formation with a Porous Tantalum Glenoid Component: Radiographic Analysis with 2-Year Minimum Follow-up.

Endrizzi DP[1], Mackenzie JA[2], Henry PD[3].

⊕ Author information

Abstract

BACKGROUND: Porous tantalum has been used effectively in hip, knee, and reverse shoulder arthroplasty implants. However, a first-generation porous tantalum glenoid component for use in anatomic shoulder arthroplasty previously demonstrated failure, with failure usually preceded by the appearance of intra-articular metallic debris. After redesign, the component was reintroduced in 2009. The purpose of the current study was to evaluate the radiographic and clinical outcomes of the redesigned glenoid component.

METHODS: Sixty-eight patients undergoing total shoulder arthroplasty received a Trabecular Metal porous tantalum glenoid component (73 components; 5 patients underwent staged bilateral procedures). No polymethylmethacrylate cement was used (off-label usage in the U.S.). A grading system to assess metallic debris formation was developed using radiographs of the previous generation of porous tantalum glenoid components that failed. Radiographs from the current series were independently reviewed by 2 shoulder arthroplasty specialists, and their results were compared. Glenoid components were evaluated for signs of bone ingrowth and metallic debris formation.

RESULTS: Sixty-six (90%) of the 73 components were evaluated at a minimum of 2 years of follow-up (mean radiographic follow-up of 50.8 months; range, 24 to 68 months). Of these, 92.4% demonstrated minimal or no glenoid radiolucency. Overall, the prevalence of metallic tantalum debris formation was 44% (29 of 66). Sequential radiograph review demonstrated that the incidence of metallic debris formation increased for each year of follow-up, with radiographs from 2, 3, 4, and ≥5 years of follow-up demonstrating a metallic debris incidence of 23%, 36%, 49%, and 52%, respectively. Additionally, the severity of metallic debris formation increased with follow-up duration. There was no component dissociation or revision due to implant breakage in this series.

CONCLUSIONS: The porous tantalum glenoid component studied had excellent short-term component fixation. However, the development of metallic debris, increasing in both overall incidence and degree of severity over time, raises concern for potential failure of this glenoid component. Longer follow-up is required.

LEVEL OF EVIDENCE: Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

Clinical Outcomes Following Total Shoulder Arthroplasty: A Comparison of Two Systems

University of CINCINNATI

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[1]University of Cincinnati, College of Medicine, Department of Orthopaedic Surgery, Cincinnati, OH
[2]Western Michigan University, Homer Stryker School of Medicine, Department of Orthopaedic Surgery, Kalamazoo, MI

Background

Primary osteoarthritis (OA) is the most common degenerative process in the shoulder,[1] and total shoulder arthroplasty (TSA) has been shown to achieve positive outcomes in OA patients in short-, mid-, and long-term follow-ups.[2,3,4] Although TSA can be accomplished using a variety of implant options, there is a paucity of data comparing outcomes using different prostheses. This analysis and understanding is important for maximizing outcomes in TSA.[5]

Shoulder prostheses are typically designed with a fixed cervicodiaphyseal angle and have a wide range of humeral head sizes, so they can be tailored to fit the patient's individual anatomy. There is evidence to suggest that modular-style components may lead to improved outcomes through better positioning of the implant,[6,7] although some authors argue that component modularity is of little significance in changing outcomes.[8]

Hypothesis

We hypothesized that there would be no difference in outcomes when comparing these two shoulder replacement systems.

Methods

This is a retrospective evaluation of anatomic shoulder replacement performed in patients with degenerative arthropathy by a single, experienced fellowship-trained shoulder surgeon.

A fixed-angle component (Implant #1) was compared to a modular implant (Implant #2), and post-operative range of motion (ROM) and complication rates, including whether a revision surgery was necessary, was evaluated.

A total of 89 implants between January 2004 and May 2015 had a minimum of 6 months follow-up and were evaluated. Differences between cohorts were compared using chi-square tests and Student's T-tests for categorical and continuous variables, respectively. A p-value of 0.05 was considered statistically significant.

Figure 1. Plain radiograph demonstrating implant #1

Figure 2. Plain radiograph demonstrating implant #2

Results

Demographic data for the patient cohorts is shown in Table 1. There were no statistically significant differences between cohorts ($p>0.05$) except for mean follow-up, which was significantly longer in the fixed-angle component cohort ($p<0.001$).

There was no statistically significant difference in post-operative ROM between cohorts ($p>0.05$) with a mean forward flexion of 151° in the fixed-angle component group and a mean of 157° in the modular implant group.

There were a total of 8 complications in the Implant #1 cohort, 3 of which were revisions. In the Implant #2 group, there were 4 total complications, 2 of which were revisions. All revisions were performed due to painful and/or unstable TSA. There was no statistically significant difference in complication or revision rates between cohorts ($p>0.05$). Complications excluding revisions were operative procedures undergone for various reasons, including tendinopathy, adhesive capsulitis, acute rotator cuff tear, and brachial plexus injury.

	Implant #1 (n= 49)	Implant #2 (n = 40)
Age (years, range)	65.5 (48-82)	65.6 (51-88)
Gender (males/females)	24/25	13/27
Follow-Up (months, range)	40.3 (6-132)	14.9 (6-46)
Hospital stay (days, range)	0.9 (0-7)	1.1 (0-5)

Table 1. Patient demographic data for prosthesis groups, showing mean values and ranges.

Discussion

No statistically significant difference in post-operative ROM or complication rate was found to exist between the two different systems used. It should be noted that the Implant #1 group had a significantly longer mean follow up. This is most likely due to the fact that this was the original system used by the senior author prior to transitioning to Implant #2; therefore, the patients who received Implant #1 are, on average, further from the index surgery than their counterparts.

As various prostheses exist for TSA, it is important to determine which implants are associated with the lowest rate of revisions and complications. Identifying such an advantage would allow surgeons to limit patient morbidity and minimize overall healthcare burden and cost associated with TSA. This study may suggest that using different implants does not seem to affect post-TSA complication rates.

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Acknowledgements

The investigators would like to thank the University of Cincinnati Orthopaedic Research and Education Foundation for funding the Medical Student Summer Research Program Award.

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We hypothesized that there would be no difference in outcomes when comparing these two shoulder replacement systems.

Methods

This is a retrospective evaluation of anatomic shoulder replacement performed in patients with degenerative arthropathy by a single, experienced fellowship-trained shoulder surgeon.

A fixed-angle component (Implant #1) was compared to a modular implant (Implant #2), and post-operative range of motion (ROM) and complication rates, including whether a revision surgery was necessary, was evaluated.

A total of 89 implants between January 2004 and May 2015 had a minimum of 6 months follow-up and were evaluated. Differences between cohorts were compared using chi-square tests and Student's T-tests for categorical and continuous variables, respectively. A p-value of 0.05 was considered statistically significant.

Are these two groups really Comparable & is the N large enough? National Registry Data from Australia, NZ, And others can only distinguish inferior Implants and not any others…does this Mean all are the same?

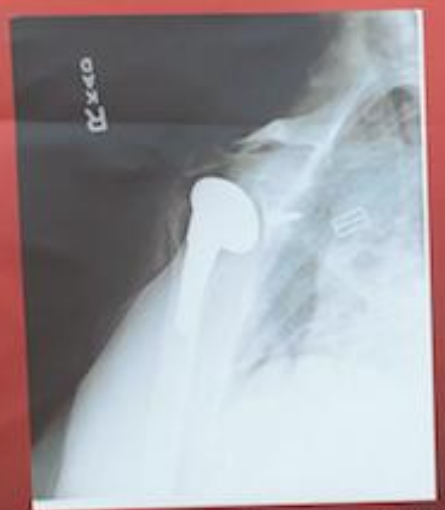

Figure 1. Plain radiograph demonstrating implant #1

Figure 2. Plain radiograph demonstrating implant #2

Results

Demographic data for the patient cohorts is shown in Table 1. There were no statistically significant differences between cohorts ($p>0.05$) except for mean follow-up, which was significantly longer in the fixed-angle component cohort ($p<0.001$).

There was no statistically significant difference in post-operative ROM between cohorts ($p>0.05$) with a mean forward flexion of 151° in the fixed-angle component group and a mean of 157° in the modular implant group.

There were a total of 8 complications in the Implant #1 cohort, 3 of which were revisions. In the Implant #2 group, there were 4 total complications, 2 of which were revisions. All revisions were performed due to painful and/or unstable TSA. There was no statistically significant difference in complication or revision rates between cohorts ($p>0.05$). Complications excluding revisions were operative procedures undergone for various reasons, including tendinopathy, adhesive capsulitis, acute rotator cuff tear, and brachial plexus injury.

	Implant #1 (n= 49)	Implant #2 (n = 40)
Age (years, range)	65.5 (48-82)	65.6 (51-88)
Gender (males/females)	24/25	13/27
Follow-Up (months, range)	40.3 (6-132)	14.9 (6-46)
Hospital stay (days, range)	0.9 (0-7)	1.1 (0-5)

Table 1. Patient demographic data for prosthesis groups, showing mean values and ranges.

What Do You Think?

Discussion

No statistically significant difference in post-operative ROM or complication rate was found to exist between the two different systems used. It should be noted that the Implant #1 group had a significantly longer mean follow up. This is most likely due to the fact that this was the original system used by the senior author prior to transitioning to Implant #2; therefore, the patients who received Implant #1 are, on average, further from the index surgery than their counterparts.

As various prostheses exist for TSA, it is important to determine which implants are associated with the lowest rate of revisions and complications. Identifying such an advantage would allow surgeons to limit patient morbidity and minimize overall healthcare burden and cost associated with TSA. This study may suggest that using different implants does not seem to affect post-TSA complication rates.

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Acknowledgements

The investigators would like to thank the University of Cincinnati Orthopaedic Research and Education Foundation for funding the Medical Student Summer Research Program Award.

This study does not consider:

1. Surgeon variability
2. Revision options (modularity)
3. Inventory management (cost)
4. Value (Outcome/cost)
5. Durability of the outcome

Early Postoperative Fluoroquinolone Use is Associated with Increased Revision Rate after Arthroscopic Rotator Cuff Repair

Cancienne JM[1], Brockmeier SF[1], Rodeo SA[2], Young C[3], Werner BC[1]

[1]University of Virginia, Charlottesville ,VA; [2]Hospital for Special Surgery, New York, NY; [3]Ortho Virginia, Richmond, VA

INTRODUCTION

- Fluoroquinolones (FQ) are one of the most frequently prescribed antibiotics in the US
- Despite their popularity, FQ use has been associated with severe tendinopathy
- While animal studies have demonstrated the deleterious effects of FQ on tendon healing following rotator cuff repair (RCR), no clinical studies in humans have supported these findings

OBJECTIVES

- To employ a national database to evaluate the association of early postoperative FQ use following arthroscopic, primary RCR with failure requiring revision RCR compared to matched controls with remote or no prior FQ exposure

METHODS

- Humana dataset within the PearlDiver database used to identify patients who underwent arthroscopic, primary RCR from 2007-2015 using CPT code 29827
- Excluded open repair, patients without 6 months follow-up
- Cohort then queried for patients who received FQ within 6 months postoperatively, sub divided into FQ use 2, 2-4, and 4-6 months postop
- A matched negative control cohort of patients with no documented FQ created
- A matched positive control cohort of patients with FQ use 6-24 months postoperatively created
- Rate of revision RCR queried for the study and 2 control cohorts within 2 years postoperatively
- Rates of revision RCR compared using a multivariable binomial regression analysis, Odds ratios (ORs), 95% CI calculated with $p < 0.05$ significant

RESULTS

Table 1. Statistical Comparison of Revision Rotator Cuff Repair Rates

Cohort	Total #	Revisions	Statistical Comparison			
			vs Neg Ctl		*vs Pos Ctl*	
	n	n (%)	O.R. [95% C.I.]	P	O.R. [95% C.I.]	P
0-6 mo Fluoroquinolone	1,292	56 (4.3%)	1.6 [1.3 - 2.1]	< 0.0001	1.7 [1.3 - 2.3]	0.0002
0-2 mo Fluoroquinolone	442	27 (6.1%)	*1.8 [1.3 - 2.5]*	*0.0009*	*1.8 [1.2 - 2.6]*	*0.0026*
2-4 mo Fluoroquinolone	433	17 (3.9%)	*1.0 [0.7 - 1.6]*	(n.s.)	*1.1 [0.7 - 1.7]*	(n.s.)
4-6 mo Fluoroquinolone	417	12 (2.9%)	*1.0 [0.6 -1.7]*	(n.s.)	*1.0 [0.6 - 1.8]*	(n.s.)
Matched Neg Controls	5,225	116 (2.2%)				
Matched Pos Controls	1,597	39 (2.4%)	0.9 [0.7 - 1.2]	(n.s.)		

* calculated using multivariate binomial logistic regression

- After matching, there were no significant differences between the study group and matched control cohorts in terms of gender, age group, tobacco use, obesity, and diabetes mellitus
- In the subgroup analysis, the rate of revision RCR was significantly higher in patients prescribed FQs within 2 months (6.1%) compared to matched negative controls (2.2%, $p = 0.0009$) and matched positive controls (2.4%, $p = 0.0026$).

DISCUSSION

- FQ use in the early postoperative period, particularly within the first 2 months, was independently associated with increased rates of revision RCR within 2 years
- While our understanding of FQ-induced tendinopathy has been advanced by laboratory research, which has suggested complex mechanisms for the deleterious effects of FQS on tendon structure and healing capacity, no clinical studies in humans to date have corroborated these findings
- Given the low incidence of revision RCR, retrospective studies are unable to generate a large enough cohort to adequately power a statistically meaningful analysis of the effect of FQ use on RCR failure
- The present study overcomes these limitations by sampling a large, representative database to demonstrate the effect of FQs that is most pronounced within the first 2 months of RCR
- This data helps translate years of laboratory and animal research into clinically significant outcomes aimed at identifying modifiable risk factors for RCR failure

CONCLUSIONS

- ***Early use of FQs following RCR was independently associated with significantly increased rates of failure requiring revision RCR compared to matched patients undergoing the same procedure without any history of FQ use.***

Glenoid Fixation in Conventional Shoulder Arthroplasty for Osteoarthritis: An Analysis of 7,079 Cases

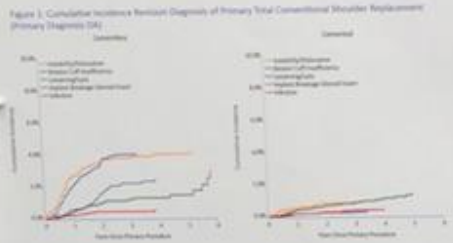
Richard S Page[1], Stephen Graves[2], Richard de Steiger[2,3], Peter L Lewis[2], Cynthia K Turner[2], Sophia Rainbird[2], Michelle Lorimer[4] (No disclosures - All authors)

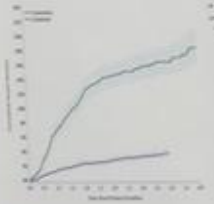
Summary

- Cemented glenoid components had the lowest revision rate for conventional TSR undertaken for osteoarthritis
- Modular metal backed glenoids had the highest revision rates
- Patients < 55 yrs had higher revision rates than other age groups

Introduction

Shoulder replacement surgery is increasing and the glenoid component remains a common cause for revision in conventional total shoulder arthroplasty (TSAs). Arthroplasty registries are able to identify prostheses with higher than expected rates of revision, but to date this process has been limited with regard to shoulder replacement. Understanding factors associated with revision TSA is crucial to decrease the incidence. This study aimed to investigate the type of glenoid fixation with respect to revision TSA.



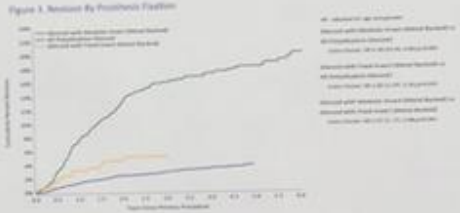


Methods

All primary conventional TSAs performed for osteoarthritis and reported to a national registry from 16 April 2004 to 31 December 2013 were identified. Kaplan-Meier estimates of survivorship were used to describe the time to first revision. Hazard Ratios (HR) from Cox proportional hazards models, adjusting for age and gender, were used to compare revision rates. Factors analysed include age, gender, glenoid fixation and type of prosthesis. Revision diagnosis and type of revision were also examined.

Results

There were 7079 (58.6% female) conventional TSAs reported with a primary diagnosis of osteoarthritis. 412 revisions of known primary procedures were analysed. The median age was 70 (range 25 to 94), the 65-74 age group had 43.2 % of procedures. Patients younger than 55 years of age had a higher rate of revision compared to those aged between 65-74 years and those aged 75 years and older (HR=1.57, 95% CI 1.03 – 2.38 and HR=1.79, 95% CI 1.15-2.70 respectively). This difference was not seen if a cemented glenoid component was used. There was no difference in revision rates between males and females (HR=0.96, 95% CI 0.79-1.18).



The most common form of fixation was hybrid (glenoid cemented, 58.7%) then cementless TSR (30.5%) and totally cemented fixation (10.2%). When compared to cemented glenoid components, uncemented glenoid components had a higher proportion of revisions for instability (% Primary 3.5% vs. 0.8%), rotator cuff insufficiency (% Primary 3.3% vs. 0.3%) and loosening (% Primary 1.3% vs 0.9%) (Figure 1). Cementless glenoids had a significantly higher revision rate than cemented glenoids (HR=4.84, 95%CI 3.93-5.94) (Figure 2). Excluding the most common uncemented implant (used in 25.4 % of cementless glenoid and 4.4% cemented glenoid cases), cementless glenoid components still had a significantly higher revision rate compared to cemented glenoids (HR=3.37, 95% CI 2.29-4.78).

Modular metal backed glenoids had a significantly higher revision rate compared with fixed insert metal backed glenoids (HR=2.97, 95% CI 1.73-5.08) and all polyethylene glenoids (HR=5.40, 95% CI 4.38-6.66). A modular prosthesis able to be converted to a reverse TSR had the highest revision rate (HR=4.97, 95%CI 4.38-5.62) compared to a fixed metal backed glenoid (HR=3.03, 95%CI, 1.99-4.40) (Figure 3). This was related to rotator cuff insufficiency in 3.3% of primary cases, but also instability (3.5%), implant breakage/dissociation (2.5%) and loosening (1.3%) respectively.

When a cemented glenoid component was used, there was no significant difference in revision rates between a pegged component and a keeled component (HR=0.85, 95% CI 0.54-1.34).

Conclusions

This study has identified cementless glenoid fixation, particularly modular metal backed glenoid components as significant risk factors for revision. Younger age is also a risk factor for revision.

Reference:

Affiliations:

National Joint Replacement Registry www.aoa.org.au

National Joint Replacement Registry

AOA AUSTRALIAN ORTHOPAEDIC ASSOCIATION

Shoulder Arthroplasty

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Figure 1: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Shoulder Replacement (Primary Diagnosis OA)

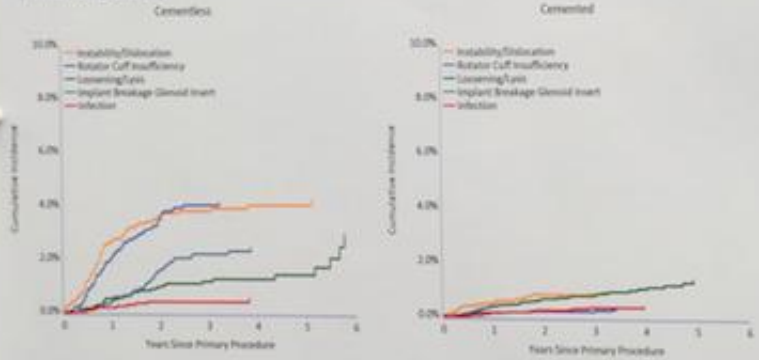

Figure 2: Cumulative Percent Revision of Primary Total Conventional Shoulder Replacement by Glenoid Fixation (Primary Diagnosis OA)

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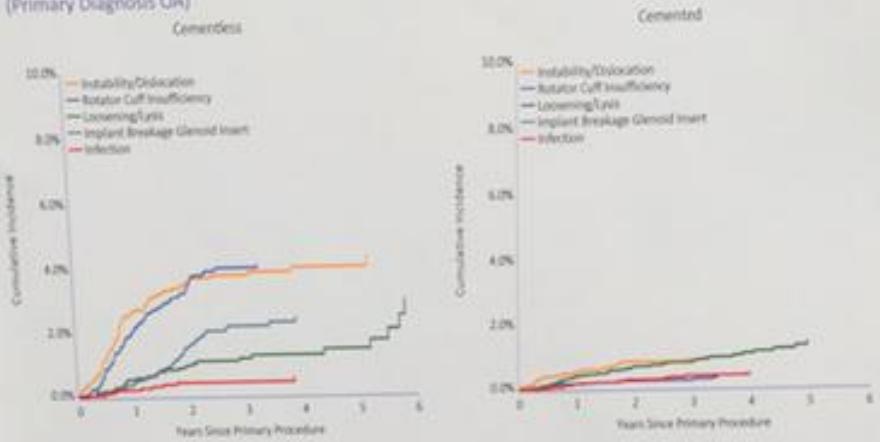

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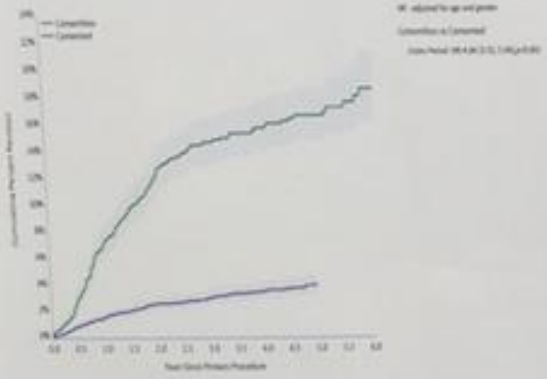

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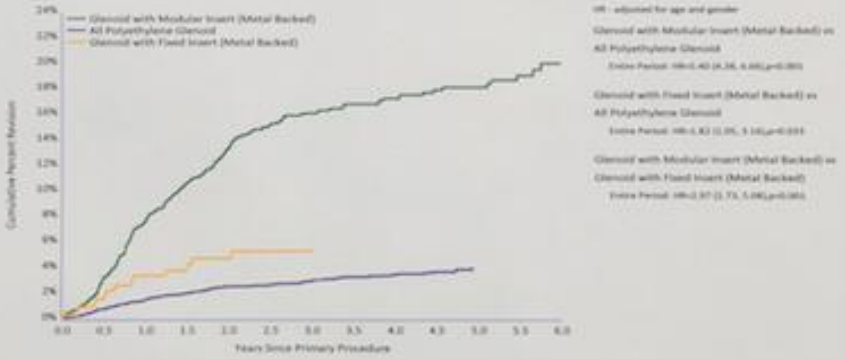
Registry does not take into account:

1. Surgeon experience & ability
2. Other relevant factors

Results

There were 7079 (58.6% female) conventional TSAs reported with a primary diagnosis of osteoarthritis. 412 revisions of known primary procedures were analysed. The median age was 70 (range 25 to 94), the 65-74 age group had 43.2 % of procedures. Patients younger than 55 years of age had a higher rate of revision compared to those aged between 65-74 years and those aged 75 years and older (HR=1.57, 95% CI 1.03 – 2.38 and HR=1.79, 95% CI 1.15-2.70 respectively). This difference was not seen if a cemented glenoid component was used. There was no difference in revision rates between males and females (HR=0.96, 95% CI 0.79-1.18).

Figure 3. Revision By Prosthesis Fixation



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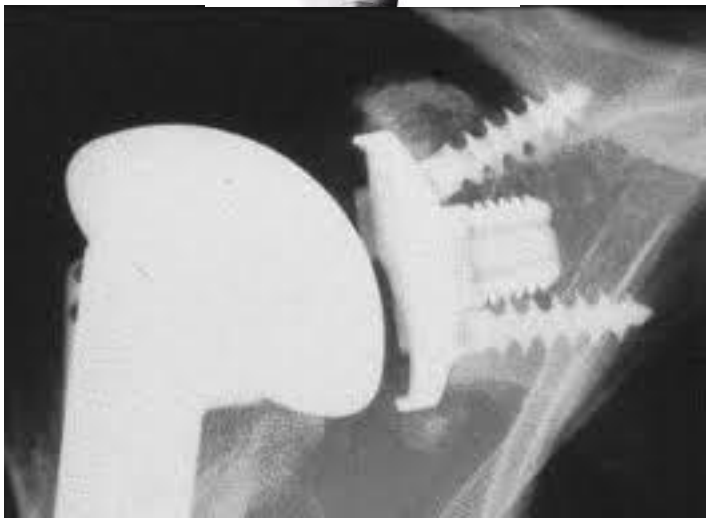

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Conclusions

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Reference:
https://aoanjrr.sahmri.com/documents/10180/217645/Shoulder%20Arthroplasty

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3. Epworth HealthCare, Victoria.
4. South Australian Health and Medical Research Institute (SAHMRI), Adelaide, South Australia.

THE SPORTS CLINIC
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Benzoyl Peroxide and Clindamycin Topical Skin Preparation Decreases Propionibacterium Acnes Colonization in Shoulder Arthroscopy

Hailey H. Dizay D.O., Diana G. Lau M.D., Wesley M. Nottage M.D.

Introduction

Propionibacterium acnes is a gram-positive anaerobe that can lead to devastating postoperative shoulder infections. Superficial skin colonization with P. acnes is high at arthroscopic portals, reported in up to 80%[1] of primary cases, and up to 90%[2] of revisions. The objective of this study was to investigate whether a benzoyl peroxide and clindamycin preoperative skin preparation reduces the incidence of P. acnes colonization during shoulder arthroscopy.

Methods

65 shoulder arthroscopy patients were prospectively enrolled. Skin culture was taken at the pre-operative visit from standard arthroscopic portal sites. Topical benzoyl peroxide 5% and clindamycin 1.2% (BPO/C) gel was applied to the shoulder once daily prior to surgery (Fig 1.) Patients were randomized to the number of applications by their preoperative visit date. Range 1-10 days of application, avg 2.3 applications. Skin culture was repeated in the operating room prior to preparation with chlorhexidine gluconate (Fig 4.) Shoulder arthroscopy proceeded with final cultures obtained within the shoulder joint (Fig 2.)

Results

P. acnes skin colonization remained similar to prior studies at 47.7% (31 of 65 patients.) With >1 application, BPO/C was 78.9% (15 of 19 patients) effective at eliminating P. acnes superficial colonization. With 1 application, it was 66.7% (8 of 12 patients) effective at eliminating superficial colonization. Deep colonization was reduced to 3.1% (2 of 65 patients) compared to 19.6% without

Figures

Figure 1. Topical BPO/C (B) was applied to the shoulder (A) each night before surgery.

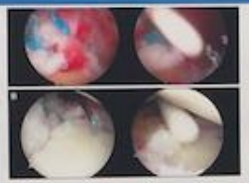

Figure 2. Intraoperative cultures taken from within the shoulder at the operative site. (A) Rotator cuff repair. (B) Labral repair.

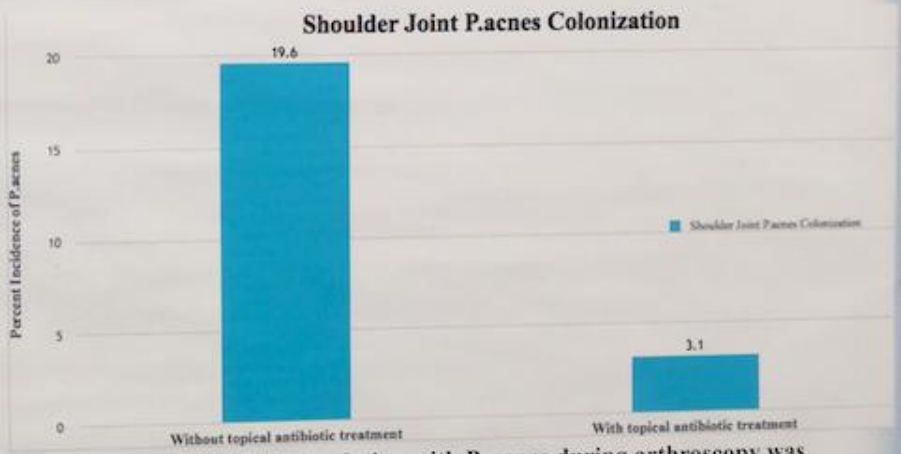

Figure 3. Shoulder joint inoculation with P. acnes during arthroscopy was decreased to 3.1% from 19.6%[1] (p=0.006) with the use of a topical benzoyl peroxide and clindamycin gel applied preoperatively.

Discussion

The low virulence of P. acnes and unconventional microbiological tests required for identification have led to under-reporting of joint colonization. P. acnes infections following shoulder arthroscopy are difficult to diagnose and treat, and results are poor even after treatment.[3] Dermatologic literature demonstrates effective reduction with BPO/C.[4] It is effective, safe, and avoids antibiotic resistance. The present study supports these findings with use in shoulder arthroscopy.

Conclusion

P. acnes skin colonization is high at arthroscopic shoulder portals, especially in men and in revisions. Despite standard skin preparation and prophylactic antibiotics, the rate of joint inoculation is much higher than the rate of infection reported in the literature. BPO/C effectively reduces P. acnes colonization in shoulder arthroscopy. It should be considered for use prior to shoulder procedures with a time-related trend of >1 application. Level of Evidence: Level II, prospective cohort study.

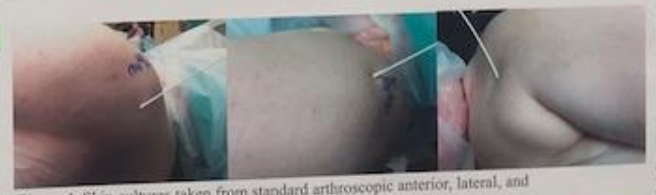

Figure 4. Skin cultures taken from standard arthroscopic anterior, lateral, and posterior portal sites.

Figure 5. Cultures were plated for 21 days on Brucella medium.

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…but incidence of infection with shoulder arthroscopy is <.01%???

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Don't ask 'Why', ask instead, 'Why not'.

John F Kennedy

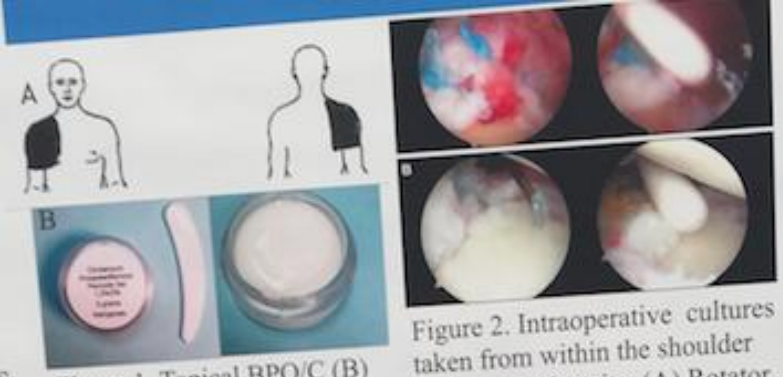

Figure 1. Topical BPO/C (B) was applied to the shoulder (A) each night before surgery.

Figure 2. Intraoperative cultures taken from within the shoulder at the operative site. (A) Rotator cuff repair. (B) Labral repair.

Discussion

The low virulence of P. acnes and unconventional microbiological tests required for identification have led to under-reporting of joint colonization. P. acnes infections following shoulder arthroscopy are difficult to diagnose and treat, and results are poor even after treatment.[3] Dermatologic literature demonstrates effective reduction with BPO/C.[4] It is effective, safe, and avoids antibiotic resistance. The present study supports these findings with use in shoulder arthroscopy.

Conclusion

P. acnes skin colonization is high at arthroscopic shoulder portals, especially in men and in revisions. Despite standard skin preparation and prophylactic antibiotics, the rate of joint inoculation is much higher than the rate of infection reported in the literature. BPO/C effectively reduces P. acnes colonization in shoulder arthroscopy. It should be considered for use prior to shoulder procedures with a time-related trend of >1 application. Level of Evidence: Level II, prospective cohort study.

See Abstracts Following this Poster

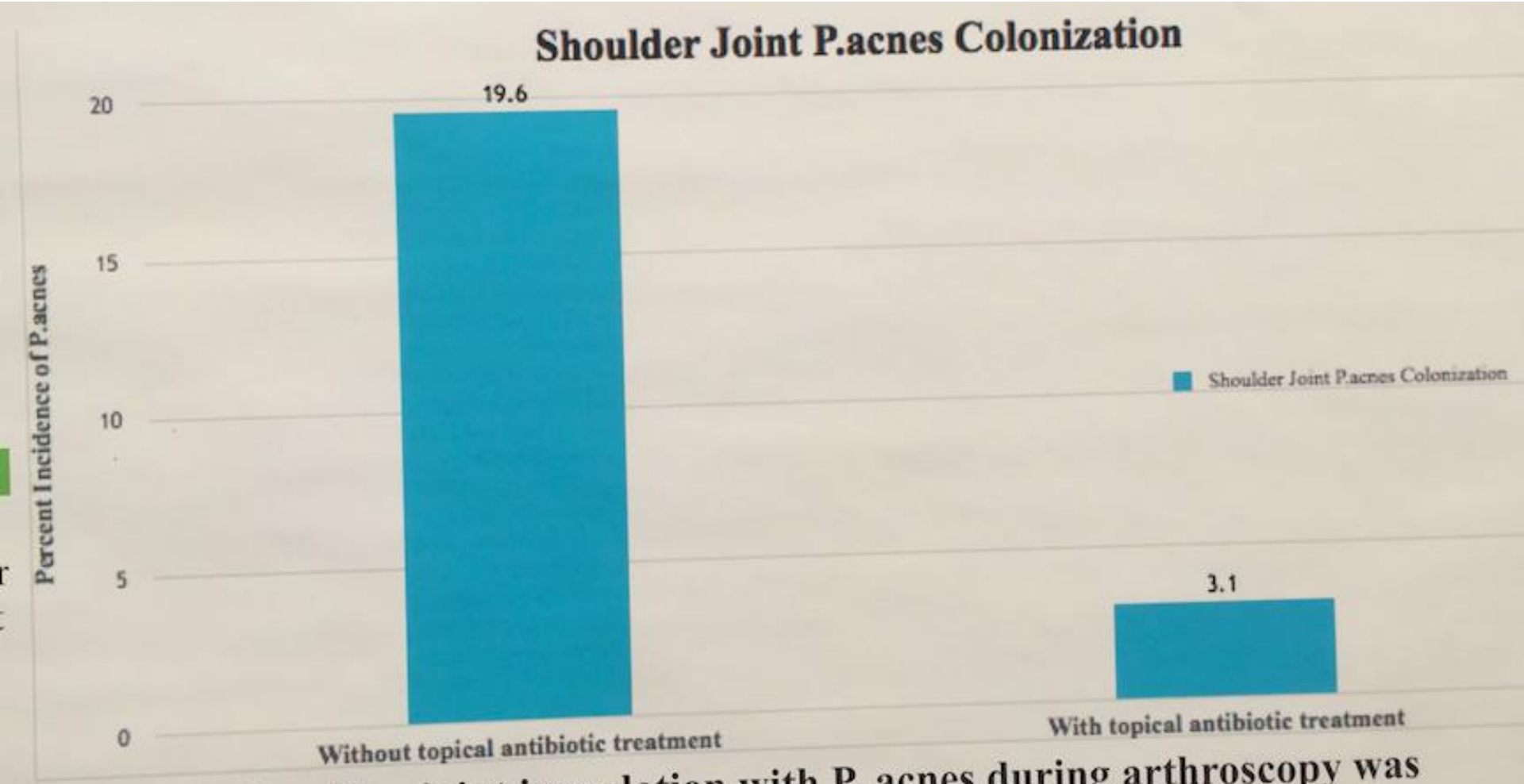

Figure 3. Shoulder joint inoculation with P. acnes during arthroscopy was decreased to 3.1% from 19.6%[1] (p=0.006) with the use of a topical benzoyl peroxide and clindamycin gel applied preoperatively.

0

Without topical antibiotic treatment

With topical antibiotic

Figure 3. Shoulder joint inoculation with P. acnes during arthroscopy was decreased to 3.1% from 19.6%[1] (p=0.006) with the use of a topical benzoyl peroxide and clindamycin gel applied preoperatively.

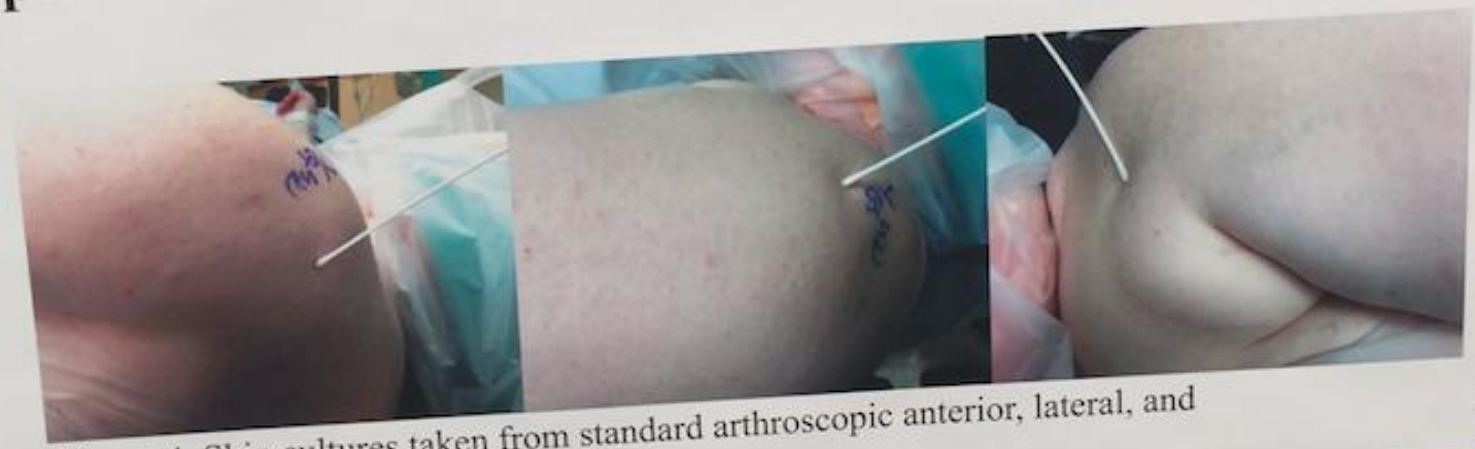

Figure 4. Skin cultures taken from standard arthroscopic anterior, lateral, and posterior portal sites.

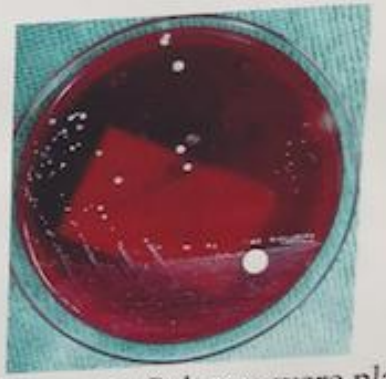

Figure 5. Cultures were pla
for 21 days on Brucella me

for

References

1. Chuang MJ, Jancosko JJ, Mendoza V, NottageWM. The incidence of Propionibacterium acnes in shoulder arthroscopy. Arthroscopy 2015.
2. Matsen FA, 3rd, Butler-Wu S, Carofino BC, Jette JL, Bertelsen A, Bumgarner R. Origin of propionibacterium in surgical wounds and evidence-based approach for culturing propionib from surgical sites. The Journal of bone and joint surgery American volume. 2013;95(23):e1811-7.
3. Athwal GS, Sperling JW, Rispoli DM, Cofield RH. Deep infection after rotator cuff repair. J Shoulder Elbow Surg 2007;16:306-311.
4. Leyden JJ, Kligman A. Contact sensitization to benzoyl peroxide, Contact Dermatitis 1977; 3 (5): 273–75

P. Acnes can cause shoulder pain After arthroscopy!

Chir Organi Mov. 2009 Apr;93 Suppl 1:S71-7. doi: 10.1007/s12306-009-0010-x.

Non-purulent low-grade infection as cause of pain following shoulder surgery: preliminary results.

Schneeberger AG[1], Gilbart MK, Sheikh R, Gerber C, Ruef C.

Author information

Abstract

Low-grade infection was systematically searched for in all revision shoulder surgeries by harvesting tissue samples. Ten consecutive patients were identified with a non-purulent low-grade infection of the shoulder. All of these patients suffered from pain and eight were stiff. Preoperative aspiration in eight patients yielded bacterial growth in only one case. Serum C-reactive protein levels were normal in seven out of 10 cases. Propionibacterium acnes was identified in seven, coagulase-negative Staphylococcus in two and Staphylococcus saccharolyticus in one case. The delay between harvesting the tissue samples and detection of bacterial growth averaged eight days (range, 2-17). After debridement and antibiotic treatment for a mean of 4.5 months, tissue samples were repeatedly harvested in nine patients due to persistent pain. The infection was microbiologically eradicated in six out of nine cases that had a repeated biopsy. However, nine out of 10 patients continued to suffer from moderate to severe pain. Low-grade infection of the shoulder can be a cause of persistent pain and stiffness. The results of antibiotic treatment are disappointing. Further studies are necessary to analyse this difficult pathology.

Clin Orthop Relat Res. 2011 Oct;469(10):2824-30. doi: 10.1007/s11999-011-1767-4. Epub 2011 Jan 15.

Propionibacterium acnes infection as an occult cause of postoperative shoulder pain: a case series.

Millett PJ[1], Yen YM, Price CS, Horan MP, van der Meijden OA, Elser F.

Author information

Abstract

BACKGROUND: Infections after shoulder surgery are potentially devastating complications. Propionibacterium acnes is recognized as a causal agent in shoulder infections. The clinical presentation is usually insidious and nonspecific, but a P. acnes infection could be an occult cause of postoperative shoulder pain.

QUESTIONS/PURPOSES: What are the clinical and microbiologic characteristics of a postsurgical P. acnes shoulder infection and how should it be addressed?

PATIENTS AND METHODS: Ten patients with an average age of 57 years presented with P. acnes postsurgical shoulder infection. Clinical infection signs and surgical history were assessed and joint aspirates and tissue biopsy specimens were obtained. Diagnosis was confirmed by microbiologic cultures.

RESULTS: At the time of confirmation of the diagnosis, clinical signs of infection were absent. C-reactive protein and erythrocyte sedimentation rates were inconsistently elevated. Cultures took a mean 7 days to confirm organism growth. The average time from surgery to diagnosis of infection was 1.8 years (range, 0.07-8.0 years). All patients underwent irrigation and débridement and were treated with antibiotics for 6 weeks.

CONCLUSIONS: P. acnes shoulder infections should be considered as a cause for persistent, unexplained shoulder pain. Shoulder aspirations and tissue samples should be obtained. Surgical débridement and intravenous antibiotics are necessary treatment modalities.

LEVEL OF EVIDENCE: Level IV, Prognostic study. See the Guidelines for Authors for a complete description of levels of evidence.

P. Acnes can cause shoulder pain After arthroscopy!

J Shoulder Elbow Surg. 2015 Jun;24(6):838-43. doi: 10.1016/j.jse.2015.03.008.

Propionibacterium acnes infection in shoulder arthroscopy patients with postoperative pain.

Horneff JG 3rd[1], Hsu JE[2], Voleti PB[1], O'Donnell J[1], Huffman GR[3].

Author information

Abstract

BACKGROUND: Recent studies have identified Propionibacterium acnes as the causal organism in an increasing number of postoperative shoulder infections. Most reports have found a high rate of P acnes infection after open surgery, particularly shoulder arthroplasty. However, there are limited data regarding P acnes infections after shoulder arthroscopy.

MATERIALS AND METHODS: We prospectively collected data on all shoulder arthroscopies performed by the senior author from January 1, 2009, until April 1, 2013. Cultures were taken in all revision shoulder arthroscopy cases performed for pain, stiffness, or weakness. In addition, 2 cultures were taken from each of a cohort of 32 primary shoulder arthroscopy cases without concern for infection to determine the false-positive rate.

RESULTS: A total of 1,591 shoulder arthroscopies were performed during this period, 68 (4.3%) of which were revision procedures performed for pain, stiffness, or weakness. A total of 20 revision arthroscopies (29.4%) had positive culture findings, and 16 (23.5%) were positive for P acnes. In the control group, 1 patient (3.2%) had P acnes growth.

CONCLUSIONS: The rate of P acnes infection in patients undergoing revision shoulder arthroscopy is higher than previously published and should be considered in cases characterized by refractory postoperative pain and stiffness.

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KEYWORDS: Propionibacterium acnes; arthroscopic surgery; complications; infection; pain; revision surgery; stiffness; synovitis

Bull Hosp Jt Dis (2013). 2015 Dec;73 Suppl 1:S140-4.

Infection Prevention in Shoulder Surgery.

Hackett DJ Jr, Crosby LA.

Abstract

The microbiome of the shoulder demonstrates distinctive differences to other orthopaedic surgical sites. Recent studies have demonstrated that the most common organisms found in deep shoulder infections are coagulase-negative staph lococcal species and Propionibacterium acnes . Many studies support diligent hand washing, decreasing operative time, routine glove changing, minimizing operating room traffic, and covering instruments as means for decreasing the risk of deep infection. On the other hand, hair clipping and the use of adhesive drapes may have little effect on decreasing the incidence of deep infection. Although generally considered the most efficacious skin preparation solution, chlorhexidine gluconate has minimal effect on eradication of P. acnes from the surgical site; however, the addition of preoperative topical applications of benzoyl peroxide to standard surgical preparation has shown promise in decreasing the rate of P . acnes culture positivity. Additionally, the use of local antibiotic formulations seems to be an effective means of preventing deep infection.

J Bone Joint Surg Am. 2009 Aug;91(8):1949-53. doi: 10.2106/JBJS.H.00768.

Efficacy of surgical preparation solutions in shoulder surgery.

Saltzman MD[1], Nuber GW, Gryzlo SM, Marecek GS, Koh JL.

Author information

Abstract

BACKGROUND: Deep infection following shoulder surgery is a rare but devastating problem. The use of an effective skin-preparation solution may be an important step in preventing infection. The purposes of the present study were to examine the native bacteria around the shoulder and to determine the efficacy of three different surgical skin-preparation solutions on the eradication of bacteria from the shoulder.

METHODS: A prospective study was undertaken to evaluate 150 consecutive patients undergoing shoulder surgery at one institution. Each shoulder was prepared with one of three randomly selected solutions: ChloraPrep (2% chlorhexidine gluconate and 70% isopropyl alcohol), DuraPrep (0.7% iodophor and 74% isopropyl alcohol), or povidone-iodine scrub and paint (0.75% iodine scrub and 1.0% iodine paint). Aerobic and anaerobic cultures were obtained prior to skin preparation for the first twenty patients, to determine the native bacteria around the shoulder, and following skin preparation for all patients.

RESULTS: Coagulase-negative Staphylococcus and Propionibacterium acnes were the most commonly isolated organisms prior to skin preparation. The overall rate of positive cultures was 31% in the povidone-iodine group, 19% in the DuraPrep group, and 7% in the ChloraPrep group. The positive culture rate for the ChloraPrep group was lower than that for the povidone-iodine group ($p < 0.0001$) and the DuraPrep group ($p = 0.01$). ChloraPrep and DuraPrep were more effective than povidone-iodine in eliminating coagulase-negative Staphylococcus from the shoulder region ($p < 0.001$ for both). No significant difference was detected among the agents in their ability to eliminate Propionibacterium acnes from the shoulder region. No infections occurred in any of the patients treated in this study at a minimum of ten months of follow-up.

CONCLUSIONS: ChloraPrep is more effective than DuraPrep and povidone-iodine at eliminating overall bacteria from the shoulder region. Both ChloraPrep and DuraPrep are more effective than povidone-iodine at eliminating coagulase-negative Staphylococcus from the shoulder.

TRIAL REGISTRATION: ClinicalTrials.gov NCT00829023.

J Shoulder Elbow Surg. 2011 Sep;20(6):928-33. doi: 10.1016/j.jse.2011.02.018. Epub 2011 May 25.

Efficacy of preoperative home use of 2% chlorhexidine gluconate cloth before shoulder surgery.

Murray MR[1], Saltzman MD, Gryzlo SM, Terry MA, Woodward CC, Nuber GW.

⊕ Author information

Abstract

HYPOTHESIS: Deep infection after shoulder surgery is a rare but devastating problem. This study tested the hypothesis that the home application of a 2% chlorhexidine gluconate cloth before shoulder surgery would be more efficacious than a standard shower of soap and water at decreasing the preoperative cutaneous levels of pathogenic bacteria on the shoulder.

MATERIALS AND METHODS: This randomized, prospective study evaluated 100 consecutive patients undergoing shoulder surgery. Patients were randomly assigned to use 2% chlorhexidine gluconate-impregnated cloths (treatment group) or to shower with soap and water before surgery (control group). Cutaneous cultures were taken from the patients'shoulders in the preoperative holding area. Patients were monitored for 2 months postoperatively for clinical signs of infection.

RESULTS: In the treatment group vs the control group, the overall positive culture rate was 66% vs 94% (P = .0008), and the positive culture rate for coagulase-negative Staphylococcus was 30% vs 70% (P = .0001). The positive culture rate for Propionibacterium acnes was 46% in the treatment group vs 58% in the control group (P = .32). No infections occurred in any patients at a minimum of 2-months after surgery.

DISCUSSION: The use of the 2% chlorhexidine cloth was effective at decreasing overall bacterial culture rates before shoulder surgery and was particularly effective at decreasing the quantity of coagulase-negative Staphylococcus, a known causative agent of postoperative shoulder infections.

CONCLUSION: Use of chlorhexidine impregnated cloths prior to shoulder surgery may be a useful adjunct to presently used infection prevention strategies.

TRIAL REGISTRATION: ClinicalTrials.gov NCT01090479.

J Shoulder Elbow Surg. 2015 May;24(5):804-8. doi: 10.1016/j.jse.2014.10.007. Epub 2014 Dec 3.

The effect of axillary hair on surgical antisepsis around the shoulder.

Marecek GS[1], Weatherford BM[2], Fuller EB[3], Saltzman MD[3].

Author information

Abstract

BACKGROUND: Infection after shoulder surgery can have devastating consequences. Recent literature has implicated Propionibacterium acnes as a causative agent for postoperative shoulder infections. Axillary hair removal has been suggested as a method for infection prevention, although data quantifying its effect on the bacterial load around the shoulder are lacking.

METHODS: We clipped one randomly selected axilla in 85 healthy male volunteers with commercially available surgical clippers. Aerobic and anaerobic culture specimens were taken from the clipped and unclipped axillae. Each shoulder was then prepared with 2% chlorhexidine gluconate and 70% isopropyl alcohol. Repeated culture specimens were then taken from both axillae. Cultures were held for 14 days and recorded with a semiquantitative system (0-4 points). Results were compared by the Wilcoxon signed rank test.

RESULTS: There was no difference in the burden of P. acnes between the clipped and unclipped axillae before or after surgical preparation ($P = .109$, $P = .344$, respectively). There was a significantly greater bacterial burden in the clipped shoulder compared with the unclipped shoulder before preparation ($P < .001$) but not after preparation ($P = .285$). There was a significant reduction in total bacterial load and P. acnes load for both axillae after surgical preparation ($P < .001$ for all).

CONCLUSIONS: Removal of axillary hair has no effect on the burden of P. acnes in the axilla. Clipped axillae had a higher total bacterial burden. A 2% chlorhexidine gluconate surgical preparation is effective at removal of all bacteria and specifically P. acnes from the axilla.

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KEYWORDS: Propionibacterium acnes; Shoulder; axilla; infection; surgical preparation

Arthroscopy. 2015 Sep;31(9):1702-7. doi: 10.1016/j.arthro.2015.01.029. Epub 2015 Mar 29.

The Incidence of Propionibacterium acnes in Shoulder Arthroscopy.

Chuang MJ[1], Jancosko JJ[2], Mendoza V[3], Nottage WM[2].

⊕ Author information

Abstract

PURPOSE: To document the skin colonization and deep tissue inoculation rates associated with arthroscopic shoulder surgery and how these rates differ with procedural and demographic factors.

METHODS: We prospectively recruited outpatient shoulder arthroscopy patients who agreed to participate and met the inclusion criteria from February 2013 to May 2014. All patients received routine antibiotic prophylaxis intravenously. Initial cultures were obtained before the skin preparation by swabbing the skin at the 3 standard portal sites: posterior, anterosuperior, and anterolateral. The skin preparation used 4% chlorhexidine scrub and 2% chlorhexidine gluconate/70% isopropyl alcohol paint applied to the entire shoulder. After completion of the arthroscopic procedure, a second culture was obtained through a cannula at the surgical site. All cultures were plated for 21 days using Brucella medium.

RESULTS: We enrolled 51 patients over a 15-month period. Cultures showed a 72.5% Propionibacterium acnes superficial colonization rate: 46.1% of female and 81.6% of male patients (P = .027). We identified a deep culture-positive inoculation rate of 19.6%, all with positive P acnes skin colonization. No correlation could be made concerning diagnosis, procedure, suture anchor use, age, or sex.

CONCLUSIONS: The rate of skin colonization with P acnes is high at arthroscopic portals, especially in men. Despite standard skin preparation and prophylactic antibiotics, the rate of deep tissue inoculation with P acnes in shoulder arthroscopy is much higher than the rate of infection reported in the literature.

CLINICAL RELEVANCE: Shoulder arthroscopy introduces a significant amount of P acnes into the deep tissues.

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J Shoulder Elbow Surg. 2015 Jul;24(7):995-1004. doi: 10.1016/j.jse.2015.04.003.

Efficacy of topical benzoyl peroxide on the reduction of Propionibacterium acnes during shoulder surgery.

Sabetta JR[1], Rana VP[2], Vadasdi KB[2], Greene RT[2], Cunningham JG[2], Miller SR[2], Sethi PM[3].

⊕ Author information

Abstract

BACKGROUND: Propionibacterium acnes infection is a significant problem after shoulder surgery. Residual P. acnes is found on the skin up to 29% of the time immediately after surgical skin preparation and in 70% of dermal biopsy specimens. These residual bacteria may be a source for infection. Identifying more ideal skin preparation may help reduce the risk of infection. The purpose of this study was to evaluate the effect that topical benzoyl peroxide (BPO), with chlorhexidine skin preparation, would have on the presence of P. acnes cultured at the time of shoulder surgery. We hypothesized that adding topical BPO to our skin preparation would reduce the number of positive P. acnes cultures identified during surgery.

METHODS: Fifty patients undergoing first-time shoulder surgery were treated with topical 5% BPO cream 48 hours before surgery. After skin preparation, 13 samples per subject were obtained. Cultures were held for 14 days.

RESULTS: Fifty patients underwent arthroscopic shoulder surgery; 650 culture specimens were obtained. The skin was positive at the initiation of surgery in 6% of cases. Tissue samples were positive in 6%. The skin was positive in 10% at the end of surgery. None of these rates of positive culture were different from the 4% rate observed with a control swab.

CONCLUSION: Application of BPO is an effective way to reduce P. acnes on skin at the beginning and, importantly, at the end of a surgical procedure. This may result in a lower risk for postoperative infection.

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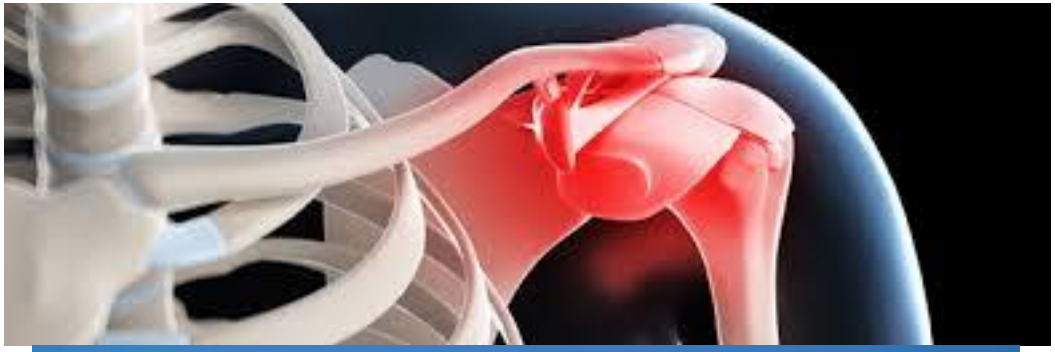
KEYWORDS: P. acnes; Shoulder; arthroscopy; aspiration; culture; infection

Postop. Shoulder Infection: Are we Doing enough to prevent it?



Progression of Muscle Atrophy and/or Fatty Degeneration in Shoulders with Symptomatic Rotator Cuff Tears: A Prospective Study of 150 shoulders

Nobuyuki Yamamoto[1)], Jun Kawakami[1)], Mitsuyoshi Mineta[1)], Hirotaka Sano[2)], Eiji Itoi[1)]

1) Department of Orthopaedic Surgery, Tohoku University School of Medicine
2) Department of Orthopaedic Surgery, Sendai City Hospital

INTRODUCTION

Our previous study (Yamamoto et al AAOS 2016) revealed that the tear size of symptomatic rotator cuff tears progressed in 55% of 150 shoulders in average 17 months, and the speed of progression was 5.8 mm/yr in length and 3.1 mm/yr in width. The risk factors for tear progression were smoking, a full-thickness tear, and a tear sized 1 to 2 cm.

PURPOSE

To demonstrate the relationship between tear progression and muscle atrophy and fatty degeneration in the same population.

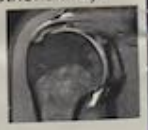
METHODS

Study design: Prospective longitudinal study

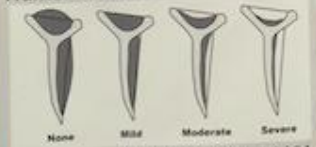
Subjects: 207 consecutive patients with symptomatic rotator cuff tears confirmed by MRI visited our institute between 2009 and 2015. Of these, 150 shoulders of 150 patients with at least two MRI examinations were

MR examination: MRI was performed every 6M with use of a 1.5-T or 3.0-T imaging unit equipped with a microscopy coil (Philips Medical Systems, Ienthoven, The Netherlands).

MRI exam were performed mean 3.5 times.



Muscle atrophy:
Warner classification



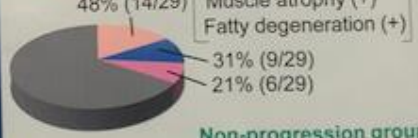
Warner et al JSES 2001

Fatty degeneration:
Goutallier classification

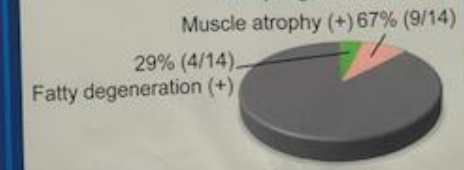
RESULTS

Muscle Atrophy and/or Fatty Degeneration

Progression group



Non-progression group



Tear Size and Progression

DISCUS

In the progression group, b
fatty degeneration progress
whereas in the non-progres
muscle atrophy progressed

Progression group

1/2 cases

Muscle atrophy
Fatty degeneration

Tear progression
⬇
Muscle atrophy
⬇
Fatty degeneration

Why progressed in the m

In medium tears with tear
atrophy and fatty degene
Medium tears ➡ Risk of t
⬇
Progression of atroph

Considering risk factors

- ✓ Tear progression
- ✓ Muscle atrophy
- ✓ Fatty degeneration

Consider surgical treatm
especially in young pts

INTRODUCTION

Our previous study (Yamamoto et al AAOS 2016) revealed that the tear size of symptomatic rotator cuff tears progressed in 55% of 150 shoulders in average 17 months, and the speed of progression was 5.8 mm/yr in length and 3.1 mm/yr in width. The risk factors for tear progression were smoking, a full-thickness tear, and a tear sized 1 to 2 cm.

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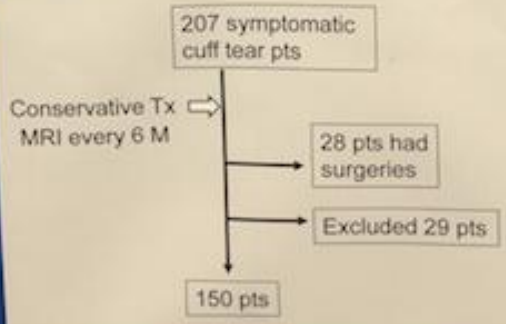


Table 1 Patient demographics

Number of subjects	150
Mean age (range)	67.8 (47-83)
Sex	
Male	85
Female	65
Follow-up (range)	17.2 (6-60) months
Tear size at first MRI	
Length (mm)	17.5 ± 13.7
Width (mm)	14.7 ± 10.6
Tear type	
Full-thickness	98
Partial-thickness	52
Bursal side	37
Articular side	15
Intratendinous	12

MR examination: MRI was performed every 6M with use of a 1.5-T or 3.0-T imaging unit equipped with a microscopy coil (Philips Medical Systems, Ienthoven, The Netherlands).

MRI exam were performed mean 3.5 times.

Muscle atrophy:
Warner classification

Warner et al JSES 2001

Fatty degeneration:
Goutallier classification

Goutallier et al CORR 1994

Definition of tear progression:
The tear progression was defined as positive when the tear size increased by more than 2 mm in width or length.

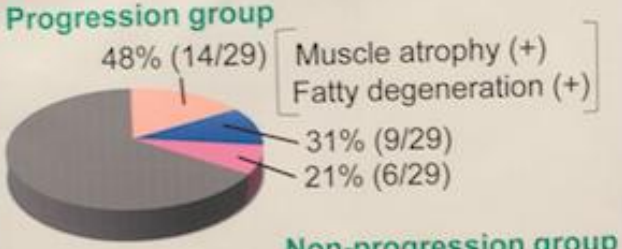
The present study was approved by the IRB of our hospital.

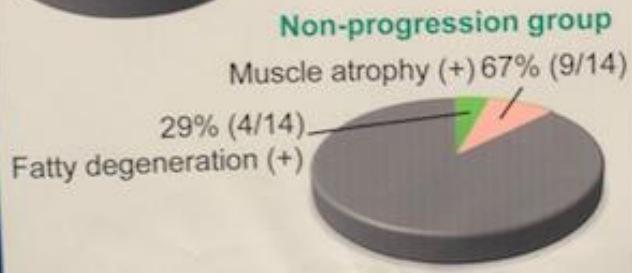
ATROPHY

FATTY DEGENERATION

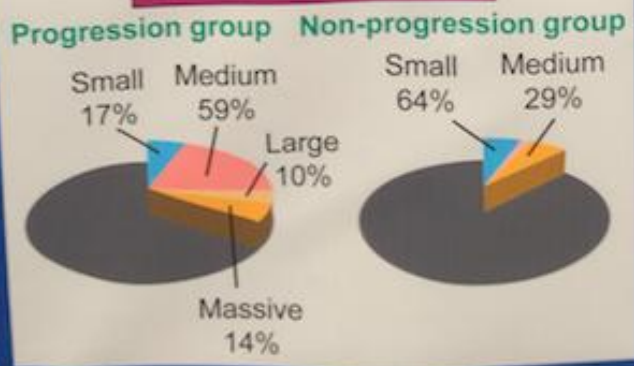
RESULTS

Muscle Atrophy and/or Fatty Degeneration





Tear Size and Progression



DISCUSSION

In the progression group, both muscle atrophy and fatty degeneration progressed in most of the cases, whereas in the non-progression group, only the muscle atrophy progressed in most cases.

Progression group (1/2 cases): Muscle atrophy, Fatty degeneration ⟺ **Non-progression group** (2/3 cases): Only muscle atrophy

No fatty degeneration

Tear progression
↓
Muscle atrophy
↓
Fatty degeneration

Why progressed in the medium tears ?

In medium tears with tear progression, muscle atrophy and fatty degeneration progressed fast.

Medium tears ➡ Risk of tear progression
↓
Progression of atrophy & fatty degeneration

Yamamoto ICSES 2015

Considering risk factors

- ✓ Tear progression
- ✓ Muscle atrophy
- ✓ Fatty degeneration

➡ High risk: Full-thickness medium tears

Consider surgical treatment at an appropriate timing especially in young pts

CONCLUSIONS

The full-thickness medium tears should be surgically treated at an appropriate timing because of high risks of tear progression and muscle atrophy and/or fatty degeneration.

Medium Size tears have a risk of progression to Atrophy & Fatty Degeneration & should be fixed
Whereas smaller tears may not progress

Comparison of Patient Reported Outcomes using a Disease Specific (ASES) and Non-Disease Specific Instrument (PROMIS) in Patients with Shoulder Pain

Benjamin Strong, Raymond Kenney, Joseph Schaffer, Jon Hedgecock, Jeff Houck, Gregg Nicandri, Michael Maloney, Ilya Voloshin
University of Rochester Medical Center, Rochester, NY 14642

Introduction

- Patient reported outcomes (PROs) give the patient a voice in their healthcare and allow for standard of care assessments and validated tracking of progress over time.
- Ideally, PROMs used should be as accurate, reliable, valid, and efficient to administer as possible.
- Psychometric evaluation and validation of the Patient-Reported Outcomes Measurement Information System (PROMIS) has been performed for foot and ankle, trauma, spine, knee, upper extremity, and shoulder.
- PROMIS has matched or outperformed multiple existing PROMs in terms of reliability and efficiency.
- The PROMIS Physical Function domain has previously been compared to the ASES for rotator cuff disease.
- The purpose of this study is to compare the non-disease specific PROMIS Physical Function (PF), Pain Interference (PI), and Depression (D) domains to the established disease specific ASES Shoulder Score for a variety of shoulder conditions.

Methods

- PRO were collected on all clinic visits for two shoulder surgeons over a 12-week period (1/26/16 - 4/20/16).
  - ASES (Pain, Function, Total Score)
  - PROMIS (PF, PI, D)
- Inclusion Criteria: New patient visit, >18 years, complete records, primary shoulder diagnosis.
- Diagnoses(n=123): Impingement (n=50), Pain (n=30), Rotator Cuff Tear (n=12), Arthropathy (n=12), Instability (n=6), Adhesive Capsulitis (n=4), Miscellaneous (n=9).
- 2-way ANOVA with age and gender as covariates used to compare ASES and PROMIS variability across diagnoses.
- Univariate analysis used to correlate ASES scores and PROMIS Domains.
  - Pearson's correlation: r>0.7 considered strong, r>0.6

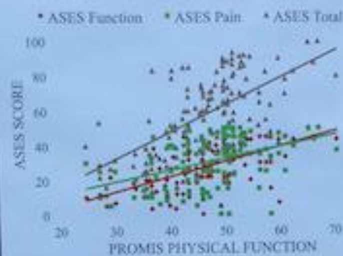


Figure 1. Comparison of PROMIS Physical Function to ASES Function (r=0.608), ASES Pain (r=0.411), and ASES Total (r=0.590).

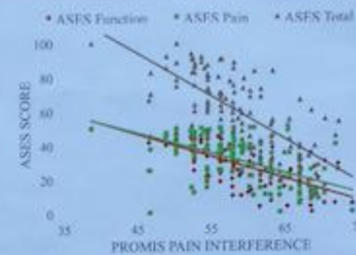


Figure 2. Comparison of PROMIS Pain Interference to ASES Function (r=0.706), ASES Pain (r=0.556), and ASES Total (r=0.735).

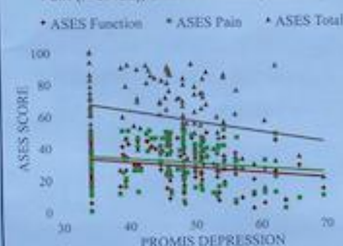


Figure 3. Comparison of PROMIS Depression to ASES Function (r=0.255), ASES Pain (r=0.195), and ASES Total (r=0.262).

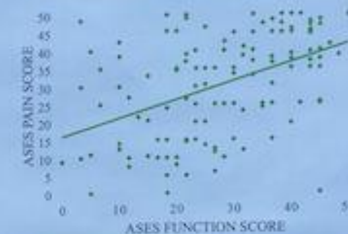


Figure 4. Comparison of ASES Function and ASES Pain (r=0.45).

	Floor Effect	Ceiling Effect
ASES Function	0.8%	1.6%
ASES Pain	2.4%	5.7%
ASES Total	0.8%	0.8%
PROMIS PF	0%	0%
PROMIS PI	0%	0%
PROMIS D	0%	0%

Table 1. Comparison of floor and ceiling effects for

	Efficiency
ASES	17 Questions
PROMIS	3.30 min (1.03-15.55)

Table 2. Comparison of efficiency for ASES (# questions to complete) and PROMIS (time in minutes to complete).

Results

- PROMIS PF correlation to ASES Function was good (r=0.608), ASES Pain was poor (r=0.411), and ASES Total was fair (r=0.590).
- PROMIS PI correlation to ASES Function was excellent (r=0.706), ASES Pain was fair (r=0.556), and ASES Total was excellent (r=0.735).
- PROMIS D had poor correlation to ASES Function (r=0.255), ASES Pain (r=0.195), and ASES Total (r=0.262).
- ASES Function and ASES Pain had poor correlation (r=0.45).
- ASES Total had 0.8% floor and ceiling effects. PROMIS domains did not demonstrate floor or ceiling effects.
- ASES questionnaire was completed in 17 questions.
- PROMIS mean time to complete was 3.30 minutes (std dev 2.61 min, minimum 1.03 min, maximum 15.55 min).

Conclusions

- PROMIS PF and PI demonstrated fair to excellent correlation across shoulder diagnoses to an accepted disease specific scale (ASES).
- PROMIS PI had a stronger correlation to ASES Function than either PROMIS PF or the ASES Pain subscore.
- Both PROMIS and ASES demonstrated minimal floor and ceiling effects.
- Efficiency could not be directly compared.
- This data shows the potential for the universally available and emerging PROMIS instrument to track shoulder problems.

References

Short-term Complications after Rotator Cuff Repair: Should We Still Perform Open Surgery?

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AAOS

I (and my co-authors) have nothing to disclose.

Introduction

- Rotator cuff (RTC) repair provides consistent pain relief and restores function in appropriately indicated patients.
- Surgical techniques include open, arthroscopic, and combined techniques, with recent increased utilization of arthroscopic techniques.
- The incidence of complications following RTC repair are infrequent but not insignificant.
- Independent risk factors for postoperative complications following RTC repair have not been well studied.

Study Objectives

1. Evaluate incidence of short-term (<30 day) complications following arthroscopic and open RTC repair.
2. Identify independent risk factors for complications following RTC repair.

Methods

- All patients who underwent open or arthroscopic RTC repair between 2005-2013 were identified in the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database.
- Short-term complications were categorized as major complications, minor complications, mortality, and unplanned 30-day readmission.
- Univariate analysis allowed comparison of patient demographics and comorbid conditions.
- Propensity score matching was used to control for demographic differences between arthroscopic and open rotator cuff repair cohorts.
- Independent risk factors for complications were identified using multivariate logistic regression.

KEY POINT

Results

- 11,314 RTC repairs were identified (24% open, 76% arthroscopic).
- Mean operative time for open RTC repair was 78 minutes, compared to 91 minutes for arthroscopic repairs (p<0.001).
- Overall complication rate was 1.3%.
- Most common complication was unplanned return to operating room (41 pts [0.36%]) (Table 1).
- 30-day readmission was 1.16.% (76/6560 patients) and mortality rate was 0.03% (3 patients).
- Any 30-day complication in the propensity score matched cohorts were higher following open repair (1.79%) versus arthroscopic (1.17%) (p=0.006).
- Overall infection rate following RTC repair was 0.56%, with the rate of deep wound infection higher in open repair cohort (p=0.003) (Table 2).
- Age >65, operative time greater than 90 minutes, and open rotator cuff repair were found to be independent risk factors for complications (Table 3).

TABLE 2. Complications with Open versus Arthroscopic Techniques

	Frequency		Percentage		P value
Surgical Technique	*Open*	*Arthroscopic*	*Open*	*Arthroscopic*	
Major Complication	3	1	0.11	0.01	0.0438
Organ space infection	0	0			
Sepsis	4	0	0.15	0	**0.0032***
Deep SSI	2	0	0.07	0	0.0562
Wound Dehiscence	5	21	0.19	0.24	0.5912
Pulmonary embolism	1	1	0.04	0.01	0.4179
Ventilator >48 hours	1	2	0.04	0.02	0.5559
Unplanned intubation	0	0			
Acute renal failure	1	0	0.04	0	0.2371
Cardiac arrest requiring CPR	0	2	0	0.02	1
Myocardial infarction	0	1	0	0.01	1
Stroke/CVA	15	26	0.56	0.3	0.052
Return to OR					
Minor Complication	8	16	0.3	0.19	0.2669
Superficial SSI	6	7	0.22	0.08	0.0569
Pneumonia	12	22	0.45	0.25	0.1115
Urinary tract infection	3	12	0.11	0.14	1
DVT / thrombophlebitis	3	5	0.11	0.06	0.4042
Bleeding requiring transfusion	1	1	0.04	0.01	0.4179
Peripheral nerve injury	0	0			
Progressive renal insufficiency	1	2	0.04	0.02	0.5559
Mortality	48	101	1.79	1.17	**0.0139***
Any Complication	22	54	1.63	1.04	0.0707
Readmission					

*Statistically significant; SSI, surgical site infection; CPR, cardiopulmonary resuscitation; CVA, cerebrovascular accident; OR, operating room; DVT, deep vein thrombosis

TABLE 1. Most Common Complications

Complication	Frequency (# patients)	Percentage
Unplanned return to operating room	41	0.36%
Urinary tract infection	34	0.30%
Surgical site infection	28	0.25%
Pulmonary embolism	26	0.23%
Deep vein thrombosis	15	0.13%

Discussion

- Regardless of technique, short-term complications following RTC repair are rare at 1.3%.
- In matched cohorts, 30-day complications were higher following open repair.
- Independent risk factors for complications include age >65, operative time >90 minutes, and open repair technique.
- Surgeons should be aware that increased operative time is associated with increased complications.
- The use arthroscopic techniques may have an impact on decreasing short-term complications after surgery.

TABLE 3. Predictors of Morbidity in Rotator Cuff Repair Identified through Multivariate Regression Analysis

Risk Factors	Adjusted odds ratio (95% Confidence Interval)
Age (>65)	**1.6** (1.2-2.3)*
HTN	1.1 (0.8-1.6)
ASA Class	1.1 (0.8-1.7)
Operative time	**1.5** (1.1-2.0)*
Open versus Arthroscopic technique	**1.6** (1.1-2.3)*

*Statistically significant; HTN, Hypertension; ASA, American Society of Anesthesiologists

Acknowledgements

The authors would like to thank the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) for access to their data in order to perform this study.

Return to Sport after the Latarjet Procedure:
- Collision versus Non-Collision Athletes -

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Purpose

- To analyze and compare the outcomes of collision and noncollision athletes including level of return to sport after the Latarjet procedure.

Material & Method

- From Jan. 2007 to Sept. 2014
- 56 athletes (56 shoulders), M : F = 54 : 2
- Follow up : ave. 67.1 mo. (24 - 113 mo.)

Patients Demographics

		Collision	Non-collision
No. of patients		29	27
Ave. age(yrs)		25.6	28.9
Dominant arm		23	20
1st dislocation ~ Latarjet(yrs)		5.5	9.0
Frequency of dislocation		16.9	17.5
Ave. glenoid defect(%)		21.9	23.0
Surgical history	Revision	24	18
	1` Latarjet	5	9
Level of activity	Competitive	15	1
	Recreational	14	26

- ✓ **Collision(29)**
  - ✓ Soccer: 10
  - ✓ Judo: 9
  - ✓ Rugby: 4
  - ✓ Boxing: 3
  - ✓ Wrestling: 2
  - ✓ Martial arts: 1
- ✓ **Non-collision(27)**
  - ✓ Basketball: 7
  - ✓ Skiing: 6
  - ✓ Baseball: 4
  - ✓ Swimming: 3
  - ✓ Badminton: 2
  - ✓ Volleyball: 2
  - ✓ Taekwondo: 2
  - ✓ Tennis: 1

Cho et al, Arthroscopy, 2006

Grade	Level of return to sport activity
1	Same sport at same level
2	Same sport at lower level
3	Cessation of pre-injury sport(Change of sport)
4	Cessation of sport activities

Results

Clinical Scores

- The VAS, UCLA and Rowe scores of both collision and non-collision groups were significantly improved (all $p < 0.05$), but there was no significant difference between 2 groups (all $p > 0.05$).

Postoperative Instability

	Collision(29)	Non-collision(27)
Re-dislocation	1(3.2%)	0
Subluxation	2(6.5%)	0

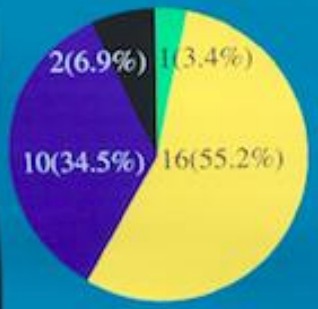
- No significant difference($p = 0.089$).

Prevalence of arthritis

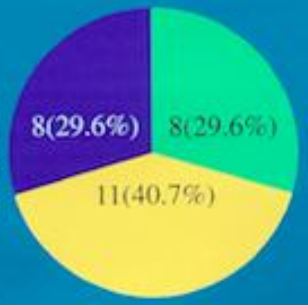
- Pre- and postoperatively, there was no significant difference between 2 groups($p = 0.584, 0.209$).

Level of Return to Sport(67months)

Collision(29)



Non-Collision(27)



Same sport at same level(Gr1):
3.4% vs 29.6%
Same sport engagement(Gr1+2):
58.6% vs 70.3%
Noncollision group showed better return level!
(p = 0.046)

- ✓ *According to the surgical history:*
  - ✓ Latarjet procedure as a revision surgery(n=42) vs primary Latarjet procedure(n=14)
  - ✓ no significant difference of level of return to sport($p = 0.114$)
- ✓ *According to the level of activity:*
  - ✓ Competitive group(n=16) vs Recreational group(n=40)
  - ✓ no significant difference of level of return to sport($p = 0.262$)

Discussion

- In spite of excellent functional outcomes, other factors such as kinesiophobia(fear of movement), fear of reinjury, low self-esteem, aging and comparing interests can have a negative effect on return to sport after arthroscopic shoulder stabilization.

Tjong et al, Am J Sports Med, 2006

- Higher rate of recurrence in collision athletes is attributed more to patients' sports actitivity level than to surgical technique.

Cho et al, Arthroscopy, 2006

Conclusions

- **Only 16.1% of patients returned to the same sport at the same level after the Latarjet procedure.**
  - ***Collision: 3.4% vs Non-collision: 29.6%***
- **Level of physical demand according to sport type is an important prognostic factor which predicts the level of return to sport after the Latarjet procedure.**
- **However, 96% of patients were still actively engaged in sport activities.**

…Results seem worse than others have Reported."

Corrosion Frequency and Severity in Total and Reverse Shoulder Arthroplasty is Low

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Introduction

Corrosion of modular junctions in total hip arthroplasty (THA) has been extensively studied, but fewer reports have been made on corrosion in shoulder arthroplasty. Corrosion has been associated with adverse local tissue reactions and elevated ion levels in THA. Reports have found evidence of corrosion in total and reverse shoulder arthroplasty (TSA and rTSA, respectively), but clinical relevance remains debated.[1,2]

Purpose

Evaluate the incidence and severity of corrosion in TSA and rTSA via retrieval analysis of a large consecutive series of mixed devices to understand the patient risk associated with modularity in shoulders.

Methods

- **70** TSA and **33** rTSA retrievals from 10 and 7 manufacturers, respectively, were taken from an IRB-approved retrieval database.
- Every device had at least one modular junction
- There was no other exclusion criteria, resulting in **136** TSA and **77** rTSA surfaces for analysis.
- Not all retrieved components were complete constructs.

Taper interfaces included

  - stem-humeral head junction (TSA),
  - stem-humeral tray junction (rTSA), and
  - Glenosphere-baseplate junction (rTSA)

- All surfaces were evaluated for corrosion and fretting using a rating of 0 indicating no damage and 3 indicating severe damage[3] (Figure 1). This is also known as a modified Goldberg scale.[4]
- Surfaces with damage to the original taper surface were measured for material loss and surface texture using a coordinate measuring machine (CMM) and/or white light profilometry.
- Material loss was reported in volume loss (mm^3) and maximum linear corrosion depth (MLCD, µm).

Figure 1: Representative images of tapers with corrosion scores 0-2. There were no tapers scored 3.

Table 1. Summary of reason for retrieval

Reason for Retrieval (TSA)	No.	Reason for Retrieval (rTSA)	No.
Loose	19	Loose	11
Pain	13	Infection	9
Infection	11	Dislocation	3
Instability	10	Fracture of implant	3
Malposition	4	Fracture of bone	2
Dislocation	3	Instability	2
Unknown	3	Polyethylene dissociation	2
Fracture of bone	2	Polyethylene wear	1
Polyethylene wear	2		
Subluxation	2		
Osteolysis	1		

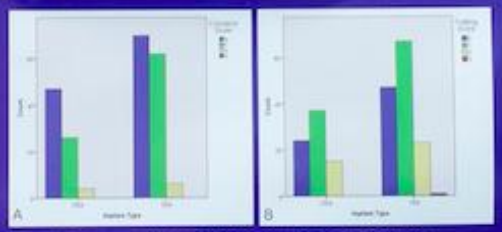

Figure 2: Frequency of scores for (A) corrosion and (B) fretting.

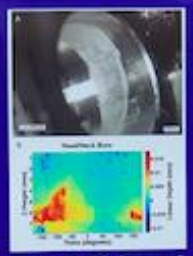

Figure 3: (A) Image of long duration implant with highest material loss and corresponding CMM scan.

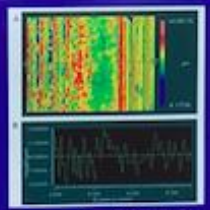

Figure 4: White light interferometry of corroded region and corresponding height (B) gives the height profile of the line in (A).

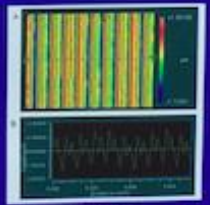

Figure 5: White light interferometry of uncorroded region and corresponding height (B) gives the height profile of the line in (A).

Results

No devices in this series were retrieved for metal-related failure (Table 1).

Qualitative scoring

The median corrosion scores for total and reverse shoulders were 1 (range 0-2) and 0 (range 0-2), respectively. Median fretting scores were 1 (range 0-3) and 1 (range 0-2), respectively (Figures 1 and 2). Only 4 components showed notable change to the original surface.

Material loss

Of components with notable change to the original surface, the average volumetric material loss was 0.11 ± 0.37 mm^3 and the average MLCD was 7.18 ± 4.92 µm. The largest volumetric material loss and MLCD were observed on one of the longest duration components (246 mos.) and were 0.91 mm^3 and 14.58 µm on the head and 0.20 mm^3 and 15.05 µm on the stem taper (Figure 3).

Topography

Figures 4 and 5 depict the typical texture of a corroded region and an uncorroded region, respectively. There is an evident change in surface texture, but little material loss.

Discussion

- Corrosion scores in this series were low. Cases of 'high' corrosion in total shoulders occurred at long duration and did not amount to high material loss.
- Minor indications of corrosion exist, but is overshadowed by fretting. This may indicate relative motion at the taper junction, but the biomechanical loads are insufficient to create the dramatic corrosion severity seen in hips.
- Most shoulder taper junctions exhibit a shallow, large diameter taper. This geometry may play a role in the electrochemical performance.
- Rare incidences of corrosion are found in TSA and rTSA, but do not translate to a large metal dose to the patient. In this large series, adverse events secondary to corrosion do not appear to be of clinical concern.

Significance Visual assessment and quantitative measurements indicate corrosion severity and material loss in shoulder arthroplasty fails to reach clinical significance.

Join our research!

To send retrievals, or to learn more about what we do, visit us at http://engineering.dartmouth.edu/dbec/retrieval.html

Acknowledgements

The authors wish to thank the surgeons who contributed the retrievals used for analyses in this study and DePuy Synthes for research support.

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1. Day, J. *et al. Bone & Joint Journal* (2016). 2. Teeter, M. G. et al. *JSES* (2016). 3. Hood et al. *J Biomed Mater Res* (1983) 4. Goldberg, J. R. et al. *CORR* (2002).

Most Shoulder Surgeons believe this already

Relationship between Fatty Infiltration of Rotator Cuff Muscles and Post-operative Outcome of Large to Massive Rotator Cuff Tear Using MRI IDEAL Technique

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BACKGROUND

☐Prognostic factor after rotator cuff repair

➢Fatty infiltration and muscle atrophy
(Thomazeau ; Clin Orthop Relat Res 1997) (Gladstone ; Am J Sports Med 2007)

➢Large to massive rotator cuff tear (RCT)
Re-tear rate 39.8% (Kim ; JBJS 2013)
94% (Galatz ; JBJS 2004)

→ Quantitative evaluation of fatty infiltration is necessary

☐IDEAL technique

New quantitative evaluation for fatty infiltration

Iterative Decomposition of water and fat with Echo Asymmetry and Least-squares estimation

➢ 3-point Dixon method

➢ To correct in each pixel by using field map, then create images with accurately divided water and fat

<IDEAL sequence in this study>

MRI : Discovery750 3.0T(GE)
coil : shoulder coil
TR : 500msec
TE : 11.8msec

- Flip Angle90°
- Bandwidth:±31.25
- Matrix:256×256
- NEX:1.0
- FOV:160×160mm²
- SliceThickness:3.0mm
- SliceSpacing:1.0mm

PURPOSE

In large to massive RCT

➢ To evaluate pre-operative fatty ratio of rotator cuff muscles using IDEAL technique

➢ To assess the relationship between pre-operative fatty ratio and post-operative clinical outcome

METHODS

☐Materials

➢ Term : February 2013 – October 2015

➢ 30 large to massive RCT patients who underwent arthroscopic rotator cuff repair

➢ Sex : 17 male 13 female (Large tear 22, Massive tear 8)

➢ Age : Av. 67.2yrs. (48-77)

➢ Follow up period: Av.13.0 months (12-29)
(all cases was followed up ≧ 12 months)

☐Method

➢ Oblique Sagittal Y-shaped view

➢ ROI: supraspinatus (SSP)
infraspinatus (ISP)
subscapularis (SSC)

➢ Fatty ratio(%)=S(Fat)/S(In)×100 (Watanabe ; JOA 2009)

➢ Statistics : Mann-Whitney U test ($p<0.05$)
ROC curve, Pearson correlation coefficient

☐Examination item

➢Fatty ratio using IDEAL technique

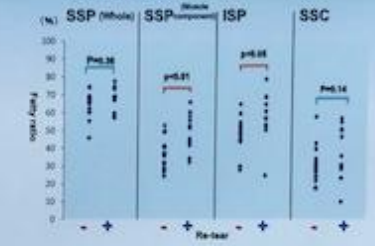
➢Post-operative outcome

✓Integrity : Sugaya classification

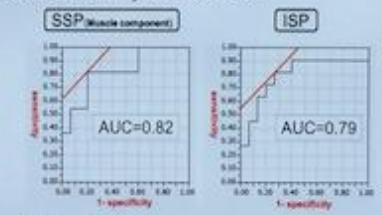
✓University of California at Los Angeles
Shoulder Score (UCLA score) : 0 - 35 points

RESULTS

➢Re-tear rate : 12/30 cases (40.0%)

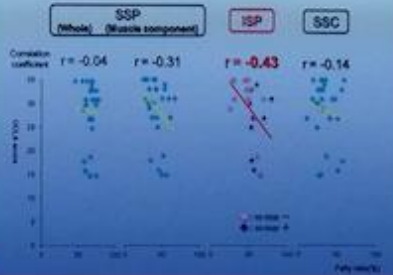


➢ROC curve : fatty ratio and re-tear



Cut-off value 41.8% 52.5%

➢Fatty ratio and UCLA score



DISCUSSION

☐ Previous reports of IDEAL technique

➢ Basic research
Mouse model of rotator cuff tears (Sanjuan ; JOR 2013)

➢ Clinical research
Fatty liver (Meisamy ; Radiology 2011)
Fatty infiltration of Rotator cuff muscle (our study)

☐Poor prognostic factor of large to massive RCT

➢Highly retraction of rotator cuff (Meyer ; Am J Sports Med 2012)

➢Fatty infiltration
✓Qualitative evaluation : Gourtallier's classification
✓Quantitative evaluation : Few previous report
→ Fatty ratio using IDEAL technique (our study)

Risk of Re-tear SSP(muscle component) : 41.8%
ISP : 52.5%
Higher fat ratio of ISP → Lower UCLA score

CONCLUSION

➢IDEAL technique might be useful to evaluate fatty infiltration of rotator cuff muscles quantitatively.

➢Higher preoperative fatty ratio of ISP was thought to be poor prognostic factor using IDEAL technique.

Biomechanical Analysis of RSA vs TSA for the Management of Biconcave (B2) Glenoids

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INTRODUCTION

- The B2 glenoid is characterized by the formation of a second neo-glenoid cavity with large retroversion
- Total Shoulder Arthroplasty (TSA) is traditionally used in B2, but there are concerns of joint instability and glenoid loosening
- Reverse Shoulder Arthroplasty (RSA) was proposed as an alternative treatment for better management of posterior instability[1], but impingement remains a concern
- Surgeons correct the large B2 glenoid retroversion during TSA and RSA to reduce the posterior shear glenohumeral forces

OBJECTIVE: Investigate the biomechanics of TSA and RSA for the management of B2 glenoids for different glenoid Version Corrections (VC)

METHODS

- Three CT reconstructed models of B2 OA scapulae
  - Average glenoid version 16.3° ±1.5°
- Virtually implanted with TSA and RSA glenoid (Biomet)
- Implantation was performed at: 0°, 5°, 10°, and 15° VC

No correction was applied to the B2 glenoid | The B2 glenoid version was corrected by 15Β

Subject-specific musculoskeletal models[2]

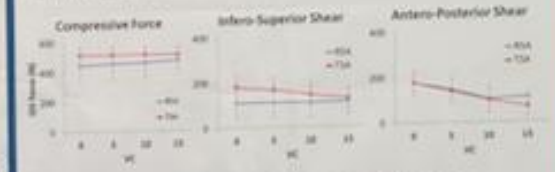
- Simulation of Activity of Daily Living (ADL)
  - 'lift object to head height' activity
- Standardized Range of Motion (ROM) activities
  - Abduction, Scapula plane elevation and Forward flexion (all from 0° to 160°)
  - Ext/Internal Rot (-80° to +80°) in 20° abduction
- Model included scapula kinematics

Model Output

- Glenohumeral forces (Compressive, Shear AP, Shear SI)
- Safety dislocation factor [3]
  - Max shear/compressive load in relation to stability area
- Impingement free ROM

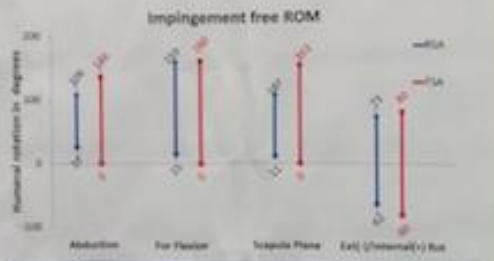
RESULTS

- Posterior shear glenoid forces decreased in both TSA and RSA as the VC increased, but Infero-Superior shear forces remained unaffected for the RSA



- The TSA showed high risk of dislocation for VC 0° and 5°
- RSA joint stability remained unaffected from the change of VC

- RSA showed smaller 'impingement free ROM' compared to TSA for all the standardized activities



CONCLUSIONS

- Version correction reduced the magnitude of the shear load more in TSA than in RSA
- RSA demonstrated great joint stability that was not affected by the VC, but ROM was restricted compared to TSA
- TSA demonstrated stability for VC≥10°, but eccentric reaming can compromise glenoid bone stock and fixation. Surgeons should consider bone graft to restore glenoid version and stability in highly retroverted (>10°) B2 glenoids

REFERENCES 1. Denard, J Shoulder Elbow Surg, 2013 2. Kontaxis, Clin Biomech, 2009
ACKNOWLEDGEMENTS Hospital for Special Surgery shoulder service

See next Slide For Prior Work of C. Gerber

J Shoulder Elbow Surg. 2006 Sep-Oct;15(5):625-9.

Effects of glenoid component version on humeral head displacement and joint reaction forces: an experimental study.

Nyffeler RW[1], Sheikh R, Atkinson TS, Jacob HA, Favre P, Gerber C.

⊕ Author information

Abstract

The purpose of this study was to determine whether changes in glenoid version are associated with humeral head displacement and changes in the joint reaction forces, as these might contribute to instability or loosening in total shoulder replacement. A total shoulder prosthesis was implanted in neutral version in 6 cadaveric shoulders. Glenoid version was then changed in steps of 4 degrees toward more anteversion and retroversion. An increase in anteversion resulted in anterior translation of the humeral head and in eccentric loading of the anterior part of the glenoid. Retroversion was associated with posterior displacement and posterior loading of the glenoid. A change in rotation of the humeral component did not compensate for altered version of the glenoid component. These results suggest that both instability and glenoid component loosening may be related to the version of the glenoid component. Therefore, assessment of loosening and instability justifies precise assessment of glenoid component version.

Does this really matter?

Extra-Capsular versus Intra-Capsular Bone Block in the Latarjet Procedure

Lacey Zack MD[1], Britt Miller MD[1], Michelle H McGarry MS[2], Nam Su Cho MD[2], Chris Bui MD[2], Michael Kuenzler MD[2], James E Tibone MD[1], Thay Q Lee PhD[2,3]
[1]Department of Orthopaedic Surgery, University of Southern California, Los Angeles, CA, USA, [2]Orthopaedic Biomechanics Laboratory, VA Long Beach Healthcare System, Long Beach, CA, USA,
[3]Department of Orthopaedic Surgery, University of California, Irvine, USA

INTRODUCTION

- The Latarjet procedure has a triple effect stabilizing mechanism
  - Bony effect of the transferred coracoid process
  - Sling effect of the conjoint tendon
  - Capsular effect due to repair of the capsule
- Management of the capsule with a Latarjet procedure varies depending on surgeon preference

OBJECTIVE

- To assess the effect of method of capsular repair with the Latarjet procedure on range of motion and glenohumeral translation
  - Capsule repair to glenoid rim (Extra-capsular bone block)
  - Capsule repair to CA ligament (Intra-capsular bone block)
  - No capsule repair

HYPOTHESES

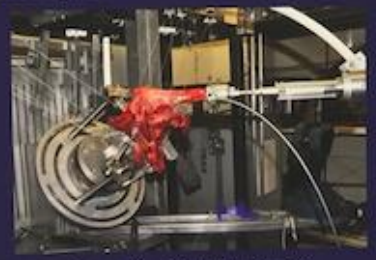
- Translational stability will be similar with all repair techniques
- Range of motion will decrease with capsule repair to the glenoid rim

METHODS

- Eight cadaveric shoulders with a mean age of 60 y were tested
- Muscle loading applied to rotator cuff and conjoint tendon based on physiological cross-sectional area ratios

Testing Positions

- Scapular and Coronal plane
- 90° shoulder abduction
  - 30° scapular inclination and 60° glenohumeral abduction



Custom Shoulder Testing System

Testing Conditions

- Intact
- 20% bony Bankart lesion
- Latarjet with extra-capsular bone block
  - 2.4 mm metal anchors 3:30 and 5:30 glenoid clock positions
  - Capsule repaired with horizontal mattress sutures
- Latarjet with intra-capsular bone block
  - Capsule repaired to CA ligament remnant
- Latarjet without capsular repair

Bankart Lesion

Latarjet

Extra-capsular Bone Block Anchor Locations

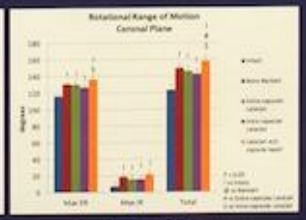
Biomechanical Parameters

- Rotational range of motion with 1.5 Nm rotational torque
- Anterior-Inferior translation in 60° external rotation with 20N, 30N and 40N
- Humeral head apex kinematics during range of motion

Statistical Analysis

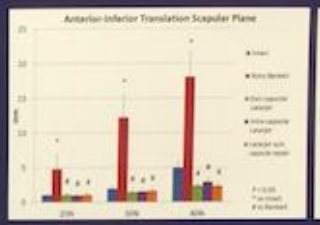
- Repeated measures ANOVA with Tukey post hoc test $P < 0.05$

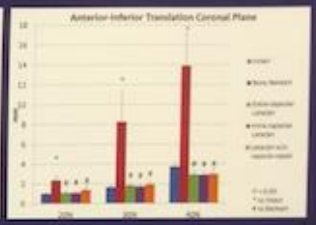
RESULTS



- Bony bankart increased total range of motion in both planes
- Latarjet procedure did not restore range of motion regardless of capsular repair technique
- Latarjet without capsule repair significantly increased range of motion beyond that of the Bankart lesion

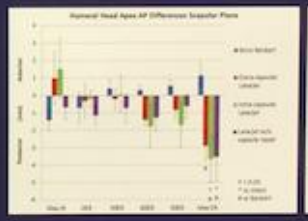
Glenohumeral Translation

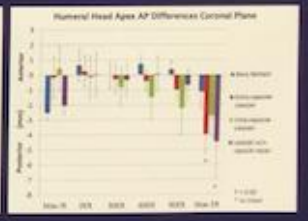




- Bony bankart significantly increased anterior-inferior translation at all loads in both the scapula and coronal planes
- All Latarjet procedures restored anterior-inferior translation in both planes

Humeral Head Kinematics





- All Latarjet procedures shifted the humeral head posterior in maximum external rotation
- There were no significant differences at other humeral rotation positions

CONCLUSIONS

- Time zero biomechanical results are similar for Latarjet with capsule repair resulting in an intra-capsular or extra-capsular bone block
- Latarjet without capsule repair restores translational stability but increases range of motion compared to Latarjet with either type of capsule repair

ACKNOWLEDGEMENTS

- VA Rehab R&D Merit Review
- All devices have been FDA approved for use as described

Outpatient TSA is safe and likely to offer major value over inpatient TSA

NewYork-Presbyterian

Columbia University Medical Center
Department of Orthopedic Surgery

Peri-Operative Complications and Quality Measures Between Inpatient and Outpatient Shoulder Arthroplasty Across a National Sample

Manish S. Noticewala, David P. Trofa, Robert L. Parisien, Christopher S. Ahmad, Charles M. Jobin, William N. Levine

Investigation performed at the Department of Orthopedic Surgery, NewYork-Presbyterian/Columbia University Medical Center, New York NY

Introduction

Shoulder arthroplasty is a highly effective treatment option with excellent long-term survivorship. Although traditionally performed as an inpatient procedure, advances in surgical technique and peri-operative analgesia have made same-day discharge possible.

Purpose

To compare differences in 30-day peri-operative complication, readmission, and re-operation rates between patients undergoing inpatient shoulder arthroplasty versus outpatient arthroplasty.

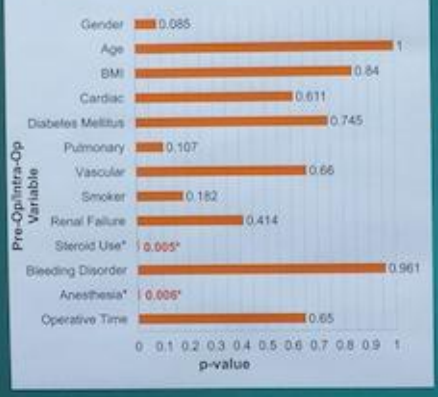
Methods

- The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database was retrospectively queried according to Current Procedural Terminology codes to isolate all shoulder arthroplasties performed between 2005-2014.
- After application of exclusion criteria, 6815 shoulder arthroplasty cases were available for analysis:
  - 344 outpatient
  - 6471 inpatient
- For each case, baseline data recorded included: gender, age, body mass index (BMI), and various comorbidities.
- Operative variables collected included anesthesia type and operative time.
- Post-operative outcomes were categorized as:
  - Any complication.
  - Minor complication (wound dehiscence, pneumonia, renal insufficiency, and/or urinary tract infection).
  - Major complication (surgical site infection, blood transfusion, thromboembolism, nerve injury, cardiac arrest, myocardial infarction, need for airway support, acute renal failure, stroke, coma, sepsis, and/or shock).
  - Readmission following discharge.
  - Return to operating room.
- Univariate and multivariate analyses were done to compare differences between the two cohorts and determine whether admission status was a risk factor for complications, readmission, or re-operation.

References

1. Bindi TJ, et al. Near Award 2016: Outpatient total shoulder arthroplasty in an ambulatory surgery center is a safe alternative to inpatient total shoulder arthroplasty in a hospital: a matched cohort study. J Shoulder Elbow Surg. 2017 Feb;26(2):204-209.
2. Dunn JC, et al. Predictors of length of stay after elective total shoulder arthroplasty in the United States. J Shoulder Elbow Surg. 2015;24:754-9.
3. Lenssa TS, et al. Outpatient total shoulder arthroplasty: a population-based study comparing adverse event and readmission rates to inpatient total shoulder arthroplasty. J Shoulder Elbow Surg. 2016 Nov;25(11):1780-1788.

GRAPH 1 Baseline Differences



Baseline Differences: Notes

- Steroid use was increased in the inpatient cohort (4.96% vs 1.45%, p<0.005); otherwise, there were no differences in demographics or comorbidities.
- For operative characteristics, there was increased utilization of non-general anesthesia among the outpatient cohort (7.27% vs 4.06%, p<0.007).

Aggregate Analysis of Complications: Notes

- Overall, there were no differences between the rates of minor (1.44% inpatient vs 0.6% outpatient, p=0.231) or major (5.55% inpatient vs 3.49% outpatient, p=0.129) complications.
- There was a trend towards a higher rate of any complication in the inpatient shoulder arthroplasty cohort in univariate analysis (6.57% vs 3.78%, p=0.052).

Univariate Analysis of Complications: Notes

- There were no significant differences with respect to the rates of each of the individual complications described between the two cohorts.

GRAPH 3 Aggregate Analysis of Complications

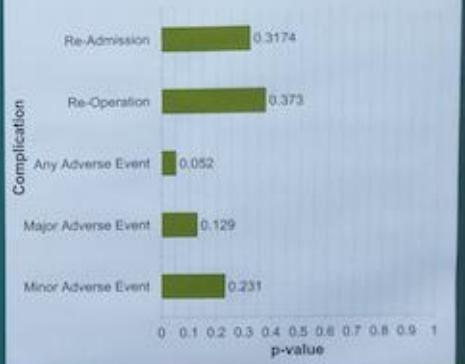
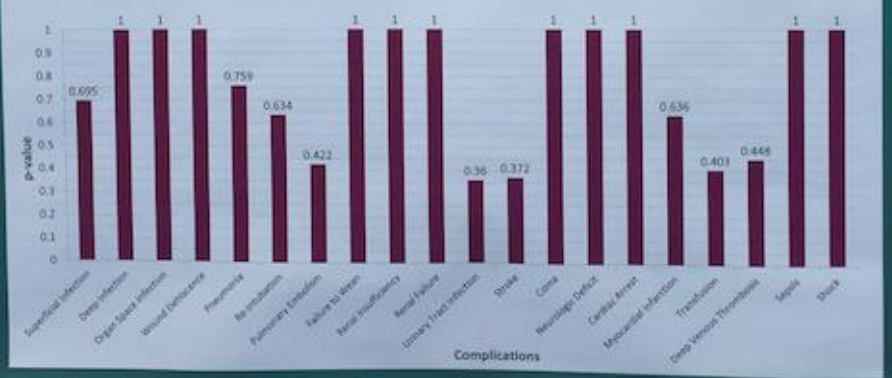


TABLE 1 Univariate Analysis of Complications



Results

- Multivariate analyses did not demonstrate admission status as being a risk factor for a minor adverse event, major adverse event, nor any adverse.
- Furthermore, multivariate analyses did not demonstrate steroid use or anesthetic type as being a significant risk factor for minor, major, or any complication types.

Discussion and Conclusions

- An analysis of a nationwide, prospective quality improvement registry demonstrates similar rates of peri-operative morbidity between inpatient and outpatient shoulder arthroplasty.
- With appropriate pre-operative patient risk stratification, surgeons can consider performing shoulder arthroplasty in an ambulatory setting.
- The decreased length of stay associated with outpatient shoulder arthroplasty would enable surgeons to meet demands for delivery of more efficient and lower cost care for operative shoulder pathology.

Acknowledgments

ACS NSQIP and the hospitals participating in the ACS NSQIP are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analyses or the conclusions derived by the authors.

KEY POINT 0

NO!

Is There a Long-Term Deterioration of The Function of Deltoid Muscle After Reverse Shoulder Replacement?

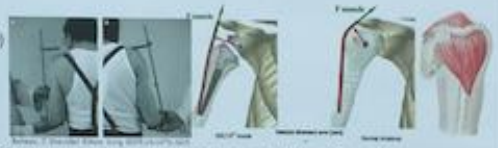
Ofer Levy, George Mazis, Caroline Witney-Lagen, Ernest Fawzy, George Arealis, Giuseppe Sforza, Ehud Atoun
Reading Shoulder Unit, Royal Berkshire Hospital and Berkshire Independent Hospital, Reading, United Kingdom.

AAOS 2017 Annual Meeting | AAOS

Reading Shoulder Unit Centre

Reverse shoulder arthroplasty:

- Increase the Acromio - Humeral Distance (AHD)
- Lengthens the arm
- Changes the muscle moment arms
- Increases the efficiency of the deltoid



Is the long term increase of the deltoid length & force associated with chronic muscle fatigue?

Objectives:

- To examine the long-term results to the deltoid function and clinical outcome.
- Our hypothesis was that there is deterioration of the function of the deltoid over time.

Materials and methods:

The study comprised 48 reverse shoulder replacements in 46 patients with a follow up of 6 or more years. The patients underwent clinical and radiological assessment preoperatively and postoperatively, at regularly set appointments after the reverse shoulder arthroplasty (Pre-op, Immediately post-op, 3w, 3m, 6m, 1y, Annually thereafter by Independent assessors. The ROM and Constant score (CS) were evaluated. Deltoid strength was measured using the digital gauge myometer.

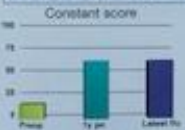
Diagnosis / Aetiology	CTA	# Sequela	RA	Failed RCR	Revision arthroplasty
No of Shoulders	33	8	5	1	1

- All the operations performed by the senior author
- VERSO Stemless Reverse Shoulder Prosthesis
- Antero-superior approach (Neviaser/Mackenzie with reinforced Deltoid repair
- Mean postoperative time at the latest F/U 83 months (range 72 to 122 months)
- Mean age at the latest follow up was 79y
- Complete preoperative and postoperative scores were available for all 48 cases
- Function and satisfaction was evaluated
- Subjective shoulder value (SSV)
- ROM
- Constant score (CS)
- Deltoid strength was measured in 90 degrees of elevation in the line of scapula using a digital gauge myometer (Isometer). Kristensen MT et al. Reliability and agreement between 2 strength devices used in the newly modified and standardised Constant score. J Shoulder Elbow Surg. 2014; Dec;23(12):1808-12.
- Paired *t*-test

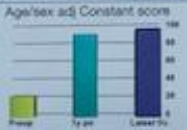
Results:

Significant improvements in all parameters between the preoperative and the postop follow ups
Mean change in the acromiohumeral (GT) distance - 2.83cm

Constant score



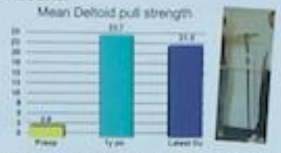
Age/sex adj Constant score



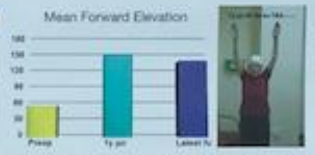
Mean preoperative deltoid pull strength was 2.6N, mean active forward flexion 53°, abduction 48° and mean CS was 15.5 (Age/sex adjusted 22).
At 1 year post op, mean deltoid pull strength was 23.7N, mean active forward flexion 140°, abduction 133° and mean CS was 60.3 (Age/sex adjusted 85.6).

Results:

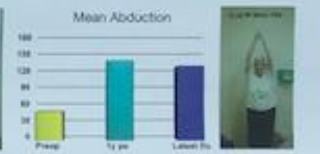
Mean Deltoid pull strength



Mean Forward Elevation



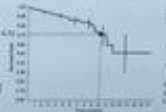
Mean Abduction



At the latest follow up (mean 83 months, range from 72 to 122 months), mean deltoid pull strength was 21.5N, mean active forward flexion 130°, abduction 124° and mean CS was 60 (Age/sex adjusted 91.2).
The mean strength of the contralateral shoulder at the latest follow up was 25.9N.
No significant difference between first year vs the latest follow up in:
Deltoid pull strength (p=0.4071), Forward Elevation (p=0.2367), Abduction (p=0.3253) and CS (p=0.9916).
No significant difference in the deltoid pull strength between the evaluated and the contralateral side (p=0.187).

Discussion

To our knowledge, this is the first study examining longterm Deltoid pull strength/function.
Favard:
Continuous deterioration of Constant score to less of 30 points with a step at 8 years



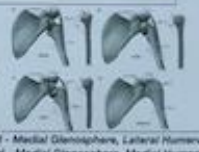
In the older series:
In the early years using rTSA (20-10y ago) - concerns regarding stability
Larger / constrained liners
Higher joint tension → Higher deltoid tension
With experience and confidence - the importance NOT to over tension the deltoid was realised

Deltoid split and re-attachment

All the patients in our series were operated using the Antero-superior approach (Neviaser-MacKenzie): Deltoid split with osteo-periosteal flap from the acromion
The deltoid was reattached to the acromion with non-absorbable sutures in a reinforced "double-row" manner
Improved deltoid efficiency - reduction in force to achieve a humeral elevation
Variable implant configuration have significant effects on shoulder ROM and deltoid forces required to achieve abduction Berliner et al. Reverse total shoulder arthroplasty: a biomechanical evaluation of humeral and glenoid bone hardware configuration. J Shoulder Elbow Surg 2015

Implant Design Variations in Reverse Total Shoulder Arthroplasty Influence the Required Deltoid Force and Resultant Joint Load. Overstuffing the articulation with progressively thicker humeral polyethylene inserts produced some adverse effects on deltoid muscle and joint loading Giles et al. Implant Design Variations in Reverse Total Shoulder Arthroplasty Influence the Required Deltoid Force and Resultant Joint Load. Clin Orthop Relat Res (2013)

All three tested designs in Hamilton's study increase the deltoid abductor moment arm
MGLH & MGMH - increase the moment arm statistically significantly more than the LGMH - due to the COR being closer to the glenoid face
Location of the COR is a dominant variable regarding abduction moment arms for the deltoid
All design philosophies showed a large increase in deltoid efficiency created by medially shifting the COR toward the glenoid face



MGLH - Medial Glenosphere, Lateral Humerus
MGMH - Medial Glenosphere, Medial Humerus
LGMH - Lateral Glenosphere, Medial Humerus

The implant used:

Minimal bone resection (20mm humeral head)
Humeral cut at 155°, 10° Oblique dial-able liner → articulating neck-shaft angle 145
Humeral offset, Slightly lateralised COR (+3mm)
Selection of thiner stable liner

The combination of variables in each rTSA design:
Liner thicknesses, Variable offset stems, Neck angle changes...etc
- Can affect the moment arms of muscles

Different design philosophies can lead to different orientations of the musculature and may behave differently clinically

Conclusion

There is no evidence of long term deterioration of the deltoid function after reverse shoulder replacement

"Our results are with specific implant design. Further longterm F/U studies needed for other rTSA designs.

Immediate and Early Complications of the Open Latarjet Procedure

A Large Consecutive Case Series

Gary M. Gartsman, MD; Wame N. Waggenspack, Jr, MD; Daniel P. O'Connor, PhD; Hussein A. Elkousy, MD; T. Bradley Edwards, MD

Background

The Latarjet procedure is a well-described treatment for recurrent anterior shoulder instability in patients with glenoid bone loss or after failed soft-tissue stabilization procedures. While longer-term complications such as recurrent instability, osteoarthritis, and graft nonunion are better defined, there is little literature focused on complications associated with the procedure itself. Most reports are retrospective in nature, composed of heterogeneous patient populations (including other coracoid transfer or stability procedures), and only briefly mention intra-operative or immediate complications or not at all.

Purpose

Report the immediate and early complications of the Latarjet procedure in a large consecutive series of patients performed by three surgeons (2 shoulder-fellowship trained, 1 sports-fellowship trained) at a single high-volume institution.

Patients and Methods

- Retrospective chart review was performed of 416 consecutive open Latarjet procedures in 400 patients (16 patients had bilateral procedures) performed by the three senior surgeon authors from October 2002 to July 2015 at a single institution.
- Demographic data and complications including neurologic injury, wound complications and infection, and hardware problems were collected.
- Patient age and history of prior arthroscopic (ATS) and/or open stabilization procedure were evaluated as risk factors for increased complications in our population.

Surgical Technique

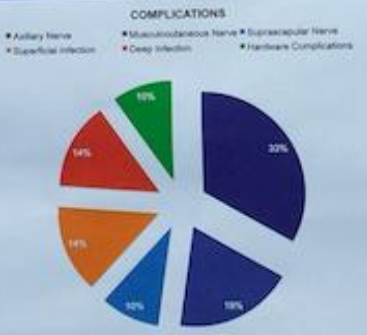
- Three surgeons all utilize the same basic surgical technique previously described[1] with variations listed below:
  - Arthroscopic evaluation of the glenohumeral joint and subacromial space at the discretion of the treating surgeon
  - One author (TBE) uses 4.5mm malleolar screws and freehand drills the glenoid
  - Other two authors (GMG, HAE) use 3.75mm cannulated screws with a parallel drill guide

[1] Edwards BT, Walch G. The Latarjet Procedure for Recurrent Anterior Shoulder Instability: Rationale and Technique. Oper Tech Sports Med. 2015;23:97-101. http://dx.doi.org/10.1053/j.otsm.2015.03.007.

Results

- Mean patient age 29.6 ± 7.3 years
- Average follow-up 7.8 months
- Prior Open/ATS Stabilization in 121 patients (29.1%)
- Complication Rate 5.0% (21 in 19 patients in 416 procedures)
  - 2 patients had combined neurologic injury
- Increased age was associated with a higher complication rate.
- Prior stabilization surgery was not associated with increased complications.

Complications



- **Neurologic Injury: 13 in 11 patients (3.1%)**
  - **7 Axillary**
    - 1 complete, 2 incomplete palsies – all resolved
    - 4 sensory only – 3 of 4 resolved
  - **4 Musculocutaneous**
    - 3 incomplete palsies – all resolved motor, 1 patient with persistent LABCN hypoesthesia
    - 1 sensory only – resolved
  - **2 Suprascapular**
    - 2 incomplete palsies – resolved
- **Infection: 6 patients (1.4%)**
  - **5 Superficial infections**
    - Treated with oral antibiotics only
  - **3 Deep infections**
    - Treated with I&D, antibiotic beads, long-term intravenous antibiotics
- **Early Hardware Problems: 2 pts (0.05%)**
  - **1 Intra-operative coracoid fracture**
    - Retained inferior portion of graft with no post-op complications
  - **1 Screw loosening due to early graft fracture**
    - Patient on chronic steroids, treated by screw removal and excision of fragment with no further post-op complications

KEY POINT

Mean Age by Complication Group

Complication (n)	Mean Age (SD)	p value
Infection		
Yes (6)	34.5 years (SD 5.2)	0.110
No (410)	27.4 years (SD 10.9)	
Neurologic Injury		
Yes (13)	27.4 years (SD 7.1)	0.956
No (403)	27.5 years (SD 10.9)	
All Complications		
Yes (21)	32.4 years (SD 11.8)	**0.031**
No (395)	27.2 years (SD 10.7)	

Complication Group by Prior Surgery

Complication (n)		p value
Infection	6 / 416 (1.4%) Total	
Prior Surgery	2/ 121 (1.7%)	0.561
No prior surgery	4 / 295 (1.4%)	
Neurologic Injury	13 / 416 (3.1%) Total	
Prior surgery	7 / 121 (4.1%)	0.317
No prior surgery	12 / 295 (2.7%)	
All Complications	21 / 416 (5.0%)	
Prior surgery	8 / 121 (6.6%)	0.336
No prior surgery	13 / 295 (4.4%)	

Conclusions

- Latarjet procedure is an effective treatment option for recurrent anterior shoulder instability.
- We found a lower rate of neurologic complication than previously reported in our large case series.
- Similar to prior studies, increased age was associated with a higher complication rate.
- Meticulous attention to technique and a thorough understanding of the relevant surgical anatomy are important for optimal results.

Texas Orthopedic Hospital
Baton Rouge Orthopaedic Clinic

KEY POINT

Do we deliver value in Revision surgery with grafts & SCR?

ROTHMAN INSTITUTE

BGO BLUEGRASS ORTHOPAEDICS

Is it worth it? Cost-analysis of revision rotator cuff repair with dermal patch augmentation

Ryan P. Donegan MD, MSc[1]; Surena Namdari MD, MSc[2]
[1]Bluegrass Orthopaedics, Lexington, KY; [2]Rothman Institute, Philadelphia, PA

BGO BLUEGRASS ORTHOPAEDICS

Sidney Kimmel Medical College at Thomas Jefferson University

INTRODUCTION

- Revision rotator cuff repair (RCR)
  - 73% failure rate in 2-tendon tears[1]
- Dermal Grafts
  - load sharing, increase load to failure
  - biologic scaffold for cell ingrowth
  - increase cost

METHODS

- Decision analytic model
- Cost per quality-adjusted life year (QALY) gained
- Incremental cost-effectiveness ratio (ICER)

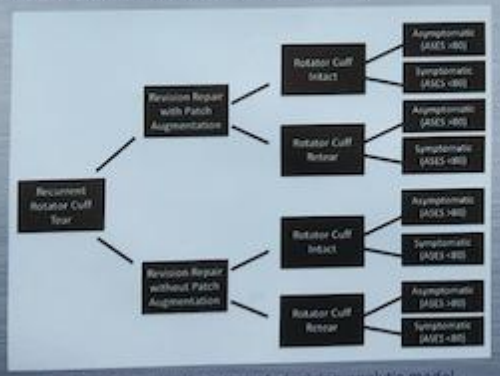


Fig1: Schematic depiction of decision analytic model

METHODS

- Probabilities for re-tear and persistent symptoms,[1,2] health utilities for the particular health states,[3] direct costs for rotator cuff repair derived from orthopaedic literature and institutional data
- Base case: 2-tendon revision rotator cuff repair with and without graft

RESULTS

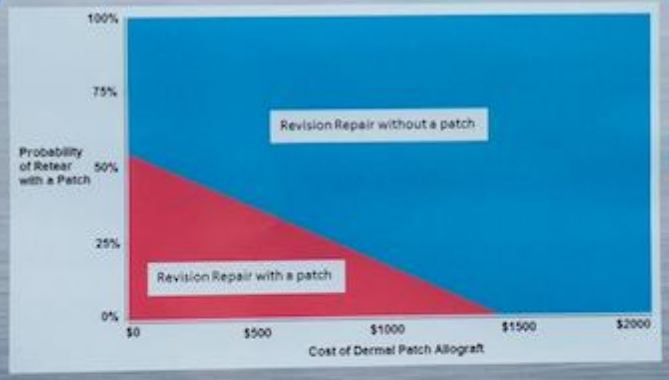


Fig 2: 2- Way Sensitivity Analysis- Cost associated with dermal augmentation was evaluated against the proportion of retear and the proportion of reduction in retear from dermal augmentation

DISCUSSION

Is dermal patch augmentation cost effective?

Not at the current pricing

What if patches reduced the retear rate to 25%?

Patches could cost $860

What is the maximum that patches could cost?

$1580 with a 0% retear rate

LIMITATIONS

- Accuracy of costs/probabilities used
- No assessment of reverse arthroplasty or other operative interventions

CONCLUSION

Threshold values in this study may help surgeons determine the most cost-effective treatment as data regarding retear rates of revision RCR with dermal augmentation becomes available

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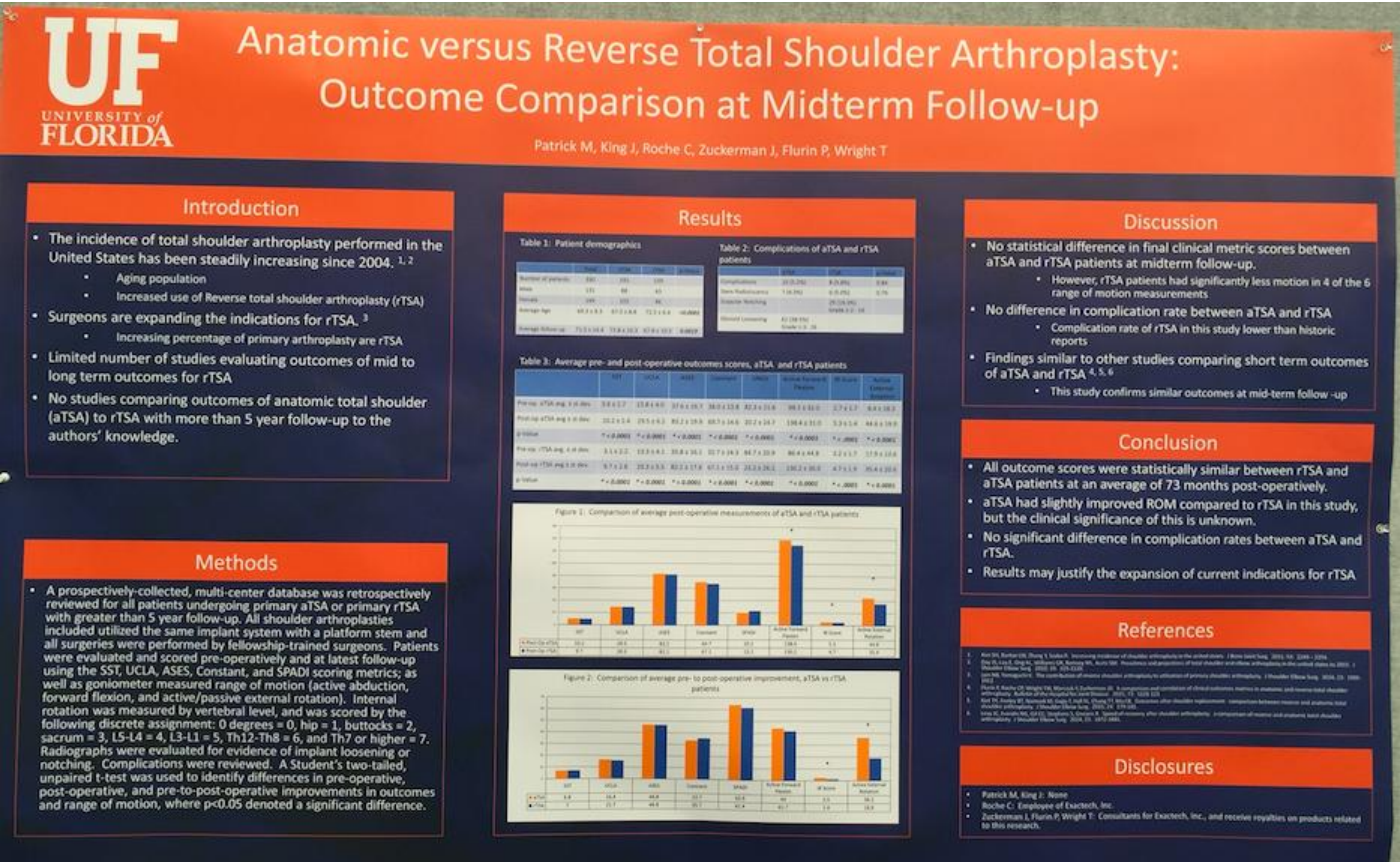
1.Keener et al. JBJS. 2010; 92(3): 590-8.
2.Namdari et al. JBJS 2014; 96(2): 99-105.
3.Vitale et al. JSES 2007; 16: 181-187.

Outcome of TSA = RSA…but you knew that.



KEY POINT

Lots of attention to rare problem

Axillary nerve palsy after arthroscopic shoulder stabilization: incidence and management

Hiroshige Hamada, Hiroyuki Sugaya, Norimasa Takahashi, Keisuke Matsuki, Morihito Tokai, Kazutomo Onishi , Yusuke Ueda, Shota Hoshika
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I and my co-authors have nothing to disclose.

Introduction

Arthroscopic (AS) shoulder stabilization is now a popular procedure for recurrent anterior shoulder instability. However, to date, there exists no published English article that reports the incidence and management of axillary nerve (AN) palsy after the index surgery, despite the anatomical proximity to the AN especially when repairing capsular tears or humeral avulsion of the glenohumeral ligament (HAGL) lesion.

The purpose of this retrospective study was to investigate incidence of AN palsy after arthroscopic shoulder stabilization and to elucidate its clinical features for prevention and early detection of the palsy.

METHODS

Subjects (Jan/2005-Aug/2015)

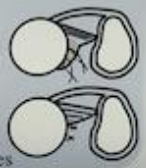
1532 patients who underwent AS stabilization
- 1115 Males, 417 females
- Mean age at surgery: 27 y.o. (range, 13-81)

Methods
- Review of operation records and videos
  - ✓ Incidence of AN palsy
  - ✓ Clinical features

Surgical Procedures
- General anesthesia
- Beach-chair position
- Viewing portal: posterior

Arthroscopic Capsular repair technique
- 30°-angled arthroscope
- Working portal: anterior
- No.2 non-absorbable sutures were placed using penetrating instruments
- Repaired in a side to side fashion

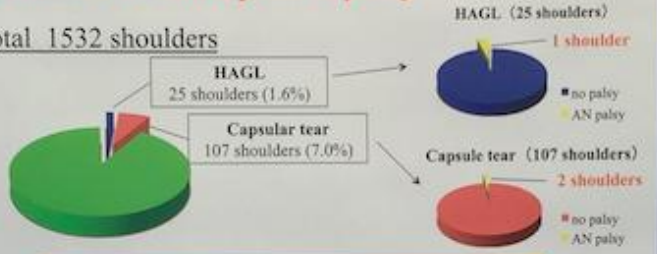
Arthroscopic HAGL repair technique [1]
- 30°- or 70°-angled arthroscope
- Working portal: anterior, 5 o'clock and 7 o'clock
- Two suture anchors are inserted
- Sutures are placed using penetrating instruments or Caspari punch
- The sutures are tied with mattress stitches



Results

Incidence of Axillary nerve palsy

Total 1532 shoulders



Axillary nerve palsy : 3 case(0.2%)

Case reports

	28 y.o. Male, Lt. shoulder	44 y.o. Male, Rt. Shoulder	27 y.o. Male, Lt. shoulder
Procedures	Bankart and capsular repair	Isolated capsular repair	Bankart and HAGL repair
Diagnosis of palsy	10 months after surgery No pain or numbness AE 175; ER 50; ADD Th10 Abduction MMT: 4 Deltoid atrophy	11 months after surgery No pain or numbness AE 170; ER 40; ADD Th8 Abduction MMT: 4 Deltoid atrophy	7 months after surgery No pain or numbness AE 170; ER 30; ADD Th8 Abduction MMT: 4 Deltoid atrophy
EMG	Loss of MUAP*	Loss of MUAP	Loss of MUAP
Revision surgery	10 months after surgery Neurolysis	13 months after surgery Nerve suturing	10 months after surgery Nerve grafting (sural nerve)
Intra-op. findings	Deltopectoral approach AN was entrapped by a suture at 7 o'clock position, but the nerve fiber was intact	Deltopectoral → posterior approach AN was disrupted by a suture at 7 o'clock position	Axillary approach AN was disrupted by a suture at 6 o'clock position
			
Final f/u	3years after revision surgery •Abduction MMT : 5− •AE 175; ER 60; ADD T9 •Slight limitation in sports	2 years after revision surgery •Abduction MMT : 5− •AE 170; ER 40; ADD T9 •Slight limitation in sports	1 year after revision surgery •Abduction MMT : 5− •AE 175; ER 50; ADD T10 •Slight limitation in daily life

*MUAP: motor unit action potential

Common clinical features
- Slightly slow recovery of active elevation in the first 2 months
- Discomfort and slight atrophy of the deltoid at 2-3 months after surgery
- Marked deltoid atrophy after 6 months

Discussion and Conclusion

Anatomy
- The closest point between AN and the inferior glenohumeral ligament (IGHL) is at 6 o'clock position with the mean distance of 2.5-3.2 mm[2,3]
- AN was held to the shoulder capsule with loose areolar tissue in the zone between 5 and 7 o'clock and was close to the glenoid in the neutral and internally rotated positions.[4]

(Matthew et al. JBJS 2004)

➡ **5 to 7 o'clock should be the most dangerous zone for AN injury.**
- ✓ In our cases, all injuries were occurred in this zone.

Prevention of axillary nerve injury during HAGL or capsular repair
- Keep in mind the axillary nerve anatomy
- Try to identify the axillary nerve
- Confirm the marginal safety from the anterior view before knot tying

Surgerical treatment for axillary nerve injuries
- Should not be delayed beyond six months after injury[5]

➡ **Early diagnosis and surgery should be feasible**

Early diagnosis for axillary nerve palsy
- Early signs of axillary nerve palsy (2-3 month after surgery)
  - ✓ Slightly slow recover of active elevation
  - ✓ Some atrophy and discomfort
- EMG can be helpful to confirm the diagnosis

References

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2. Matthew R, et al. JBJS Am. 2004; 86: 2135-42.
3. Bryan WJ, et al. Am J Sports Med. 1986; 14: 113-6.
4. Uno A, et al. 1999 May-Jun.; 8(3): 226-30
5. Webbe J, et al. 2004 Feb;70(1): 11-8.

The Effect of Proximal Ingrowth Coating on Clinical and Radiographic Results of a Cementless Short-Stem Shoulder Prosthesis at Minimum Two-Year Follow Up

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Introduction

- Mini-stem humeral component (MSHC) use during total shoulder arthroplasty (TSA) provides bone preservation and ease of revision.
- MSHCs rely solely on proximal metaphyseal fixation; some early reports demonstrate an unacceptably high rate of early loosening.
- To our knowledge, no study analyzing the effect of proximal porous coating on MSHCs has been performed.

Purpose/Hypothesis

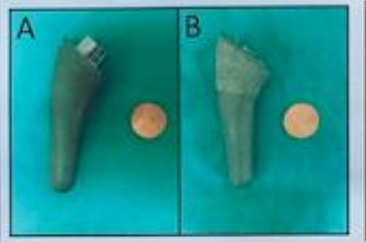
- Purpose: To describe and compare the clinical and radiographic results between porous and non-porous coated, cementless short-stem shoulder prostheses
- Hypothesis: MSHCs with proximal, porous ingrowth coating would exhibit superior radiographic outcomes compared to MSHCs without proximal coating

Methods

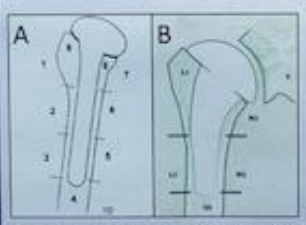
- Retrospective review of consecutive patients who underwent anatomic TSA utilizing coated or uncoated MSHCs with minimum 2-year follow-up.
- Post-operative radiographs were assessed for risk of or frank stem loosening, subsidence, and presence of radiolucencies.
- Range of motion (ROM), outcomes scores (VAS pain, ASES, and SANE), and any complications were noted.
- Pre- and post-operative data for those patients with at least 2-years follow-up was compared using the Student's 2-tailed *t* test, with $p < 0.05$ considered significant.

Results

- Figure 1 (A) Tornier Ascend MSHC without proximal ingrowth coating, (B) Tornier Ascend Flex MSHC with proximal ingrowth coating (penny for scale). Fig 2. Radiograph of loose uncoated humeral stem.



- Fig 3. Radiographic grading zones for (A) standard length humeral implants (*used with permission, Sanchez-Sotelo et al.*), and (B) mini-stem humeral implants (*used with permission, Schnetzke et al.*) Fig 4. Fibrous in-growth around smooth stem revised for loosening (black arrow).



- Table I. 6-week and final postoperative radiographic evaluation. "At-Risk" defined as either positive subsidence or radiolucencies seen in three or more consecutive zones. *=statistically significant.

	6 weeks	Coated Group	Uncoated Group	p-value
Number and Location of Humeral Lucencies (Sanchez-Sotelo)	0	Per zone: 2 shoulders x zone 1, 1x2, 0x3, 0x4, 0x5, 1x6, 1x7, 4x8	Per zone: 2 shoulders x zone 1, 0x2, 0x3, 3x4, 2x5, 3x6, 9x7, 9x8	0.04*
Number and Location of Glenoid and Humeral Lucencies (Schnetzke)	0	Per zone: 2 shoulders x zone L1, 0xL2, 0xUS, 0xM2, 5xM1, 0xG	Per zone: 2 shoulders x zone L1, 0xL2, 3xUS, 2xM2, 14xM1, 2xG	<0.05*
Number and Location of Glenoid Lucencies (Lazarus)	0	0	2 (5.9%)	0.18
Number of Loose Humeral Stems	0	0	1 (2.9%)	0.32
Number of "At Risk" Humeral Stems	0	1 (2.9%)	7 (20.6%)	0.03*
Number of Subsided Stems	0	1 (2.9%)	3 (8.8%)	0.31
Number of Patients with Medial Humeral (Calcar) Lucency (Zone 7 and/or 8)	0	5 (14.7)	14 (41.2%)	0.01*

Results

- 68 shoulders with mean follow-up of 27.3 months (range 24-50 months) were analyzed. 34 had proximal coating, and 34 were uncoated.
- In the coated group, no stems loosened, 1 (2.9%) subsided, and 7 (20.6%) developed radiolucencies (generally in the calcar region).
- In the uncoated group, 1 stem (2.9%) became aseptically loose (requiring revision after 26 months), 7 (20.6%) were judged at risk of loosening (2 due to subsidence), and 15 (44.1%) developed radiolucencies.
- There was a statistically significant difference between the coated and uncoated groups in stems judged to be "at-risk" for future loosening ($p=0.03$), overall number of lucencies surrounding the stem ($p=0.04$) and in patients who developed evidence of proximal medial humeral radiolucencies ($p=0.01$).
- There were no significant differences in final ROM or outcomes scores.

Conclusions And Summary

- MSHC use is appropriate for TSA, achieving desired pain relief and functional improvement.
- Overall, component loosening appears uncommon at early follow-up; however, uncoated stems appear to be at greater risk of loosening and developing radiolucencies.
- Selecting a MSHC with proximal porous coating may decrease the risk of implant-related complications.

Radiographic and Clinical Survival in Total Shoulder Arthroplasty: Pegged Glenoid Components

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Abstract

Background: Loosening of the glenoid component is a primary reason for failure of an anatomic shoulder arthroplasty. Pegged glenoids were designed in an effort to outperform keeled components. This study evaluated the midterm clinical and radiographic survival of a single implant design with implantation of an in-line pegged glenoid component and identified risk factors for radiographic loosening and clinical failure.

Materials and methods: There were 330 total shoulder arthroplasties that had been implanted with a cemented, all-polyethylene, in-line pegged glenoid component evaluated with an average clinical follow-up of 7.2 years. Of these shoulders, 287 had preoperative, initial postoperative, and late postoperative radiographs (mean radiographic follow-up, 7.0 years).

Results: At most recent follow-up, 30 glenoid components had been revised for aseptic loosening. This translated to a rate of glenoid component survival free from revision for all 330 shoulders of 99% at 5 years and 83% at 10 years. Of 287 glenoid components, 120 were considered loose on the basis of radiographic evaluation. Four humeral components were considered loose. Component survival (Kaplan-Meier) free from radiographic failure at 5 and 10 years was 92% and 43%. Severe preoperative glenoid erosion (Walch A2, B2, C) and patient age <65 years were risk factors for radiographic failure. Late humeral head subluxation was associated with radiographic failure.

Conclusions: Despite the predominant thinking that pegged glenoid components may be superior to keeled designs, midterm radiographic and clinical failure rates were high with this pegged component design, particularly after 5 years. Advanced preoperative glenoid erosion and younger patient age are risk factors for radiographic loosening. Revision rates underestimate radiographic glenoid loosening.

Background

Anatomic TSA is an effective treatment for patients suffering from end-stage osteoarthritis, with reliable pain relief and low revision rates at 10 years. However, the rates of radiographic loosening reported in the literature have been much higher. Most of these studies assessed keeled glenoids. Pegged components were introduced in an attempt to improve results. This study was conducted to evaluate the long-term radiographic and clinical survival of a single all-polyethylene pegged glenoid component.

Figure 1

Design of the all-polyethylene glenoid implant used in this study. It has a curved and textured back, 3 in-line pegs with grooves for cement interdigitation, and 3 sizes (small size is shown).

Methods

330 total shoulder arthroplasties were implanted between March of 1997 and May of 2010, with an average clinical follow-up of 7.2 years. Survival analysis free of component revision was conducted on all 330 shoulders. 287 of these shoulders had a complete set of preoperative, initial postoperative, and late postoperative radiographs, with a mean radiographic follow-up 7.0 years (minimum 4 years). These shoulders comprised the primary study group. 49% of patients were male. Average patient age was 65. The primary indication for surgery was osteoarthritis (81%), followed by post-traumatic arthritis, inflammatory arthritis, and AVN.

Radiographs were evaluated by 3 orthopedic surgeons specializing in shoulder surgery. Preoperative glenoid erosion was categorized using the Walch classification. Humeral head subluxation, glenoid component periprosthetic lucency, and humeral component lucency were graded according to previously described classification systems. Glenoid and humeral component shift in position were determined by comparing early and late postoperative radiographs. Survival analysis free of radiographic loosening was conducted on the primary study group of 287 shoulders.

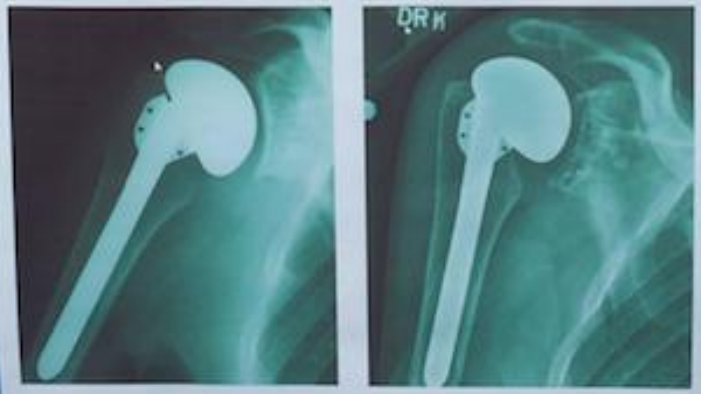
Results

A total of 30 glenoid components were revised for aseptic loosening. This translated to a rate of glenoid component survival free from revision for all 330 shoulders of 99% at 5 years and 83% at 10 years.

In the primary study group, 120 out of 287 glenoids were considered loose on the basis of radiographic evaluation. Component survival free from radiographic failure at 5 and 10 years was 92% and 43%. Four humeral components were considered loose. Utilizing univariate analysis, severe preoperative glenoid erosion (Walch A2, B2, C) and patient age <65 years were found to be risk factors for radiographic failure. Late humeral head subluxation was associated with radiographic failure. Use of a large glenoid component trended towards significance as a risk factor.

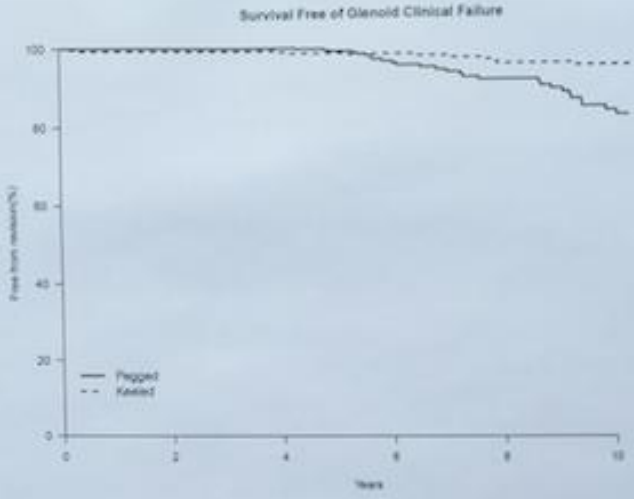
This data was then compared to a previous study performed at this institution that assessed the radiographic and clinical survival of keeled glenoid components. The risk for glenoid clinical failure was noted to be higher in the pegged glenoids. The risk for radiographic failure was also noted to be higher in the pegged glenoids.

Figure 2



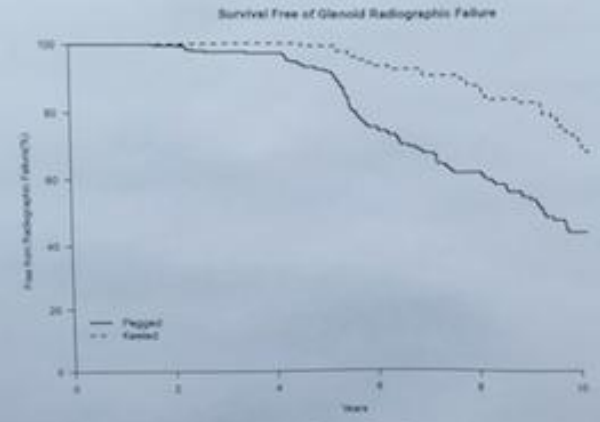
Early postoperative radiograph (*left*) shows a centered humeral head with no lucencies about the glenoid pegs. Late operative radiograph (*right*) in the same patient demonstrating superior migration of the humeral head, lucency about the pegs, and a shift in glenoid position.

Figure 3



Survival of the glenoid component free of clinical failure: pegged vs. keeled components.

Figure 4



Survival of the glenoid component free of radiographic failure: pegged vs. keeled components.

Discussion

A pegged, cemented, curved back, all-polyethylene glenoid component with a slight radial mismatch is thought to provide patients with the best possible long-term outcome. However, there still exists some controversy with regards to keeled vs. pegged designs. We hypothesized that the pegged components in this study would have equivalent rates of radiographic and clinical failure. Surprisingly, we found the radiographic and clinical failure rates of pegged glenoids to be higher than previously studied keel designs at our institution.

It is important to note that the glenoid implants used in this study possessed an in-line peg configuration. This differs from the majority of pegged components currently available, which utilize a triangular peg configuration. To date, there are no studies demonstrating a clear superiority of one peg configuration over the other.

Conclusions

Midterm to long-term radiographic and clinical failure rates indicate that an in-line all-polyethylene pegged glenoid component performs similar to keeled designs, with an even higher rate of radiographic loosening (42% vs. 34%, respectively). Radiographic failure rarely occurs before 5 years. The presence of advanced preoperative glenoid erosion and patient age <65 years appear to be risk factors for radiographic loosening. Revision rates for this study group are significantly higher than for the keeled components but remain relatively low in comparison to the rate of radiographic failure.

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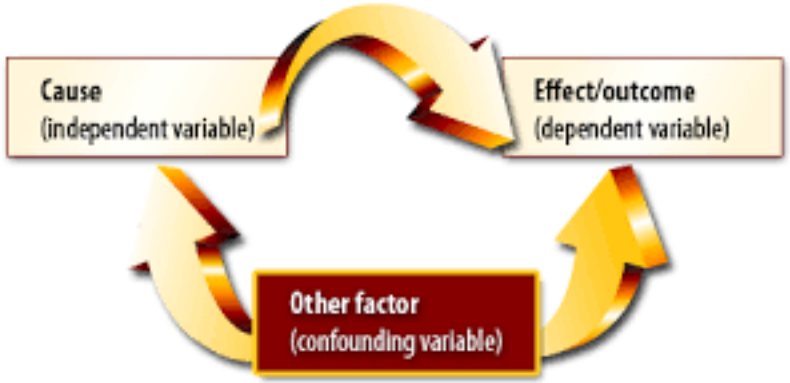

Comparison of Patient Reported Outcomes using a Disease Specific (ASES) and Non-Disease Specific Instrument (PROMIS) in Patients with Shoulder Pain

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Introduction

- Patient reported outcomes (PROs) give the patient a voice in their healthcare and allow for standard of care assessments and validated tracking of progress over time.
- Ideally, PROMs used should be as accurate, reliable, valid, and efficient to administer as possible.
- Psychometric evaluation and validation of the Patient-Reported Outcomes Measurement Information System (PROMIS) has been performed for foot and ankle, trauma, spine, knee, upper extremity, and shoulder.
- PROMIS has matched or outperformed multiple existing PROMs in terms of reliability and efficiency.
- The PROMIS Physical Function domain has previously been compared to the ASES for rotator cuff disease.
- The purpose of this study is to compare the non-disease specific PROMIS Physical Function (PF), Pain Interference (PI), and Depression (D) domains to the established disease specific ASES Shoulder Score for a variety of shoulder conditions.

Methods

- PRO were collected on all clinic visits for two shoulder surgeons over a 12-week period (1/26/16 - 4/20/16).
  - ASES (Pain, Function, Total Score)
  - PROMIS (PF, PI, D)
- Inclusion Criteria: New patient visit, >18 years, complete records, primary shoulder diagnosis.
- Diagnoses(n=123): Impingement (n=50), Pain (n=30), Rotator Cuff Tear (n=12), Arthropathy (n=12), Instability (n=6), Adhesive Capsulitis (n=4), Miscellaneous (n=9).
- 2-way ANOVA with age and gender as covariates used to compare ASES and PROMIS variability across diagnoses.
- Univariate analysis used to correlate ASES scores and PROMIS Domains.
  - Pearson's correlation: r>0.7 considered strong, r>0.6 good, r>0.5 moderate, and r<0.5 poor.

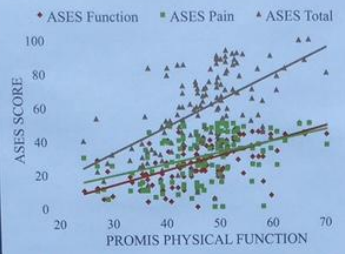

Figure 1. Comparison of PROMIS Physical Function to ASES Function (r=0.608), ASES Pain (r=0.411), and ASES Total (r=0.590).

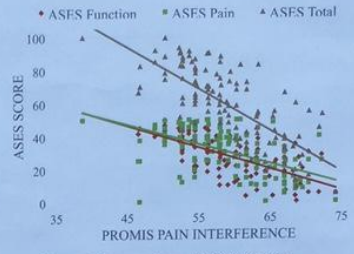

Figure 2. Comparison of PROMIS Pain Interference to ASES Function (r=0.706), ASES Pain (r=0.556), and ASES Total (r=0.735).

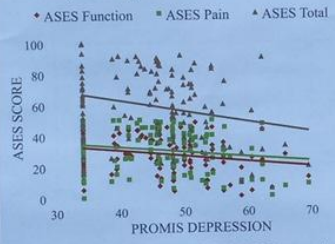

Figure 3. Comparison of PROMIS Depression to ASES Function (r=0.255), ASES Pain (r=0.195), and ASES Total (r=0.262).

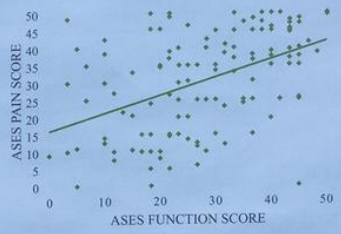

Figure 4. Comparison of ASES Function and ASES Pain (r=0.45).

	Floor Effect	Ceiling Effect
ASES Function	0.8%	1.6%
ASES Pain	2.4%	5.7%
ASES Total	0.8%	0.8%
PROMIS PF	0%	0%
PROMIS PI	0%	0%
PROMIS D	0%	0%

Table 1. Comparison of floor and ceiling effects for ASES and PROMIS.

	Efficiency
ASES	17 Questions
PROMIS	3.30 min (1.03-15.55)

Table 2. Comparison of efficiency for ASES (# questions to complete) and PROMIS (time in minutes to complete).

Results

- PROMIS PF correlation to ASES Function was good (r=0.608), ASES Pain was poor (r=0.411), and ASES Total was fair (r=0.590).
- PROMIS PI correlation to ASES Function was excellent (r=0.706), ASES Pain was fair (r=0.556), and ASES Total was excellent (r=0.735).
- PROMIS D had poor correlation to ASES Function (r=0.255), ASES Pain (r=0.195), and ASES Total (r=0.262).
- ASES Function and ASES Pain had poor correlation (r=0.45).
- ASES Total had 0.8% floor and ceiling effects. PROMIS domains did not demonstrate floor or ceiling effects.
- ASES questionnaire was completed in 17 questions.
- PROMIS mean time to complete was 3.30 minutes (std dev 2.61 min, minimum 1.03 min, maximum 15.55 min).

Conclusions

- PROMIS PF and PI demonstrated fair to excellent correlation across shoulder diagnoses to an accepted disease specific scale (ASES).
- PROMIS PI had a stronger correlation to ASES Function than either PROMIS PF or the ASES Pain subscore.
- Both PROMIS and ASES demonstrated minimal floor and ceiling effects.
- Efficiency could not be directly compared.
- This data shows the potential for the universally available and emerging PROMIS instrument to track shoulder problems.

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A Modification to the Walch Classification of the Glenoid in Primary Glenohumeral Osteoarthritis Using Three-Dimensional Imaging

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INTRODUCTION

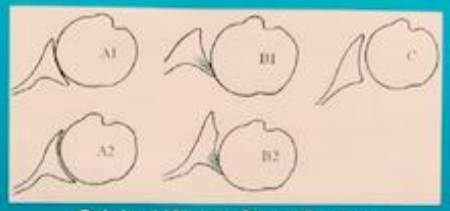
Since Walch and colleagues originally classified glenoid morphology in the setting of glenohumeral osteoarthritis, several authors have reported varying levels of interobserver and intraobserver reliability. We propose several modifications to the Walch classification that we hypothesize will increase interobserver and intraobserver reliability.

METHODS

We propose the addition of the B3 and D glenoids and a more precise definition of the A2 glenoid:

- B3 glenoid: Monoconcave, worn posteriorly with pathologic retroversion ≥ 15° and/or posterior subluxation ≥ 70%.
- D glenoid: Glenoid anteversion or anterior humeral head subluxation
- A2 glenoid: Line connecting the anterior and posterior native glenoid rims transects the humeral head.

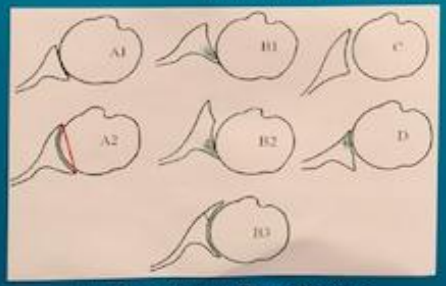
Using 3-dimensional computed tomography glenoid reconstructions, 3 evaluators used the original Walch classification and the modified Walch classification to classify 129 nonconsecutive glenoids on 4 separate occasions. Reliabilities were assessed by calculating κ coefficients.



Original Walch Classification

Updated Glenoids in Modified Classification

Automated 3-D Reconstruction



Modified Walch Classification

RESULTS

Inter-observer reliability

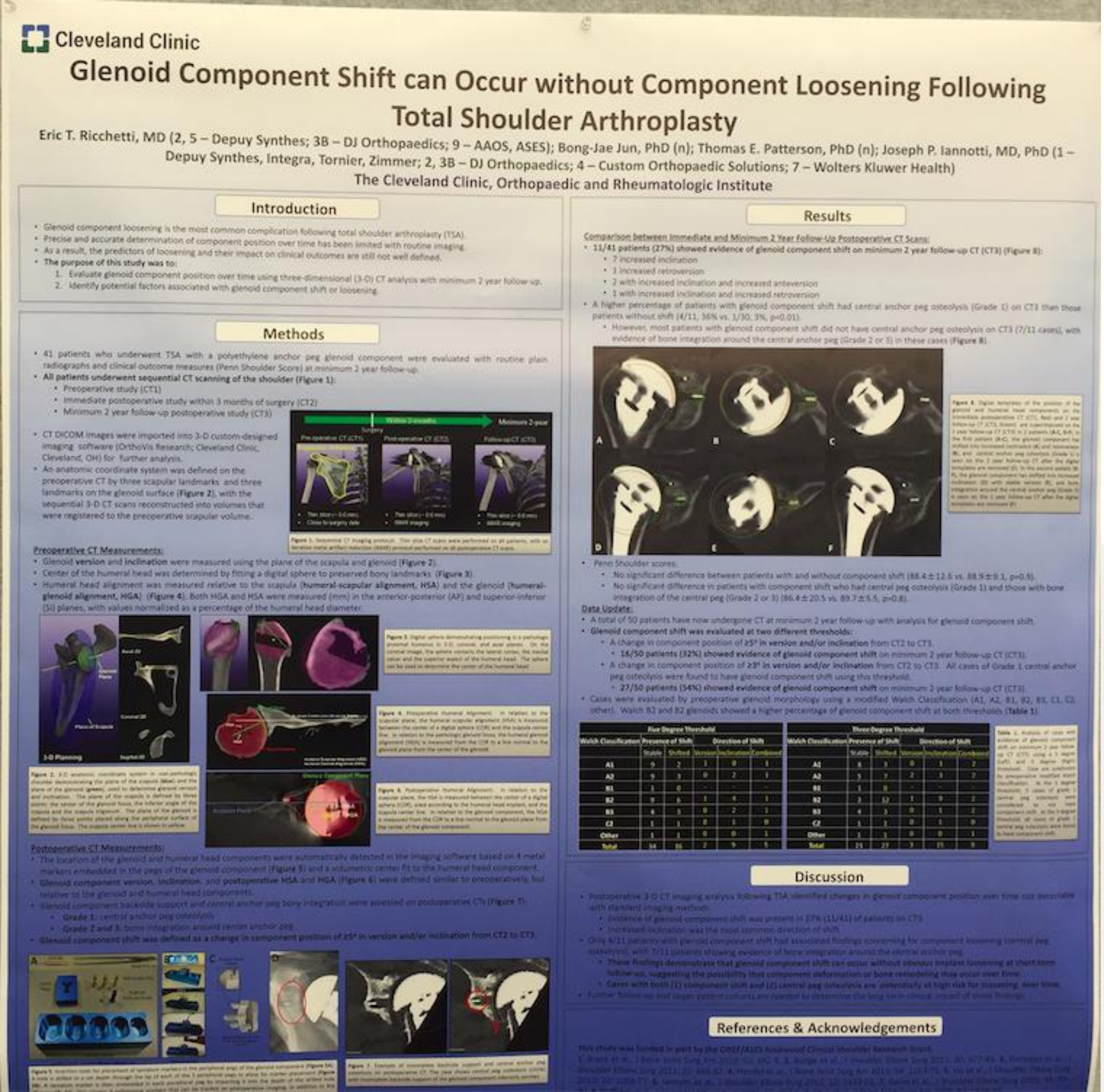
	Observer 1:2	Observer 1:3	Observer 2:3	Average
Original Class. Agreement	0.446 Moderate	0.383 Fair	0.345 Fair	0.391 Fair
Modified Class. Agreement	0.776 Substantial	0.662 Substantial	0.671 Substantial	0.703 Substantial

Intra-observer reliability

	Observer 1	Observer 2	Observer 3	Average
Original Class. Agreement	0.624 Substantial	0.629 Substantial	0.558 Moderate	0.604 Moderate
Modified Class. Agreement	0.884 Near-perfect	0.861 Near-perfect	0.9 Near-perfect	0.882 Near-perf

CONCLUSION

When 3-dimensional glenoid reconstructions and the modified Walch classification described herein are used, improved interobserver and intraobserver reliabilities are obtained.



Cleveland Clinic
Glenoid Component Shift can Occur without Component Loosening Following Total Shoulder Arthroplasty
Eric T. Ricchetti, MD (2, 5 – Depuy Synthes; 3B – DJ Orthopaedics; 9 – AAOS, ASES); Bong-Jae Jun, PhD (n); Thomas E. Patterson, PhD (n); Joseph P. Iannotti, MD, PhD (1 – Depuy Synthes, Integra, Tornier, Zimmer; 2, 3B – DJ Orthopaedics; 4 – Custom Orthopaedic Solutions; 7 – Wolters Kluwer Health)
The Cleveland Clinic, Orthopaedic and Rheumatologic Institute
Introduction
Glenoid component loosening is the most common complication following total shoulder arthroplasty (TSA).
Precise and accurate determination of component position over time has been limited with routine imaging.
As a result, the predictors of loosening and their impact on clinical outcomes are still not well defined.
The purpose of this study was to:
1. Evaluate glenoid component position over time using three-dimensional (3-D) CT analysis with minimum 2 year follow-up.
2. Identify potential factors associated with glenoid component shift or loosening.
Methods
41 patients who underwent TSA with a polyethylene anchor peg glenoid component were evaluated with routine plain radiographs and clinical outcome measures (Penn Shoulder Score) at minimum 2 year follow-up.
All patients underwent sequential CT scanning of the shoulder (Figure 1):
Preoperative study (CT1)
Immediate postoperative study within 3 months of surgery (CT2)
Minimum 2 year follow-up postoperative study (CT3)
CT DICOM images were imported into 3-D custom-designed imaging software (OrthoVis Research; Cleveland Clinic, Cleveland, OH) for further analysis.
An anatomic coordinate system was defined on the preoperative CT by three scapular landmarks and three landmarks on the glenoid surface (Figure 2), with the sequential 3-D CT scans reconstructed into volumes that were registered to the preoperative scapular volume.
Preoperative CT Measurements:
Glenoid version and inclination were measured using the plane of the scapula and glenoid (Figure 2).
Center of the humeral head was determined by fitting a digital sphere to preserved bony landmarks (Figure 3).
Humeral head alignment was measured relative to the scapula (humeral-scapular alignment, HSA) and the glenoid (humeral-glenoid alignment, HGA) (Figure 4). Both HGA and HSA were measured (mm) in the anterior-posterior (AP) and superior-inferior (SI) planes, with values normalized as a percentage of the humeral head diameter.
Postoperative CT Measurements:
Results
Comparison between Immediate and Minimum 2 Year Follow-Up Postoperative CT Scans:
11/41 patients (27%) showed evidence of glenoid component shift on minimum 2 year follow-up CT (CT3) (Figure 8):
7 increased inclination
1 increased retroversion
2 with increased inclination and increased anteversion
1 with increased inclination and increased retroversion
A higher percentage of patients with glenoid component shift had central anchor peg osteolysis (Grade 1) on CT3 than those patients without shift (4/11, 36% vs. 1/30, 3%, p=0.01).
However, most patients with glenoid component shift did not have central anchor peg osteolysis on CT3 (7/11 cases), with evidence of bone integration around the central anchor peg (Grade 2 or 3) in these cases (Figure 8).
Penn Shoulder scores:
No significant difference between patients with and without component shift (88.4±12.6 vs. 88.9±9.1, p=0.9).
No significant difference in patients with component shift who had central peg osteolysis (Grade 1) and those with bone integration of the central peg (Grade 2 or 3) (86.4±20.5 vs. 89.7±5.5, p=0.8).
Data Update:
A total of 50 patients have now undergone CT at minimum 2 year follow-up with analysis for glenoid component shift.
Glenoid component shift was evaluated at two different thresholds:
A change in component position of ≥5° in version and/or inclination from CT2 to CT3.
16/50 patients (32%) showed evidence of glenoid component shift on minimum 2 year follow-up CT (CT3).
A change in component position of ≥3° in version and/or inclination from CT2 to CT3. All cases of Grade 1 central anchor peg osteolysis were found to have glenoid component shift using this threshold.
27/50 patients (54%) showed evidence of glenoid component shift on minimum 2 year follow-up CT (CT3).
Cases were evaluated by preoperative glenoid morphology using a modified Walch Classification (A1, A2, B1, B2, B3, C1, C2, other). Walch B2 and B2 glenoids showed a higher percentage of glenoid component shift at both thresholds (Table 1).
Five Degree Threshold
Three Degree Threshold
Walch Classification
Presence of Shift
Direction of Shift
Discussion
References & Acknowledgements

KEY POINT

Does Total Shoulder Arthroplasty Increase Patients' Activity Levels?

Keith M. Baumgarten, MD, Peter S. Chang BS, Tasha M. Almond PhD, Elaine K. Foley BS, Anthony P. Fiegen BS.

Introduction

- It is well known that both anatomic and reverse total shoulder arthroplasty decrease pain, improve range of motion, and increase strength[1]. However, it remains unknown if these improvements in pain relief, functional range of motion, and increased strength translate to an improvement in a patient's activity level postoperatively.
- The Shoulder Activity Level has been developed to be used as a shoulder-specific outcomes tool to measure a patient's shoulder activity[2]. It has been proven to be both reliable and valid[2]. It has been recommended that this outcomes metric should be included in shoulder outcomes studies[3]. Currently, the Shoulder Activity Level has only been utilized in nonoperative[4,5,6] or preoperative patients[7] and, to the best of our knowledge, has not been utilized to analyze the influence of surgery on a patient's activity level.

Objective

- The purpose of this study was to determine the influence of anatomic total shoulder arthroplasty and reverse total shoulder arthroplasty on patients' activity levels. The authors hypothesized that both anatomic total shoulder arthroplasty and reverse total shoulder arthroplasty would result in improvements in a patients activity level as determined by the Shoulder Activity Level.

Materials and Methods

- Prospective collection of preoperative patient-determined outcomes scores on patients undergoing both total shoulder arthroplasty and reverse total shoulder arthroplasty by a single surgeon (KMB) was begun in December 2008. The Shoulder Activity Level was the primary outcome scores examined in this study since it is a validated, patient-determined outcome score that can be used to measure a patient's activity level. Secondary outcome scores that were collected include the Western Ontario Osteoarthritis of the Shoulder index (WOOS), the American Shoulder and Elbow Score (ASES), the Simple Shoulder Test (SST), and the Single Assessment Numeric Evaluation (SANE). These secondary scores were included to ensure that index procedures had a positive influence on patients' quality of life since the Shoulder Activity Level does not assess quality of life outcomes.
- After review of the database, 133 shoulders that underwent total shoulder arthroplasty for glenohumeral osteoarthritis or reverse total shoulder arthroplasty for rotator cuff tear arthropathy and had completed preoperative patient outcome forms had the potential for inclusion in this study. Exclusion criteria were patients with less than two years follow-up, patients who were deceased before postoperative outcomes measures could be obtained, and patients with concomitant cervical radiculopathy or a diagnosis of rheumatoid arthritis.
- Patients were mailed the postoperative follow-up outcomes measures by U.S. mail and asked to complete the identical outcome scores that were taken preoperatively.
- A paired samples t-test was conducted, on pre and post test scores for anatomic total shoulder arthroplasty and reverse total shoulder arthroplasty to determine statistically significant improvements in quality of life scales and the Shoulder Activity Level. The eta squared statistic (η^2) was utilized to determine the effect size[8]. The level of significance was set at 0.05.

Results

- One-hundred-thirty-three shoulders met inclusion and exclusion criteria. Eleven shoulders (nine patients) were lost to follow up (8%). Seventy-four patients underwent 80 total shoulder arthroplasties with 42 of them performed on women (53%). The mean age was 68.9 (range 42-87). Forty-one patients underwent 42 reverse total shoulder arthroplasties with 22 of them performed on women (52%). The mean age was 74 (range 51-92). For all patients included in the study, the mean follow-up was 3.7 years (range 2 – 6.9 years).
- Patients undergoing anatomic total shoulder arthroplasties had improvements in median WOOS, ASES, SST, and SANE ($p<0.0001$) with large effect sizes.
- **The median Shoulder Activity Level improved but did not quite reach statistical significance (7-8; p=0.07).**
- Patients undergoing reverse total shoulder arthroplasties had improvements in median WOOS, ASES, SST, and SANE scores ($P<0.0001$) with large effect sizes.
- **The median Shoulder Activity Level improved but did not reach statistical significance (4.5-6; p=0.38).**

Since there were non-significant improvements in the Shoulder Activity Level for both anatomic total shoulder arthroplasty and reverse total shoulder arthroplasty, the groups were combined to determine if a larger sample size that examined the effect of shoulder arthroplasty (both anatomic and reverse) on the Shoulder Activity Level would demonstrate a statistically significant improvement compared to preoperative levels. **Among all shoulder arthroplasties, there was a statistically significant improvement in median postoperative Shoulder Activity levels (SAL=8) compared to preoperative levels (SAL = 6) with a moderate effect size (p=0.004).**

Discussion

- Patient-determined outcome scores have become the standard for determining outcomes after treatment interventions. Disease-specific measures have been suggested to be the best outcomes determinants for use in clinical trials and for monitoring and clinical decision making in individual patients[9]. Although highly recommended as an outcomes tool, disease-specific quality of life scores do not specifically account for the patient's activity level.
- Patients with different activity levels may have different expectations of treatment outcomes. In addition, patient may limit activity levels to help diminish symptoms to an acceptable range. Thus, activity level scores should be used to supplement disease-specific outcomes measures.

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Table 1. Patient-determined Outcome Scores

Anatomic Total Shoulder Arthroplasties					
Outcome Score	Preoperative Median Score	Range	Postoperative Median Score	Range	P-value
Shoulder Activity Level	7	0 - 20	8	0 - 18	0.07
WOOS	34	1 - 91	89	0 - 100	<0.0001
ASES	30	0 - 80	87	15 - 100	<0.0001
SST	2	0 - 11	9	0 - 12	<0.0001
SANE	23	0 - 90	90	0 - 100	<0.0001

Reverse Total Shoulder Arthroplasties					
Outcome Score	Preoperative Median Score	Range	Postoperative Median Score	Range	P-value
Shoulder Activity Level	4.5	0 - 20	6	0 - 20	0.38
WOOS	31	5 - 64	83	31 - 100	<0.0001
ASES	29	0 - 68	82	30 - 100	<0.0001
SST	2	0 - 8	7	0 - 12	<0.0001
SANE	20	0 - 65	85	10 - 100	<0.0001

Conclusions

- In this cohort of patients with glenohumeral osteoarthritis and rotator cuff tear arthroplasty, patients' activity levels were improved by anatomic total shoulder arthroplasty and reverse total shoulder arthroplasty. In addition, the disease-specific and joint-specific quality of life scores all had statistically significant improvements. This is the first known study that examined the effects of shoulder surgery, specifically anatomic total shoulder arthroplasty and reverse total shoulder arthroplasty, on the Shoulder Activity Level.

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Disclosures

- This study was supported by the University of South Dakota Student Research Grant
- The authors do not have any other relevant disclosures.

ORTHOPEDIC INSTITUTE

Cleveland Clinic

Efficacy of Preoperative Aspirates in Periprosthetic Joint Infections of the Shoulder

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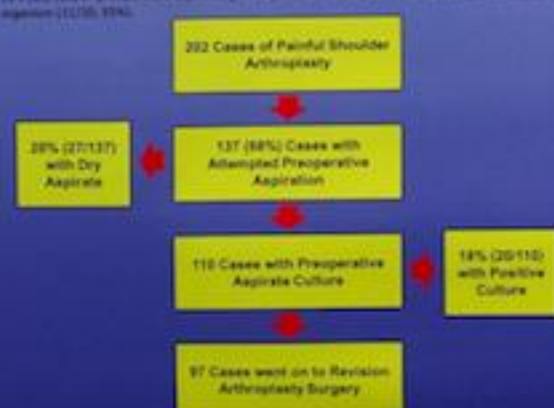
Introduction

- Shoulder periprosthetic joint infection (PJI) can be both a diagnostic and therapeutic challenge due to the indolent nature of the commonly cultured organisms.
  - Propionibacterium acnes (P. acnes), the most common pathogen, represents approximately 2/3 to 3/4 of positive cultures.
  - Coagulase-negative Staphylococcus species (CNS), the next most common pathogen.
- Established diagnostic tests for hip and knee PJI are often negative in the shoulder despite the postoperative growth of intra-operative cultures:
  - Preoperative aspiration often low volume due to the indolent organisms.
  - Limited data available regarding (1) rate of successful preoperative aspiration and (2) its efficacy in diagnosis of shoulder PJI.
- **The purpose of this study was to:**
  1. Determine the rate of successful preoperative aspiration.
  2. Determine the utility of preoperative aspiration in the diagnosis of infection in revision shoulder arthroplasty.

Methods

- A retrospective chart review was performed on 202 cases evaluated for painful shoulder arthroplasty.

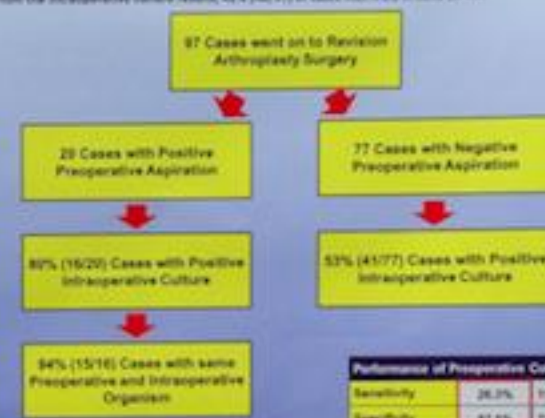
Results



Results

Intraoperative Culture Results:

- Intraoperative cultures were positive in 59% (57/97) of cases that went on to revision surgery.
  - P. acnes was the most commonly cultured organism at revision surgery (43/57, 75%).
  - From the intraoperative culture results, 42% (40/97) of cases met MSIS criteria for PJI.



Performance of Preoperative Culture		
Sensitivity	26.3%	15.5-38.7%
Specificity	87.5%	73.2-95.8%
Positive Likelihood Ratio	2.11	0.83-5.32
Negative Likelihood Ratio	0.84	0.69-1.02
Positive Predictive Value	75%	50.9-91.3%
Negative Predictive Value	45.5%	34.1-57.2%
*95% confidence intervals		

Discussion

References

The Effect of Neck-Shaft Angle on Joint Loads and Contact Mechanics in Reverse Total Shoulder Arthroplasty

Abdulla, I.; Langohr, G.D.G.; Athwal, G.S.; Johnson, J.A.

Roth|McFarlane Hand and Upper Limb Centre, Western University, London, Canada.

BACKGROUND

- Reverse shoulder arthroplasty (RSA) is a common and effective treatment option for rotator cuff tear arthropathy.
- Computational models have suggested that reducing neck shaft (N-S) angle can increase impingement-free adduction range of motion (ROM). However, little is known of the associated effects of altering this variable on implant contact mechanics and subsequent implant wear.
- ***Objective:*** Using a cadaveric model, the purpose of this in-vitro biomechanical study was to investigate the effects of N-S angle on RSA joint loads and range of motion and to then use this data to evaluate the effects of N-S angle on RSA contact mechanics using a finite element model.

HYPOTHESIS

Reducing N-S angle would increase adduction ROM, but would have a negative effect on articular contact mechanics.

MATERIALS & METHODS

An instrumented RSA implant capable of measuring load and varying N-S angle (155˚, 145˚, 135˚, Fig.1) was implanted into 6 cadavers (60±21 yrs).

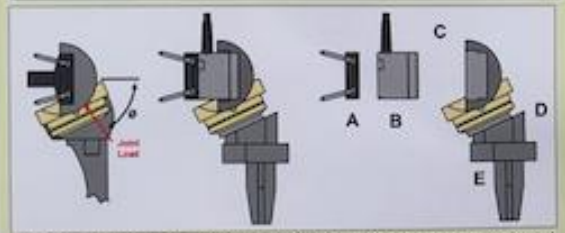


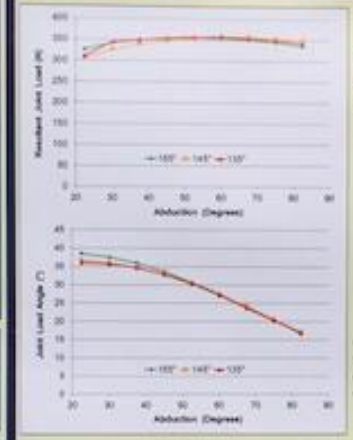
Fig. 1 – Custom RSA implant: (A) base plate, (B) load cell, (C) glenosphere, (D) N-S angle adjustment block, (E) humeral component. Joint load angle shown on left.

An active shoulder motion simulator was used to test all possible implant configurations using active and passive motion protocols.

Shoulder kinematics and joint loads were recorded and then employed in a finite element model (ABAQUS v6.12).

Contact area & maximum contact stress were computed & compared.

RESULTS



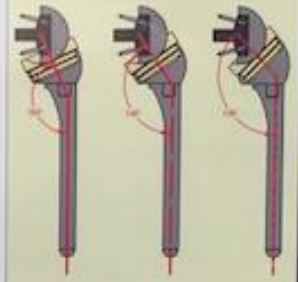


Fig. 2 – Mean Resultant Joint Load (Left Top) and Joint Load Angle (Left Bottom) for 155˚ (green), 145˚ (yellow), and 135˚ (red) N-S angles. All N-S angles tested shown on Right.

- When N-S angle was reduced (155˚→145˚→135˚) no significant effects were detected for joint load (P=0.941) or load angle (P=0.906, Fig.2).
- Decreasing N-S angle significantly decreased the angle between the joint load and the edge of the cup (P=0.003, Fig.3).
- Both the 145˚ and 135˚ N-S angles provided greater adduction range of motion than the 155˚ (P=0.017 and P=0.013 respectively).
- In terms of contact mechanics, reducing the N-S angle from 155˚ to 145˚ caused no changes in peak contact stresses (P=0.248, Fig. 4), however, reducing N-S angle from 155˚ to 135˚ significantly increased stress (P=0.006, Fig. 4).
- This negative effect on contact stress was most evident at higher abduction angles with the 135˚ NS angles producing nearly double the contact stress (Fig.4).

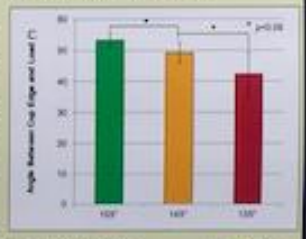
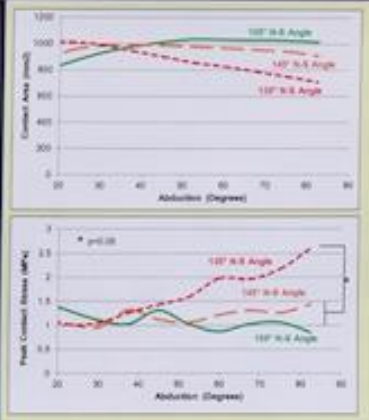


Fig. 3 – Mean (+/- 1 standard deviation) Angle Between the Cup Edge (shown to the right) and Joint Load for all N-S Angles Tested

REFERENCES



82.5° Abduction

Fig. 4 – Mean Contact Area (Top) and Peak Contact Stress (Bottom) for 155˚ (grn), 145˚ (yellow), and 135˚ (red) N-S angles. Contact Stress Maps Shown at Right.

DISCUSSION

- Although reducing N-S angle has a positive effect on adduction range of motion, this comes with negative contact mechanics most notably at the inferior edge of the implant.
- The location of the maximum contact stress is significant as retrieval studies have shown that the predominant area of wear in RSA is at this inferior edge.
- Polyethylene wear in this area could potentially be amplified when N-S angles are altered to achieve greater ROM.

CONCLUSIONS

An important balance between optimizing range of motion and contact mechanic considerations will need to be made when considering decreasing N-S angle in RSA.

ACKNOWLEDGEMENTS

ROTH | McFARLANE HAND & UPPER LIMB CENTRE
ST. JOSEPH'S HEALTH CARE LONDON

Western

Single Shot versus Continuous Interscalene Block for Postoperative Pain Control Following Primary Shoulder Arthroplasty: A Prospective Randomized Clinical Trial

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All authors have submitted up to date conflict of interest information on the AAOS website

Introduction
Multimodal Pain Management

Background

- Optimal pain management is a priority focus for health care providers and essential for creating health care value
- Postoperative pain after prosthetic shoulder arthroplasty (PSA) impacts patient satisfaction and hospital length of stay

Regional Anesthesia

- A cornerstone of perioperative pain management for shoulder surgery
- Reduces baseline pain levels, increases patient satisfaction, and decreases hospital stay
- The efficacy of regional anesthesia can be extended by continuous catheter infusion of local anesthetics
- However, safety issues remain a concern

Continuous vs. Single Shot Nerve Blocks

- Several randomized controlled trials have compared single shot interscalene block (SSIB) and continuous interscalene block (CIB) after open and arthroscopic surgery
- However, we were unaware of any randomized controlled trial comparing SSIB and CIB exclusively in PSA patients

Purpose and Hypothesis

- The study purpose was to compare SSIB and CIB for postoperative pain control after primary shoulder arthroplasty
- The hypothesis was that the two interventions would offer similar safety and efficacy

Methods

- 76 patients randomly assigned:

Group 1 – SSIB:
37 patients receiving single shot interscalene block using 30ml, 0.5% ropivacaine

Group 2 – CIB:
39 patients receiving single injection of 30ml, 0.5% ropivacaine followed by 0.2% ropivacaine at 8 ml/hr for 50 hours via ultrasound guided catheter and elastomeric infusion pump system

- Patients underwent assessments pre-op, POD 1-4, & POD 10:
  - 10-point VAS pain score
  - 5-point Likert scale to score overall satisfaction
- Recorded:
- Postoperative opioid use
  - Converted to MSO_4 equivalent to facilitate comparison
- Hospital length of stay
- Catheter tip withdrawal
- Adverse perioperative events
- Estimated mean cost

Statistical Analysis

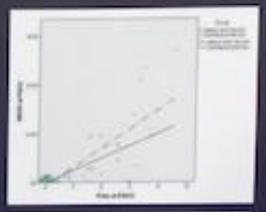
- Performed at the $p<0.05$ level of significance
- At 80% power & alpha = .05, a priori power analysis based on previous studies established that 33 patients would be needed in each group
- After incorporating an attrition rate of 15% the final study sample size was 76 patients
- Demographic variables were compared using independent samples t-test, Pearson Chi-Square or Fisher's Exact test
- Mann-Whitney U test for non-normally distributed variables
- Univariate chi square analysis for categorical variables
- Fisher's exact test for categorical variables with expected cell counts less than 5

Demographics

	Total (N = 76) Mean (SD); n (%)	Group 1: SSIB (n=37, 48.7%) Mean (SD); n (%)	Group 2: CIB (n=39, 51.3%) Mean (SD); n (%)	p-value
AGE (years)	76 (100)	66.64 (9.261)	70.18 (9.150)	0.105
GENDER: M	41 (53.9)	21(56.8)	20 (51.3)	0.632
GENDER: F	35 (46.1)	16 (43.2)	19 (48.7)	
BMI	30.4(5.4)	31.0(5.5)	29.8 (5.3)	0.315
CAD (Yes)	14 (18.4)	6 (16.2)	8 (20.5)	0.626
Diabetes (Yes)	13 (17.1)	7 (18.9)	6 (15.4)	0.683
PREOP OPIOIDS	30 (39.5)	14 (37.8)	16 (41.0)	0.776
SIDE: RIGHT	47 (61.8)	22 (59.5)	25 (64.1)	0.677
SIDE: LEFT	29 (38.2)	15 (40.5)	14 (35.9)	
ASA 1	4 (5.3)	2 (5.4)	2 (5.1)	0.470
ASA 2	23 (30.3)	13 (35.1)	10 (25.6)	
ASA 3	47 (61.8)	22 (59.5)	25 (64.1)	
ASA 4	2 (2.6)	0 (0)	2 (5.1)	
LEFT HAND	10 (13.2)	3 (8.1)	7 (17.9)	0.311
RIGHT HAND	66 (86.8)	34 (91.9)	32 (82.1)	
TSA	50 (65.8)	24 (64.9)	26 (66.7)	0.323
HEMI	5 (6.6)	4 (10.8)	1 (2.6)	
RSA	21 (27.6)	9 (24.3)	12 (30.8)	
ADV EVENT	10 (13.2)	2 (5.4)	8 (20.5)	0.087

Results

- Pain scores on POD#1 were significantly lower in the continuous interscalene nerve block group ($p\leq0.010$)
- Opioid use was substantially lower in the continuous interscalene nerve block group (15 mg vs. 22.5 mg, $p\leq0.003$)
- No difference in hospital LOS (1.4 d vs. 1.8 d, $p=0.142$) with available #s
- Opioid use and pain scores were highly correlated →



- Adverse event rates were higher in the CIB group (8/39 vs. 2/37) but this was not statistically significant ($p \geq 0.087$) →
- Most common adverse event in CIB group was 3 syncopal episodes, one of which resulted in pacemaker implantation

Group	Adverse Event
1: SSIB	Bleeding from drain site
	Chest tightness
	Syncope
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	Syncope
	Catheter Block, Oversedation
	SOB, Bradycardia, Acute Renal Failure, Emesis
	Hypotension, Bradycardia, Syncope, Pacemaker inserted POD#4
	Hyponatremia, Hypokalemia

- 4/39 (10.3%) incidence of catheter tip withdrawal
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- Costs:
  - $25 for SSIB
  - $475 for CIB

Discussion

- No previous randomized clinical study has compared the efficacy of SSIB and CIB exclusively in PSA patients
- Okoroha et al. compared SSIB to liposomal bupivacaine (LB) and found less opiate use in LB group
- Routman et al. compared SSIB to SSIB/LB/dex and found the latter had decreased postop pain and hospital LOS
- Sabesan et al. compared CIB to SSIB/LB and found similar hospital LOS but complications and cost were higher in CIB group
  - Also encountered frequent catheter tip withdrawal 15.2% (5/33) similar to 10.3% here

Conclusions

- Our study found CIB lowered opioid use and pain levels on POD #1, but this did not translate to a shorter LOS
- The incidence of catheter tip withdrawal remains too high
- Additional studies will need to compare CIB to emerging perioperative pain management interventions such as LB and "cocktail" infiltrations

References

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Investigation performed at TriHealth's Good Samaritan Hospital Cincinnati, Ohio

Good Samaritan TriHealth Hospital

Introduction
Multimodal Pain Management

Background

- Optimal pain management is a priority focus for health care providers and essential for creating health care value
- Postoperative pain after prosthetic shoulder arthroplasty (PSA) impacts patient satisfaction and hospital length of stay

Regional Anesthesia

- A cornerstone of perioperative pain management for shoulder surgery
- Reduces baseline pain levels, increases patient satisfaction, and decreases hospital stay
- The efficacy of regional anesthesia can be extended by continuous catheter infusion of local anesthetics
- However, safety issues remain a concern

Continuous vs. Single Shot Nerve Blocks

- Several randomized controlled trials have compared single shot interscalene block (SSIB) and continuous interscalene block (CIB) after open and arthroscopic surgery
- However, we were unaware of any randomized controlled trial comparing SSIB and CIB exclusively in PSA patients

Good Samaritan
TriHealth Hospital

Purpose and Hypothesis

- The study purpose was to compare SSIB and CIB for postoperative pain control after primary shoulder arthroplasty
- The hypothesis was that the two interventions would offer similar safety and efficacy

Methods

- 76 patients randomly assigned:

Group 1 – SSIB:
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Group 2 – CIB:
39 patients receiving single injection of 30ml, 0.5% ropivacaine followed by 0.2% ropivacaine at 8 ml/hr for 50 hours via ultrasound guided catheter and elastomeric infusion pump system

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- Opioid use and pain scores were highly correlated →
- Adverse event rates were higher in the CIB group (8/39 vs. 2/37) but this was not statistically significant ($p \geq 0.087$) →
- Most common adverse event in CIB group was 3 syncopal episodes, one of which resulted in pacemaker implantation

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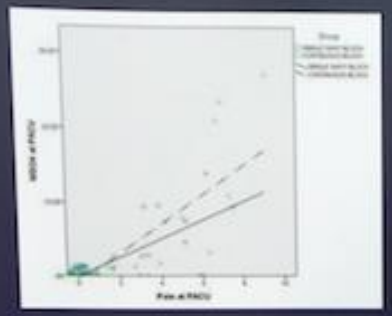

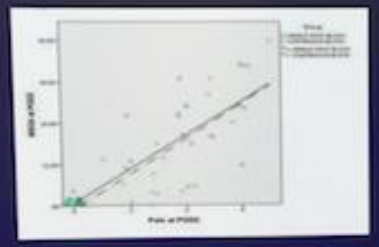

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Investigation performed at TriHealth's Good Samaritan Hospital Cincinnati, Ohio

Effectiveness of intra-articular local infiltration analgesia compared to interscalene block in the early postoperative pain control after total shoulder arthroplasty. A comparative randomized non-inferiority trial.

M Ferrand[1], S Klouche1, J Sicard[2], JC Auregan[1], N Billot[3], F Lespagnol[4], N Solignac[3], C Conso[5], S Poulain[6], P Hardy[1].

[1] Hôpital Ambroise Paré, Boulogne (France). [2] Hôpital Mignot, Le Chesnay. [3] Claude Bernard Private Hospital, Ermont. [4] Clinique Jules Verne, Nantes. [5] Institut Montsouris, Paris. [6] Clinique du Plateau, Bezons.

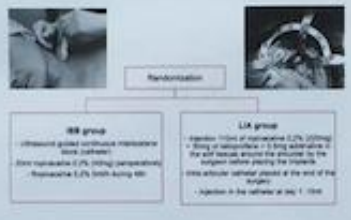
Introduction

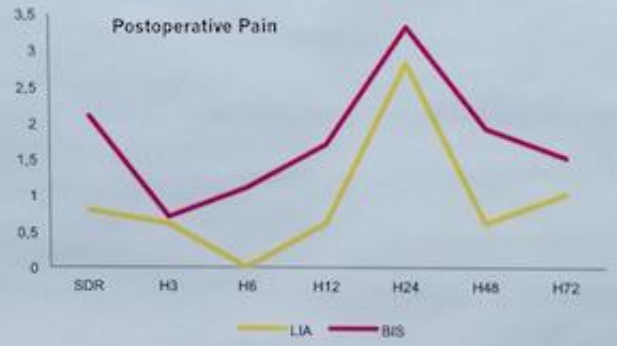
Postoperative pain after shoulder surgery was reported from moderate to severe in 70% of patients(1). Ultrasound guided InterScalene Block (ISB) is the gold standard in postoperative pain management of shoulder procedures(2), but has adverse effects(3-4). Local Infiltration Analgesia (LIA) was reported as an efficient alternative to femoral block with comparable results for postoperative analgesia of hip and knee surgery(5-6). The effectiveness of LIA was reported in arthroscopic procedures of the shoulder(7) but never in total shoulder arthroplasty.

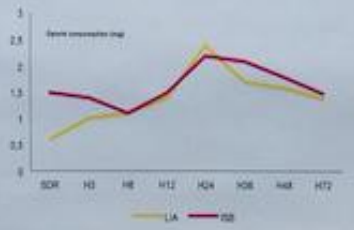
We designed a randomized prospective comparative multicentric study to compare the effectiveness of Local Infiltration Analgesia to the gold standard, the Interscalene Block.

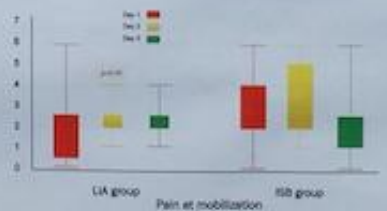
Material and methods

A prospective randomized controlled study was conducted between 2014 and 2016 in 4 orthopedic surgery centers. All patients who underwent surgery for either anatomic or reverse TSA for any degenerative cause were included. Trauma cases, because of the particular presentation, were excluded. In ISB group, patients received interscalene block with perineural catheter insertion before induction of general anesthesia under ultra-sound guidance and continue infusion of ropivacaïne 0.2% during 48h. In LIA group, the surgeon injected 110ml of ropivacaïne 0.2%, ketoprofen 30mg and epinephrine 0.5mg next to the glenoid and in soft tissues around the shoulder and inserted a catheter into the glenohumeral joint before wound closure. For a more convenient and a more efficient infiltration, the injection was made just before putting the implants, giving a good access to the posterior capsule that can absorb a lot of local analgesia directly in contact with the prosthesis. The next morning, the surgeon reinjected 10 ml of ropivacaïne 0.2%, ketoprofen 30 mg and epinephrine 0,5mg through the catheter and removed it. The drain was stopped during 2 hours to allow proper diffusion of the local analgesia and prevent absorbtion through the drain.









Postoperative analgesic protocol was the same in both groups. Patients' pain was assessed using a Visual Analogic Scale (VAS) from 0 to 10. The primary outcome was the mean pain during the 48h after surgery (recovery room, H3, H6, H12, H24, H36, H48). Secondary outcomes were mean postoperative opioid consumption from the recovery room to H72, pain during early mobilization from the first to the third postoperative day, and postoperative complications. The sample size was calculated with a non-inferiority margin of 0.5/10. The population in the 2 groups was reproducible and comparable (Table 1). The study was approved by an institutional review board and was declared in a clinical trial register.

Results

99 (50 LIA/49 ISB) patients were included, mean age 72±9.6 years, 35 men and 64 women, 36 anatomic TSA and 63 reversed TSA. No significant difference was found between the LIA group (mean NRS score, 1.4±0.9) and ISB group (mean NRS score, 1.7±1) for mean 48-hour postoperative pain (p=0.19) but LIA group had significantly less pain in the recovery room (0.6±1 vs 1.5±1.7, p=0.003). The mean pain during mobilization at the second postoperative day was lower in LIA group (2.6±1.4 vs 3.2±1.3, p=0.03). Total consumption of opioids was similar (p=0.27) except at recovery room where LIA group has consumed significantly less opioid (p=0.01). No complications occurred in both groups. 100% of patients in the ISB group had a motor block with paresthesia versus none in the LIA group (p=0.0001).

Conclusion

This study has shown that the local infiltration analgesia is not less effective than the interscalene block in the early postoperative pain control after total shoulder arthroplasty. LIA appears to be a safe alternative to the ISB, particularly in cases of contraindication to the loco-regional anesthesia.

Short Term Outcomes using Uncemented Humeral Components in Reverse Total Shoulder Arthroplasty

Mina Abdelshahed MD[1] • Michael Yip MD[1] • Pierre-Henri Flurin MD[2] • Yann Marczuk MD[3] • Ryan Simovitch MD[4], Thomas Wright MD[5] • David Mai MD, MPH[1] • Chris Roche MS, MBA[6] • Joseph Zuckerman MD[1] • Mandeep Virk MD[1]

[1]Hospital for Joint Diseases at NYU Langone Medical Center, New York, NY; [2]Bordeaux Merignac Sports Clinic, Merignac, France; [3]Chenieux Clinic, Limoges, France; [4] Palm Beach Orthopaedic Institute, Jupiter, FL; [5]University of Florida, Gainesville, FL; [6]Exactech Inc, Gainesville, FL

Disclosure: No conflicts of interest

OBJECTIVE

There has been increasing interest in using uncemented or press fit humeral fixation in reverse total shoulder arthroplasty (rTSA). The purpose of this study was to report minimum two-year functional and radiographic outcomes of rTSA using uncemented humeral components.

METHODS

Retrospective analysis of prospectively collected data from multiple surgeons (multi-institutional) who performed rTSA with uncemented humeral components between 2007 - 2014.

Inclusion criteria:

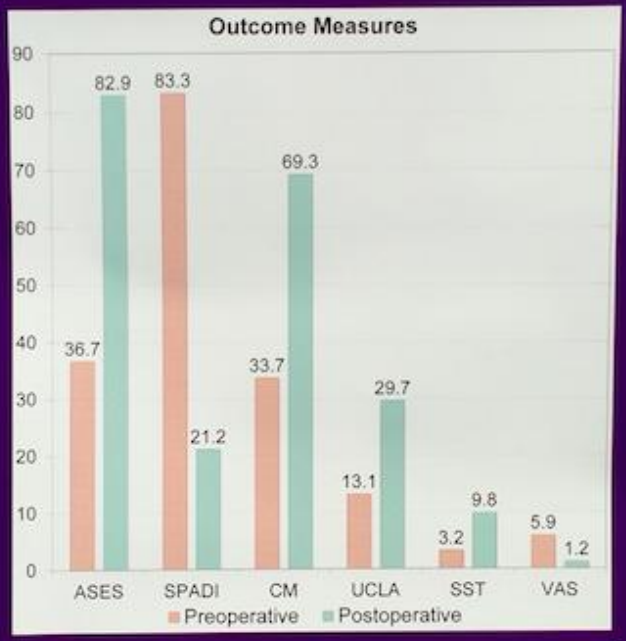
- Uncemented humeral stem in rTSA
- Minimum two year follow up

Primary outcome measure:

- Revision for humeral component loosening

Secondary outcome measures:

- Outcome scores:
  - American Shoulder and Elbow Surgeons (ASES)
  - Shoulder Pain and Disability Index (SPADI)
  - Constant-Murley (CM)
  - University of California Los Angeles (UCLA)
  - Simple Shoulder Test (SST)
  - Visual Analog Scale (VAS) for Pain
- Objective measures:
  - Radiographs
  - Range of motion



Range of Motion	Pre-op	Post-op
Active Abduction	70°	111°
Active Forward Elevation	87°	137°
Active External Rotation	14°	34°

RESULTS

- 598 patients with a minimum of two-year follow-up were identified and reviewed
- Average follow up was 37.5 ± 16 months

At final follow-up:

- Significant ($p < 0.05$) improvements in outcome scores (ASES, SPADI, CM, UCLA, SST, VAS)
- Significant ($p < 0.05$) improvements in ROM
- Radiographically
  - No component loosening noted
  - 3 radiographs were noted to be "at risk" for loosening (radiolucent lines ≥ 2mm in 3 or more Gruen Zones)
- Overall complication rate: 5.5%
  - Acromion and scapular spine fractures (9)
  - Postoperative humeral shaft fractures from trauma (7) with one requiring revision of humeral component and one requiring ORIF
  - Glenoid component loosening (3)
  - Dislocation (1)
  - Polydissocation (1)
  - Prosthetic Joint infection (1)
  - Pulmonary embolism (1)

CONCLUSION

Uncemented rTSA humeral stems are associated with a very low rate of humeral loosening at short term. The complications with uncemented humeral stems in rTSA are comparable to the historic controls with cemented stems. Studies with long term follow up are necessary for evaluating the revision rate due to stem failure in uncemented rTSA.

Trends in the Epidemiology of Elective Total Shoulder Arthroplasty in the United States from 2002-2012

NYU Langone MEDICAL CENTER

Siddharth A Mahure MD, MBA • Stephen Yu, MD • Brent Mollon MD, FRCSC
Joseph D Zuckerman MD • Young W. Kwon MD, PhD
Department of Orthopaedic Surgery, Hospital for Joint Diseases at NYU Langone Medical Center, New York, NY

Disclosure: No conflicts of interest

INTRODUCTION

- Incidence of primary and revision shoulder arthroplasty is increasing in the United States
- Rising popularity of rTSA will continue to contribute significantly to the overall volume of TSAs being performed
- Combination of increasing surgeon familiarity with shoulder arthroplasty and an aging, more active population will likely lead to even further increases in procedural volume

OBJECTIVES

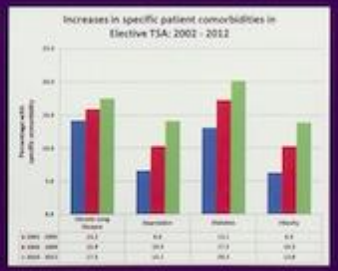
- Queried a national inpatient database to identify patients undergoing TSA and evaluated the change in demographics, hospital characteristics and regional differences over time
- Hypothesized that as training and familiarity with TSA increased, more procedures would be performed in smaller and non-academic hospitals and in patients with greater overall comorbidity burden

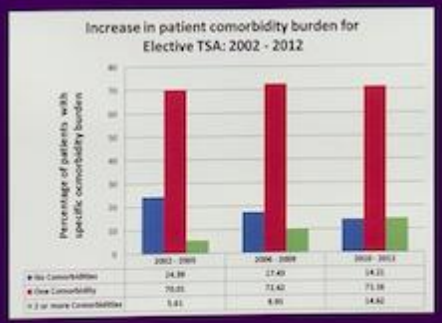
METHODS

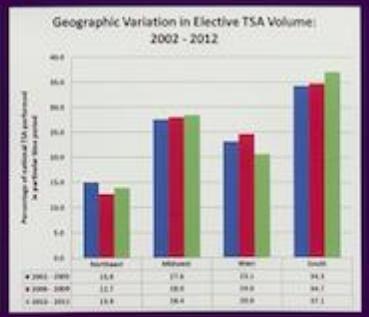
- Nationwide Inpatient Sample (NIS) -- identify patients undergoing TSA (ICD-9 procedure code 81.80 and 81.88) between the years 2002-2012
- Excluded patients with fracture-related diagnoses and those undergoing surgery for infection, tumor, or due to previous surgical complications (revision surgery)
- Patient demographics and comorbidity burden were collected, along with information regarding hospital size, location, and teaching status

RESULTS

- We identified 262,556 total TSAs performed from 2002-2012
- 513% increase across the time period – 7,993 in 2002 vs 48,978 in 2012
- Average age of the patients undergoing TSA in 2002 was 67.7 years which increased to 69.6 years in 2012 (p<0.0001)
- Females were the majority of TSA recipients (53.0% 2002 vs 55.2% 2012)
- Similarly, Caucasians were the largest demographic to receive TSAs (91.4% 2002 vs 89.2% 2012)
- In 2012, more patients were Medicare insured vs 2002 (70.2% vs 63.7%; p<0.0001)
- Mean length of stay (LOS) decreased from 2.6 days in 2002 to 2.1 days by 2012 (p<0.0001)
- Inflation-adjusted costs increased from $11,239 in 2002 to $17,738 by 2012 (p<0.0001)







HOSPITAL TRENDS

- A significant increase in elective TSA performed at urban hospitals was observed (87.3% in 2002 vs 90.5% in 2012; p<0.001)
- No differences in regards to hospital teaching status (49.8% in 2002 were performed at a teaching hospital as compared to 48.7% in 2012 (p=0.40)
- From 2002 to 2012 there was an increase in the proportion of TSAs being performed at smaller and medium sized hospitals (13.2% vs 19.4% and 19.3% vs 25.7%, respectively p<0.0001)

DISCUSSION

- Our trends observed regarding significant increases in procedural volume mimic total joint arthroplasty literature
  - Singh et al Mayo Clinic Proc. 2010
  - Klika et al JOA 2014
- Continued cost-effective analyses based on pre-existing patient characteristics should be performed to help provide efficient value-based care in the ever-changing healthcare reimbursement environment
  - Renfree et al JSES 2014

CONCLUSION

- 513% increase in elective TSA's performed between 2002 and 2012
- Females, Caucasians and those with Medicare were most common patient demographics
- Mean LOS has decreased by nearly half a day, while costs have increased by nearly 60%
- Over time, more patients had TSAs performed at smaller and medium sized urban hospitals
- Percentage of patients with significant comorbidity burden has increased dramatically

Early Follow-Up of Total Shoulder Arthroplasty in Patients Under Sixty Five Years of Age versus Older than Seventy-Five

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Objective

- To determine if a difference in function and outcomes exist between patients younger than 65 years old compared with those older than 75 undergoing total shoulder arthroplasty

Methods

- Multicenter prospective cohort of 365 patients (262 patients < 65 years and 103 patients > 75 years)
- Mean follow-up was 44.8 months in the younger than 65 year group and 44.0 months in the older than 75 year group.
- Outcomes assessed using validated outcomes measures, range of motion testing and radiographic evaluation.

Results

- Patients **under 65: Greater** pre-op **Constant scores, active abduction** and **active forward flexion.**
- No difference in postoperative function and outcome scores.
- Patients **over 75: increased improvement in active forward flexion, abduction, constant score** and **UCLA score.**
- Higher incidence of previous surgery and higher complication rate in younger cohort

	<65 years old (N=262)	>75 years old (N=103)	P Value
Average age, years	57.7 ± 6.2	79.8 ± 3.6	**<.001**
Body mass index	30.6 ± 7.4	26.9 ± 4.9	**<.001**
Female, N	130	74	—
Previous surgery	25.2% (66)	5.8%(6)	**<.05**
Humeral head size, mm	45.9 ± 3.6	45.1 ± 3.5	.058
Humeral stem size, mm	11.8 ± 2.1	11.7 ± 2.0	.600

Table 1: Demographics. Bolded values are statistically significant

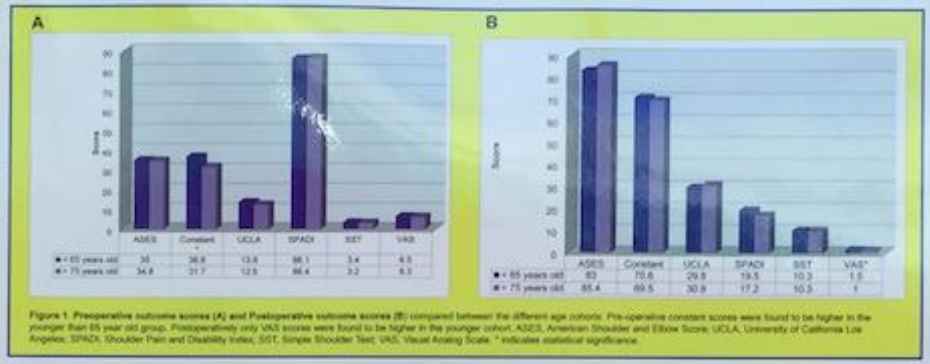

Figure 1. Preoperative outcome scores (A) and Postoperative outcome scores (B) compared between the different age cohorts. Pre-operative constant scores were found to be higher in the younger than 65 year old group. Postoperatively only VAS scores were found to be higher in the younger cohort. ASES, American Shoulder and Elbow Score; UCLA, University of California Los Angeles; SPADI, Shoulder Pain and Disability Index; SST, Simple Shoulder Test; VAS, Visual Analog Scale. * indicates statistical significance.

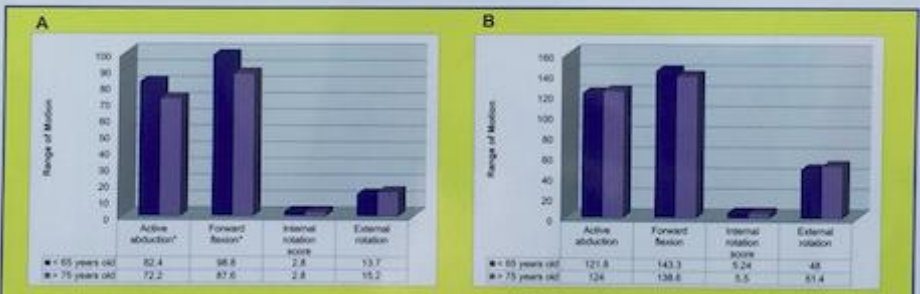

Figure 2. Preoperative range of motion (A) and Postoperative range of motion (B) compared between the different age cohorts. Pre-operative active abduction and forward flexion were found to be higher in the younger than 65 year old group. Postoperatively there was no difference in range of motion between the groups. * indicates statistical significance

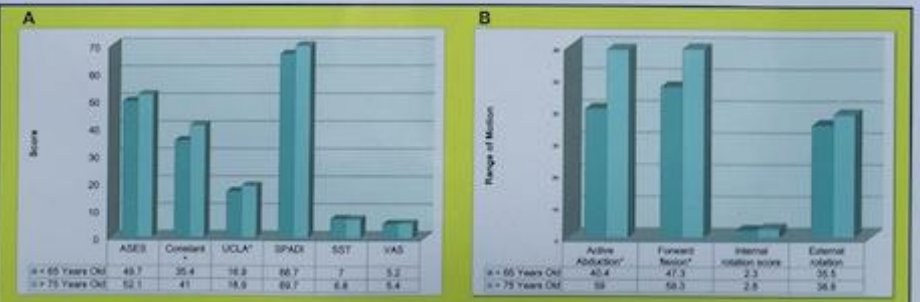

Figure 3. Absolute Improvement of Outcome Scores (A). Range of motion (B) compared between the different age cohorts. The younger than 65 year old group demonstrated increased improvement in constant and UCLA scores, as well as active abduction and forward flexion. ASES, American Shoulder and Elbow Score; UCLA, University of California Los Angeles; SPADI, Shoulder Pain and Disability Index; SST, Simple Shoulder Test; VAS, Visual Analog Scale. * indicates statistical significance

Complications	< 65 years old (N=212)	> 75 years old (N=77)	P Value
Glenoid loosening	2		—
Humeral loosening	1		—
Rotator cuff tear	3		—
Adhesive capsulitis	1		—
Instability	1		
Infection	1		—
Neuropathy	2	1	—
Other	5		—
Total	16	1	**<0.05**
Glenoid Radiolucency	28.80%	28.6	0.92
Humeral Radiolucency	3.30%	1.3	0.36

Table 2. Complications. Bolded values are statistically significant

Discussion

- Demand for TSA anticipated to rise by 333 % in patients under 55 years.
- Therefore, the effect of age on outcomes is important to ascertain.
- Lower range of motion and outcome scores in the older cohort suggest higher level of disability
- Following surgery the older cohort had more room for improvement as had worse function pre-operatively.
- Younger patients also may have expected more improvement post-op and therefore reported lower function and outcomes
- Higher complication rate in younger cohort may reflect higher activity level. Although there was a higher incidence of previous surgery in the younger cohort.
- There was no difference in glenoid/humeral radiolucencies.

Conclusion

- Overall function and range of motion are not altered by the age at which one undergoes total shoulder arthroplasty.
- However, younger patients may experience less improvement from preoperative levels and a higher complication rate.

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Future Surgery after Revision Shoulder Arthroplasty: the Impact of Unexpected Positive Cultures

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INTRODUCTION

- Revision indications expanding[1]
- Unexpected positive cultures (UPCs) found in up to 56% of revisions[2,3]
- UPCs found in up to 56 % of primaries[4,5]

PURPOSE

Report our rates of UPC in our revisions and analyze how presence of UPCs affects reoperation rates

METHODS

- Retrospective, all revisions, single hospital
- Jan 2011-Dec 2013
- Excluded clinical infections:
  - Draining wound
  - Sinus tract
  - Elevated ESR or CRP
  - Positive synovial aspiration
  - Obvious intraoperative purulence
- Analyzed risk factors for UPC
- Compared reoperations between the UPC and non-UPC groups

RESULTS

- 117 one-stage revisions without suspected infection:
- 28 (23.9%) with UPCs:
  - 59.5±11.2 yo; 64.3% male
- 89 (76.1%) no UPCs:
  - 64.4±11.8 yo (p=0.053); 42.7% male (***p=0.046***);
- For 28 UPCs, 13 (46.4%) *P. acnes* and 17 (60.7%) received abx (Table 1)

P+C's' Advance	Bacterial Species	Antibiotics
2/2	P acnes	Vancomycin
3/4	P acnes	None
1/6	P acnes	None
2/2	P acnes	Vancomycin
3/8	P acnes	None
1/6	P acnes	None
1/1	P acnes	None
2/4	P acnes	None
1/6	P acnes	None
1/6	P acnes	None
2/2	P acnes	Vancomycin
1/2	P acnes	Penicillin
2/6	P acnes	Penicillin
3/6	P acnes, Coag Neg Staph (CNS)	Vancomycin
3/6	P acnes, CNS	Vancomycin
1/2	CNS	Vancomycin
1/4	Lactobacillus, C Perfringens	Flagyl, Vancomycin
1/1	E faecalis	Ampicillin
1/6	MRSA	TMP-SMX
1/2	CNS	Keflex
2/2	CNS, Corynebacterium	Keflex
1/3	CNS	None
1/2	CNS	None
1/1	VRE	Daptomycin
1/2	CNS	Keflex
2/2	Polymicrobial	Tetracycline
1/2	Actinomyces	None
1/3	CNS	Keflex

Days to Re-Op	Diagnosis	Procedure
280	Dislocated RTSA	Revision RTSA
546	Dislocated RTSA	Revision RTSA
6	Dislocated RTSA	Revision RTSA
1450	Chronic RTSA dislocation	Revision RTSA
1477	Chronic RTSA dislocation	Liner exchange
139	Dislocated RTSA	Liner exchange
245	PJI	Antibiotic spacer
324	Stage 2 revision	Revision to RTSA
10	Instability TSA	Revision TSA with bone graft
980	PJI	Antibiotic spacer
663	Arthrofibrosis	Resection arthroplasty
70	Humerus fracture	ORIF
312	Stage 2 glenoid graft	Stage 2 glenoid graft
266	RTSA instability	Revision RTSA
112	Cuff failure	Conversion to RTSA
84	ATSA instability	Conversion to RTSA
561	Stage 2 glenoid graft	Stage 2 glenoid graft
966	PJI	Antibiotic spacer
328	Stage 2 glenoid graft	Stage 2 glenoid graft
294	Cuff failure	Conversion to RTSA
736	Pec major rupture	Revision and pec major repair
1164	Dislocated RTSA	Revision RTSA
805	PJI	I&D, liner exchange (2° severe exudation)
364	Painful hemiarthroplasty	Revision to ATSA
204	Cuff Failure	Conversion to RTSA

- 20/117 (17.1%) with 25 reoperations (Table 2):
  - 64.6±8.1 yo; 45.0% male; BMI 31.3±9.0; ***2/20 (10%) with UPCs***
- 97/117 shoulders (82.9%) without reoperation:
  - 62.9±12.4 yo (p=0.45); 48.5% male (p=0.78); BMI 29.6±5.8 (p=0.43); ***26/97 (26.8%) with UPCs (p=0.11)***

DISCUSSION

What was our UPC rate?

23.9%- consistent with prior analysis[2,4,6]

What were our risk factors for UPCs?

Male gender was the strongest risk factor

What was our UPC reinfection rate?

3.6%- substantially lower than previous analysis (25%)[6]

What was our UPC reoperation rate?

7.1%- compared to 19.1% in those without UPCs

Limitations

- Retrospective
- Majority did not have index procedure in our practice
- Significance may be limited by sample size

CONCLUSION

Reoperation was rare in UPCs. The implications of UPCs remains poorly understood.

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Early Revision in Conventional Total Shoulder Arthroplasty in Osteoarthritis: A Cross-Registry Comparison

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1. The Permanente Medical Group; 2. St. John of God Hospital/Deakin University; 3. Australian Orthopaedic Association National Joint Replacement Registry; 4. South Australian Health and Medical Research Institute; 5. Southern California Permanente Group (See final program for author disclosures)

Introduction

Shoulder arthroplasty registries have proven beneficial for monitoring patient and prosthesis outcomes.

In this study, we evaluated conventional total shoulder arthroplasties (TSA) performed for a diagnosis of osteoarthritis in a large national joint replacement registry (Australian Orthopaedic Association National Joint Replacement Registry) and a regional health system's shoulder arthroplasty registry from the United States (Kaiser Permanente Shoulder Arthroplasty Registry).

Purpose

To analyze demographics of those undergoing conventional TSA for osteoarthritis in two separate registry populations, to harmonize reasons for revision between the two registries, and to examine differences in early revision rates (under two years).

Methods

A cross-sectional comparison of both registries was performed between the years of 2009 to 2012.

Only those patients who underwent conventional TSA for a primary diagnosis of osteoarthritis between the years of 2009 and 2012 were included.

Aggregate level data of those patients undergoing early revisions done within two years of index arthroplasty was evaluated, and a descriptive analysis was conducted.

Reasons for revision were harmonized between the two registries and compared.

KAISER PERMANENTE

Results

During the study period 4,614 patients underwent TSA for osteoarthritis in the national joint replacement registry compared to 2,153 in the regional shoulder arthroplasty registry.

More women (58.4%) than men were in the national cohort, while just over half of patients were male in the regional cohort.

Roughly equal proportions of patients were under the age of 60, with 13.7% in the national cohort compared to 14.2% of those in the regional cohort (**Table 1**).

Table 1. Patient Demographics		KPSAR	AOANJRR
Age Category	Under 40	0 (0%)	16 (0.3%)
	40-49	25 (1.2%)	67 (1.5%)
	50-59	281 (13.1%)	549 (11.9%)
	60-69	815 (37.9%)	1743 (37.8%)
	70-79	756 (35.1%)	1756 (38.1%)
	80 and over	276 (12.8%)	483 (10.5%)
Gender	Male	1112 (51.6%)	1919 (41.6%)
	Female	1041 (48.4%)	2695 (58.4%)
	Total	2153	4614

Higher rate of revision in AOANJRR in patients age 40-49, and in KPSAR in male gender (**Table 2**).

Table 2. Early Revisions		KPSAR	AOANJRR
Age Category	Under 40	0 (0%)	1 (6.3%)
	40-49	1 (4.0%)	10 (14.9%)
	50-59	5 (1.8%)	39 (7.1%)
	60-69	15 (1.8%)	108 (6.2%)
	70-79	5 (0.7%)	99 (5.6%)
	80 and over	5 (1.8%)	16 (3.3%)
Gender	Male	20 (1.8%)	109 (5.7%)
	Female	11 (1.1%)	164 (6.1%)
	Total	31 (1.4%)	273 (5.9%)

Early revisions occurred in 5.9% of patients in the national cohort compared to 1.4% in the regional cohort. A high rate of revision in the national joint replacement registry was found to be secondary to the failure of one specific prosthesis, which is no longer utilized. With this prosthesis excluded, the revision rate in the national registry cohort was 2.9%.

With the low performing prosthesis excluded, rotator cuff pathology, component loosening, and prosthetic instability were the most common reasons for revision in both registries (**Table 3**).

Table 3. Reason for Revision	KPSAR	AOANJRR
Arthrofibrosis	0 (0%)	3 (3.2%)
Component Loosening/Lysis	10 (32.2%)	20 (21.3%)
Incorrect Sizing/Implant Malposition	2 (6.5%)	7 (7.5%)
Infection	4 (12.9%)	10 (10.6%)
Instability	4 (12.9%)	35 (37.2%)
Other	0 (0%)	5 (5.3%)
Peri-prosthetic Fracture	1 (3.2%)	3 (3.2%)
Rotator Cuff Pathology	10 (32.2%)	11 (11.7%)
Totals	31	94

Conclusions

- Comparing reasons for early revision in conventional total shoulder arthroplasty revealed several similarities between these two registries, with both cohorts having significant complications related to component loosening, prosthetic instability, and rotator cuff pathology.
- Significant differences were also noted, and this study served to highlight the importance prosthesis selection can play in determining outcomes.
- Cooperation amongst registries may allow for earlier identification of risk factors for failure in total shoulder arthroplasty and help determine best practices for the treatment of glenohumeral osteoarthritis.

Acknowledgements

The authors would like to thank all the surgeons and staff who participate in the Australian Orthopaedic Association National Joint Replacement Registry and the Kaiser Permanente Shoulder Arthroplasty Registry, helping to make these registries possible.

References

Please see e-poster

AOA

Comparison of Clinical Outcomes of Between Arthroscopic and Open Procedures for Traumatic Anterior Shoulder Instability in Collision and Contact Athletes: A Prospective Cohort Study Based on Patient Selection

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Background

The risk of recurrence is especially high in young and active athletes. Especially, collision and contact (CC) athletes are reported to have high risk for recurrent traumatic shoulder instability (Cole BJ, et al. Clin Sports Med, 2000, Karlsson J et al. AJSM 2001.).

Purpose

We performed a prospective cohort trial to evaluate the results of anterior shoulder stabilization in CC athletes and compared the clinical results between the arthroscopic Bankart repair (ABR) and the open (the modified inferior capsular shift: MICS) procedure.

Materials & Methods

Prospective cohort study based on the patient selection method of 87 shoulders (86 patients) from 2007 to 2014. (approval number : 14R-004)

101 shoulders of CC athletes (99 patients)

Over 3times dislocations and/or subluxation of the shoulder

exclusion criteria:
1, >25% anterior glenoid bone defect
2, multidirectional instability
3, over 40 y/o

87shoulders (86 patients)

information for choice of operation:

	ABR	MICS
Incision	1cm 3 points	5cm + 1cm
PO limitation of ER	5°	15°
PO reinstability	10-15%	5%
Rehabilitation	easy	hard

PO; post operative, ER; external rotation

ABR: 57 shoulders (57 patients)

MICS: 30 shoulders (29 patients)

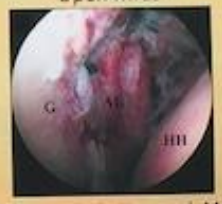
✓ Details according to both group

Variable	All Patients	ABR	Open MICS
No. of patients	86	57	29
No. of shoulders	87	57	30
Gender			
Male	77	51	25
Female	10	6	4
Mean age (range), years	21.4 (16-39)	21.9(16-39)	20.5 (16-39)
Dominant arm	45	31	14
Collision and contact sports			
Judo	35	23	12
Rugby	22	12	10
Am football	10	7	3
Other (soccor, boxing, martial art etc.)	19	15	4
Times of dislo or sublux (range)	38.8 (3-120)	36.5(3-100)	39.3(5-120)
Length of follow-up (range), months	22.7 (12-48)	23.0 (12-46)	21.1 (12-48)

✓ Surgical methods

ABR

Open MICS



Three bioabsorbable Panalok suture anchors (Depuy Mitek, Norwood, MA) were used for Bankart repair in both operations. The rotator interval closer was augmented in both techniques. G, glenoid; AL, anterior labrum; HH, humeral head

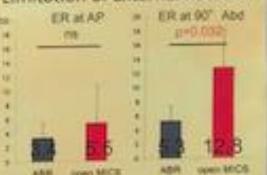
Results

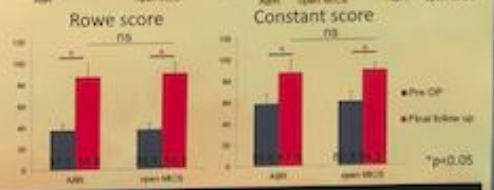
Recurrence instability rates in the arthroscopic ABR group were higher than those in the open MICS group (12.3% vs 0%, p=0.045). No significant difference in ER at the anatomical position was noted between the ABR and open MICS groups. However, significant differences in ER at 90° abduction was noted between the groups (p=0.032).

The Rowe and Constant scores at the final follow-up significantly improved from those preoperatively in both groups (both, p<0.05), but the differences in scores between the ABR (average 86.8 and 87.5 points, respectively) and open MICS (average 88.9 and 89.3 points, respectively) groups were not statistically significant.

Recurrence Instability Rates

Limitation of External Rotation





Conclusion

Our data clearly suggest that open MICS results in lower recurrent instability rates than ABR. However, ER is relatively limited with open repair than with arthroscopic repair. The Rowe and Constant scores were not significantly different between the MICS and ABR groups at the final follow-up. Thus, open anatomical stabilization may be a more reliable method for treating traumatic anterior shoulder instability in collision and contact athletes without anterior glenoid bone loss.

HOSPITAL FOR SPECIAL SURGERY

Analysis of Online Rating Websites for Sports Medicine Surgeon "Quality"

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Investigation performed at the Hospital for Special Surgery

INTRODUCTION

Online physician rating websites have become mainstream and may play a role in future healthcare policy.

Little is known about the validity of online rating content within orthopaedic surgery

OBJECTIVES

1) To evaluate online patient ratings for U.S. sports medicine surgeons

2) To determine predictors of positive ratings, and analyze for inter-website scoring correlation

METHODS

275 sports medicine surgeons identified from the American Orthopedic Society for Sports Medicine (AOSSM) member directory search

Surgeon rating data reviewed on HealthGrades.com (HG), RateMDs.com (RM) and Vitals.com (V)

Written comments categoriezed into surgeon competence, surgeon affability and process of care.

Pearson correlation, bivariate and multivariable analysis performed where appropriate

RESULTS

275 sports medicine surgeons were included. 271 (99%) had ratings on at least one of the three websites.

Sports surgeons were rated highly across all three websites (mean > 4.0/5) however there was only a low to moderate degree of correlation among websites ($p<0.0001$) for all ratings.

On HG, female surgeons ($p=0.042$) and surgeons in academia ($p=0.034$) were more likely to receive higher overall ratings.

Across all three websites, increased number of years in practice inversely correlated with ratings; this relationship neared significance for HG ($p=0.072$) and was significant for RM ($p=0.021$).

In multivariable regression analysis for ratings on HG, female sex ($p=0.04$) was the only significant predictor of higher ratings.

2,341 written comments were reviewed: perceived surgeon competence and communication influenced the direction of ratings for the top and bottom tier surgeons.

healthgrades

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RESULTS

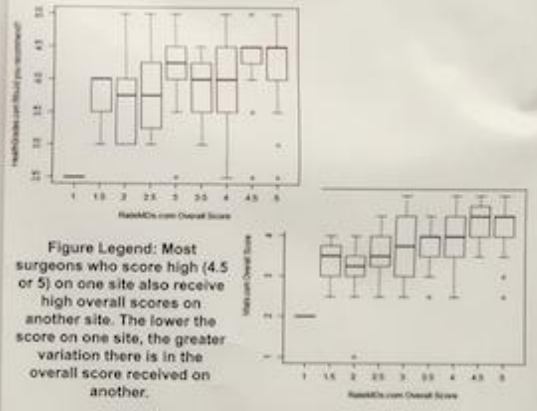

Figure Legend: Most surgeons who score high (4.5 or 5) on one site also receive high overall scores on another site. The lower the score on one site, the greater variation there is in the overall score received on another.

CONCLUSIONS

There is a fair degree of correlation among online websites for surgeon ratings – the best correlation is for highly rated surgeons

Female surgeons and those with fewer years in practice appear to have higher ratings on these websites

Comment content analysis suggests that high and low ratings are influenced by perceived surgeon competence and affability

I hope this Was of helpful…