Management of the Younger Arthritic Shoulder

Gerald R. Williams, Jr, MD
John M. Fenlin, Jr, MD Professor of Shoulder and Elbow Surgery

Conflict of Interest Slide

• Royalties
  - Depuy: shoulder arthroplasty
  - DJO: shoulder arthroplasty
  - Walters Kluwer: shoulder texts
  - IMDS/Cleveland Clinic: arthroplasty
• Research: Tornier, Depuy, Synthesome
• Stock Ownership: In-vivo therapeutics, CrossCurrent Business Analytics, LLC, OBERD, LLC, Force Therapeutics

Agenda

• Background
• Definition
• Epidemiology
• Factors affecting decision-making
• Treatment options
• Results
• Personal approach
• Conclusions

Young-Definition

• Age is just a number—loose proxy for activity
• 50 is a common threshold for TSR
  * One revision gets them to 80... maybe

Epidemiology

• Demand in patients 55 and younger increasing substantially
• Living longer
• More active
**Epidemiology**

- Increasing revision burden
- Cost

**Factors Affecting Decision-making**

- Age/activity level
- Patient expectations
- Stiffness
- Cuff integrity
- Prior surgery
- Infection
- Bone deformity
- Humerus
- Glenoid

**Factors Affecting Decision-making**

Subtler problems deserve subtler solutions

**Treatment Options**

**Nonoperative**

- Activity modification
- NSAIDS
- Injections
  - Cortisone
  - HA (off label, not FDA approved)
  - Stem cells, PRP, etc.
- Therapy

**Surgical**

**Joint Sparing**

- Soft-tissue release, debridement, synovectomy
  - Arthroscopic
  - Open
- Soft-tissue interposition
  - Arthroscopic
  - Open
- Osteotomy
  - Glenoid
  - Humeral

**Joint Sacrificing**

- Arthrodesis
- Resection arthroplasty
- Joint replacement
  - Resurfacing
  - Partial
  - Complete
- Hemiarthroplasty +/- concentric glenoid reaming
- Total shoulder
  - MUS (min)
  - Standard
Arthroscopy Arthroplasty

Treatment Options
Surgical
A Continuum

Results
Nonoperative

Treatment of Glenohumeral Osteoarthritis

Nonoperative
Corticosteroid Injection

AAOS Clinical Practice Guideline Summary

Recommendation 2
We are unable to recommend for or against the use of intra-articular corticosteroid injection for the treatment of OA of the shoulder. Whether performed with or without fluoroscopic, arthroscopic, or CT guidance. Corticosteroid injections are used widely in clinical practice for patients with shoulder pain of all etiologies, especially those with musculoskeletal OA. The current evidence does not support or refute the use of atraumatic corticosteroid injection for the treatment of GH OA.

Results
Nonoperative

Viscosupplementation

• anti-inflammatory
• analgesic effects
• precise mechanism for pain relief is not known
• acute local reactions
• flare-up of pseudogout
• pseudosepsis (acute systemic reactions)
• Anecdotally— if it worked well in their knee, more likely to help shoulder

NOT FDA APPROVED

Results
Nonoperative

Viscosupplementation

Sodium hyaluronate for the treatment of chronic shoulder pain associated with glenohumeral osteoarthritis: a multicenter, randomized, double-blind, placebo-controlled trial

J Shoulder Elbow Surg (2015) 24, 564-570

Young W. Hwan, MD, PhD*, Gerald Elterman, MD, Joseph D. Jazdzewski, MD
Results
Nonoperative
• Minimal data
• Cash payment
• Popular among professional athletes
• Apparently lucrative

Advanced PRP & Stem Cell
CENTER OF BOCA RATON & MIAMI

Results
Surgical (Joint Preserving)
Arthroscopy
• Less severe deformity
• Arthroscopic debridement
• Arthroscopic capsular release
• Arthroscopic interposition

Non-prosthetic management of grade IV osteochondral lesions of the glenohumeral joint
J Shoulder Elbow Surg January/February 2002

F/U avg 34 months (range 12-74 months)
41 males, 20 females
Treatment: debridement, capsular release (n=22), acromioplasty (n=18)
9.8% converted to arthroplasty (mean 16 months)
Predictor: lesion >2cm²

What Is the Role of Arthroscopic Debridement for Glenohumeral Arthritis? A Critical Examination of the Literature

• Systematic Review
• 5 studies, 212 patients
• Mean age 49 years (18-87)
• Mean follow-up 34 months (12-152)
• Improvements in pain relief, motion, function
• 18% conversion to arthroplasty
• Unable to identify predictors for successful outcome
• Insufficient evidence to support routine use of arthroscopic debridement/capsular release for GH DJD

AACOS CPG

Recommendation 5
We are unable to recommend for or against the use of arthroscopic treatment of patients with GH OA. Recommendation grade 1 Level of evidence V
Results Surgical (Joint Sparing)

Arthroscopic Interposition

- Mild deformity – mild humeral osteophytes, concentric joint
- Mild to moderate stiffness
  - Capsular release increases difficulty
  - Release alone might be adequate

Results Surgical (Joint sparing)

Arthroscopic Interposition

- Porcine Intestine Basement membrane (Restore by Depuy)
- 23 patients (mean age 32)
- F/u 3-6 years
- 3 lost to f/u
- 5 converted to arthroplasty (resurfacing)
- 75% satisfaction rate

Arthroscopic Glenoid Resurfacing as a Surgical Treatment for Glenohumeral Arthritis in the Young Patient: Midterm Results

Felix H. Sussman III, M.D., Kenneth J. Brune, M.D., and David Argo, M.D.

Results Surgical (Joint Sparing)

Arthroscopic Interposition

- stiff shoulder
- More deformity than appropriate for arthroscopic release
- No biconcavity
- Very active (young)
- Do everything I would do in a TSR except replace the joint

Results: 1-4 yr f/u, 6 pts

Table 1. Pre- and Post-op Range of Motion

<table>
<thead>
<tr>
<th>ROM</th>
<th>Mean Pre-op AROM</th>
<th>Mean Post-op AROM</th>
<th>AROM</th>
<th>Percent Increase AROM</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF</td>
<td>120</td>
<td>157</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>ER 0</td>
<td>23</td>
<td>44</td>
<td>21</td>
<td>91</td>
</tr>
<tr>
<td>ER 90</td>
<td>37</td>
<td>65</td>
<td>28</td>
<td>76</td>
</tr>
<tr>
<td>IR</td>
<td>17</td>
<td>47</td>
<td>30</td>
<td>&gt;100</td>
</tr>
</tbody>
</table>

Results: 1-4 yr f/u, 6 pts

Table 2. Mean Outcome Measurements

<table>
<thead>
<tr>
<th>Penn Shoulder Score</th>
<th>Mean Pre-op Score</th>
<th>Mean Post-op Score</th>
<th>Δ Score</th>
<th>Percent Increase Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain:</td>
<td>30</td>
<td>17</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>Satisfaction:</td>
<td>10</td>
<td>9</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Function:</td>
<td>60</td>
<td>31</td>
<td>56</td>
<td>25</td>
</tr>
<tr>
<td>Total Score:</td>
<td>100</td>
<td>48</td>
<td>93</td>
<td>45</td>
</tr>
</tbody>
</table>
Open Release/Debridement
Soft-Tissue Interposition

27 yo male weight lifting coach for a high school football team

Open debridement
No interposition

- 35 y o RHD union carpenter
- Two year history of right shoulder pain
- Motion
  - 120° elevation
  - 30° external rotation
  - L5 internal rotation
Hemiarthroplasty

- Hemiarthroplasty (stemmed or stemless)
- Resurfacing
- Concentric reaming only with biconcave glenoid
- Done without resurfacing
- Head removal facilitates glenoid exposure

Results

Surgical (Joint sacrificing)

- Hemiarthroplasty +/- concentric glenoid reaming

Results - Hemiarthroplasty

- N=28 shoulders
- ~17.2 years mean f/u (13-21)

<table>
<thead>
<tr>
<th>Patient Satisfaction According to the Neer Criteria</th>
<th>At 2.4</th>
<th>At 7.9</th>
<th>At 17.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>74%</td>
<td>61%</td>
<td>25%</td>
</tr>
<tr>
<td>Concomitant glenoid (type I)</td>
<td>84%</td>
<td>67%</td>
<td>42%</td>
</tr>
<tr>
<td>Eccentric glenoid (type II)</td>
<td>63%</td>
<td>56%</td>
<td>12%</td>
</tr>
<tr>
<td>Primary osteoarthritis</td>
<td>80%</td>
<td>NA</td>
<td>44%</td>
</tr>
<tr>
<td>Secondary osteoarthritis</td>
<td>72%</td>
<td>NA</td>
<td>16%</td>
</tr>
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</table>

Long-Term Follow-up of Shoulder Hemiarthroplasty for Glenohumeral Osteoarthritis

- Revision rate = 29% - Levine et al
- 17% - Rispoli et al, 32% mod-severe pain
- 2% - Wirth et al

Results - Ream and Run


Results - Ream and Run

Nonprosthetic glenoid arthroplasty with humeral hemiarthroplasty and total shoulder arthroplasty yield similar self-assessed outcomes in the management of comparable patients with glenohumeral arthritis.
Results - Ream and Run

- 65 shoulders in patients 55 and under
- Minimum 2 yr f/u
- 22 with radiographic f/u
- Avg. medial erosion of 1.1 mm at 44 months
- 14% revision rate at 2 years or less


Results - Hemiarthroplasty + biologic resurfacing

- No to minimal posterior subluxation
- Minimal glenoid deformity

Results - Wirth, et. al.

<table>
<thead>
<tr>
<th>Score</th>
<th>Prop.</th>
<th>Postop.</th>
<th>Change</th>
<th>P Value</th>
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<tbody>
<tr>
<td>Simple Shoulder Two-score</td>
<td>2.7 ± 2.2</td>
<td>7.3 ± 3.9</td>
<td>-4.6 ± 3.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stability</td>
<td>40.0 ± 14.6</td>
<td>20.5 ± 25.8</td>
<td>-19.4 ± 22.2</td>
<td>0.01</td>
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<td>Level of pain</td>
<td>40.0 ± 14.6</td>
<td>20.5 ± 25.8</td>
<td>-19.4 ± 22.2</td>
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<td>Pain with maximum activity</td>
<td>81.7 ± 11.5</td>
<td>61.0 ± 33.3</td>
<td>-20.7 ± 31.2</td>
<td>&lt;0.001</td>
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<tr>
<td>Pain at rest</td>
<td>45.0 ± 20.3</td>
<td>14.8 ± 19.6</td>
<td>-30.2 ± 24.2</td>
<td>&lt;0.001</td>
</tr>
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</table>

The values are given as the mean and the standard deviation.

*Preoperative minus postoperative score.

Results - Biologic Interposition


### Results

- **Total Shoulder Arthroplasty**
  - Better than hemiarthroplasty in older patients
  - Concern for glenoid longevity
  - Concern for revision

### Biological Glenoid Resurfacing for Glenohumeral Osteoarthritis: A Systematic Review


#### Table 1

<table>
<thead>
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<th>Year</th>
<th>Type of Study</th>
<th>Shoulder Arthroplasty</th>
<th>Glenoid Erosion</th>
<th>Survival Rate</th>
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#### Results

- Glenoid erosions 68-72%
- Survival estimates less than TSA
- Glenoid lucency 59-76%

### Minimum Fifteen-Year Follow-up of Neer Hemiarthroplasty and Total Shoulder Arthroplasty in Patients Aged Fifty Years Old or Less

#### Table 2

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### Shoulder Arthroplasty in Patients Aged Fifty-Five Years or Younger with Osteoarthritis

- 1) Minimum f/u 2 years (mean 7 yrs)

#### Hemis and Totals will both Fail

- Glenoid erosion– often asymmetric with subluxation
- Often require structural bone graft or augmented component
- Results never as good as initial total would have been

- Glenoid bone loss– usually central
- Often cannot be revised to 2nd anatomic glenoid at 1st revision
- May have humeral bone loss from polyethylene wear

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Revision Hemi to Total

Conversion of painful hemiarthroplasty to total shoulder arthroplasty: Long-term results

Raymond M. Connell, MD, Belkis Izquierdo, MD, Michael Yacoucan, MD, Theodore A. Blain, MD, William N. Inman, MD, and Louis L. Reichert, MD, New York, NY

- Follow-up 5.5 years
- Unsatisfactory Outcome (47%)
- Reoperations (33.3%)

Revision Hemi to Total

Aseptic glenoid loosening or failure in total shoulder arthroplasty: revision with glenoid reimplantation

Nicolas Bonnevialle, MD, Barbara Melis, MD, Lionel Neyton, MD, Luc Favard, MD, Daniel Mele, MD, Gilles Walsh, MD, Pascal Belleau, MD

- Follow-up ~5 years
- Complications (45%)
- Reoperations (21%)

How do we decide?

Value-Based Decision Making

Cost

Functional Outcome

Survival

Purpose:

To create decision model that could evaluate cost and effectiveness of hemiarthroplasty and total shoulder arthroplasty in a cohort of young patients (US population 30-50 yrs “at risk” – Monte Carlo simulation).

Results

<table>
<thead>
<tr>
<th>Annual Cohort Size = 5,279</th>
<th>Hemiarthroplasty</th>
<th>Total Shoulder Arthroplasty</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revisions</td>
<td>2090</td>
<td>1605</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Years “Satisfactory” Outcome</td>
<td>59,574</td>
<td>85,969</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Direct Reimbursements</td>
<td>$132,452,776</td>
<td>$125,540,617</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
Threshold Analysis

• How could Hemis be made to equal totals?

  total reimbursement of hemi to 16,600k/case (from 17.8k)

  10- years survival rate of hemi to 90.7% (from 82%)

Implications

Treatment of glenohumeral arthritis in patients aged 30 to 50 in the United States with total shoulder arthroplasty, instead of hemiarthroplasty, would result in:

1. Greater cost savings
2. Avoid a substantial number of revision surgeries
3. Greater years with a “satisfactory outcome”

Disclaimer: per case patient selection for treatment remains important

Personal Approach

• Accept that all patients will need revision
  • Minimize the number— aim for 1-2
• Choose least invasive option with any hope of success
• Preserve joint if possible
• When sacrificing the joint, preserve as much bone as possible— especially glenoid
• Include patient in the process— shared decision-making
• Every patient gets initial nonoperative management
  • Primarily injections and activity modification

Personal Approach

• Arthroscopic debridement
  • Concentric joint, mild to moderate deformity, mild to moderate stiffness
• Arthroscopic capsular release
  • Concentric joint, no to mild deformity, moderate to severe stiffness
• Arthroscopic interposition
  • Rarely used— extremely young, concentric glenoid, bad glenoid, minimal deformity, mild to moderate stiffness
• Open debridement/capsulectomy
  • Extremely young/active, concentric joint, no longer use interposition, motivated patient
• Hemiarthroplasty
  • Most lifters, ream if biconcave, motivated patient, no longer use resurfacing, stemless good option
• Total shoulder
  • Concentric joint—in lay glenoid
  • Biconcave: augmented component

Conclusions

• There are no right answers. There are only individualized decisions
• No treatment is life-long
• No treatment is curative
• Consider the revision surgery
• Tremendous opportunity for innovation

Thank You