Total Shoulder Arthroplasty

The Delta CTA™ Reverse Shoulder System

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Department of Physical Therapy
Inspiration
Over 23,000 shoulder arthroplasties are performed annually\(^1\)

More than 10,000 are total shoulder arthroplasties

Currently there is a 5% annual growth of shoulder arthroplasty performed\(^2\)
Shoulder Arthroplasty

2002 Major Joint Replacement Volume in U.S.

Discharges per Year\(^1\)

- Hip Replacement: 343,000
- Knee Replacement: 400,000
- Shoulder Replacement: 23,100

\(^1\) National Center for Health Statistics: National Hospital Discharge Survey 2002
Data extracted and analyzed by AAOS Dept of Research and Scientific Affairs
History

- First shoulder arthroplasty Jules Pean (1893)\(^3\)
- Charles Neer (1955)\(^4,5\)
  - Hemiarthroplasty to treat humeral head osteonecrosis, fracture, and glenohumeral arthritis.
  - Complications leading to pain and decreased function include:
    - Rotator cuff deficiency
    - Abnormal glenoid surface
    - Continued degeneration of glenoid surface

- Solution: Total Shoulder Arthroplasty/Replacement\(^6\)
Anatomy

Supraspinatus

Infraspinatus

Teres minor

Subscapularis

http://www.Shoulder1.com
Anatomy

http://www.shoulderdoc.co.uk

http://www.nismat.org/orthocor/exam/shoulder.html
Types of Shoulder Arthroplasty

- Total arthroplasty
- Hemiarthroplasty
- Reverse arthroplasty

http://orthoinfo.aaos.org/fact
www.umm.edu/orthopadic/rsr.html
Total Shoulder Arthroplasty (TSA)

- **Primary Indications**
  - Osteoarthritis
  - Rheumatoid Arthritis
  - Post Traumatic Arthritis
  - Osteonecrosis
  - Infections
  - Fracture
Total Shoulder Arthroplasty

- Secondary Indications
  - Defect arthroplasty
  - Decentering of prosthetic head leading to impingement
  - Dislocation of prosthetic head
  - Periprosthetic infection
  - Inflammatory response - ultrahigh molecular weight polyethylene particles from previous arthroplasty
Total Shoulder Arthroplasty

- **Contraindications**
  - Loss of deltoid and rotator cuff musculature
  - Severe brachial plexus injury
  - Chronic infection
  - Chronic osteomyelitis
  - Substantial bone loss—especially at the glenoid
Total Shoulder Arthroplasty

Total Left Shoulder Joint Replacement

A. An incision is made into the shoulder over the joint space.
B. Dissection is carried down exposing the humeral head.
C. The humeral head is removed and the bone edges prepared for the prosthesis.
D. The humeral shaft is reamed to accept placement of the prosthesis.
E. Once the humeral shaft is prepared, cement is injected into the opening.
F. The prosthesis is placed into the humeral shaft and the wound closed.

lpig.doereport.com/imagescooked/1435W.jpg
Total Shoulder Arthroplasty

http://www.orthop.washington.edu/uw/shoulderreplacement
Total Shoulder Arthroplasty

http://www.orthop.washington.edu/uw/shoulderreplacement
Reverse Total Shoulder Arthroplasty

The Delta CTATM Reverse Shoulder System
Reverse Total Shoulder Arthroplasty

Delta CTA Reverse Shoulder System: For End-Stage Cuff Tear Arthropathy DePuy Orthopaedics, Inc. 2000-2006, All rights reserved. http://www.jointreplacement.com
Reverse Total Shoulder Arthroplasty

**Indications**

- The reverse design is used in patients **without** an intact rotator cuff.

- The reverse design medializes the center of rotation of the GH joint, allowing the deltoid to function with a longer lever arm.

Reverse Arthroplasty

Fig. 4-C
A drawing of the Reverse Shoulder Prosthesis implanted in a shoulder, demonstrating how the device causes the center of rotation and lateral offset to shift medially with respect to the anatomic shoulder but to a smaller degree than with the Delta-III prosthesis. (Reprinted with permission of Lewis E. Calver.)

http://www.cjbjs.org/cgi/content/abstract/87/8/1697
Overall TSA Complications

- Pain\textsuperscript{9}
- Infection\textsuperscript{10}
- Component loosening\textsuperscript{11}
- Fractures\textsuperscript{12}
- Inflammatory reactions\textsuperscript{13,22}
- Impingement of components-notching\textsuperscript{14}
Review and meta-analysis\textsuperscript{15}

- McMaster University, Canada
- Compared 2 year post-operative outcomes between hemiarthroplasty and TSA in patients with shoulder osteoarthritis
- Studies 1966-2004
- Major orthopedic meetings 1995-2003
  - 112 patients (50 hemi, 62 TSA)
    - Pain scores favored TSA
    - Greater increased forward flexion (13 degrees) with TSA
TSA Outcomes

- Two-year Results After Exchange Shoulder Arthroplasty Using Inverse Implants\textsuperscript{16,17,18}

<table>
<thead>
<tr>
<th>Table: Shoulder Function and Analgesic Intake (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Preoperatively</strong></td>
</tr>
<tr>
<td>Abduction/adduction (NPM)</td>
</tr>
<tr>
<td>Extension / Flexion (NPM)</td>
</tr>
<tr>
<td>Internal/external rotation from 0\degree abduction (NPM)</td>
</tr>
<tr>
<td>Hand to neck (%)</td>
</tr>
<tr>
<td>Hand to back (%)</td>
</tr>
<tr>
<td>Analgesics (%)</td>
</tr>
<tr>
<td>Regularly</td>
</tr>
<tr>
<td>Sporadically</td>
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</tbody>
</table>

*Abbreviation: NPM=neutral position method.*

(Katzer 2004)
Overall TSA Outcomes

- **Good short-term efficacy**
  - Decreased Pain
  - Increased ROM
  - Generally considered better than hemiarthroplasty\(^1^9,^2^1\)

- **Long-term efficacy inconclusive**
  - Osteoarthritis does progress and glenoid degeneration and prosthetic loosening following total shoulder replacement may affect the 5 and 10 year outcomes.\(^2^0,^2^2,^2^3\)
  - X-rays reveal micro-fissures of the peri-glenoid region suggesting bone fracturing under the glenoid cap.\(^1^7\)
Quality of Life Outcomes Following Hemiarthroplasty or Total Shoulder Arthroplasty in Patients with Osteoarthritis

- 42 patients with osteoarthritis randomized at time of surgery
- Outcomes measured at 3, 6, 12, 18 and 24 months
  - Constant Score
  - Pain scales- McGill and VAS
  - WOOS Index
  - Global health measure
  - American Shoulder and Elbow Surgeons form
## TABLE III Two-Year WOOS Scores Following Hemiarthroplasty and Total Shoulder Arthroplasty

<table>
<thead>
<tr>
<th>Domain</th>
<th>Hemiarthroplasty*</th>
<th>Total Shoulder Arthroplasty*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total quality of life</td>
<td>81.5 ± 24.1</td>
<td>90.6 ± 13.2</td>
<td>0.18</td>
</tr>
<tr>
<td>Domain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical symptoms</td>
<td>82.7 ± 23.5</td>
<td>91.9 ± 12.8</td>
<td>0.17</td>
</tr>
<tr>
<td>Sports/recreation/work</td>
<td>75.2 ± 28.9</td>
<td>86.1 ± 20.8</td>
<td>0.21</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>82.5 ± 25.4</td>
<td>89.7 ± 13.8</td>
<td>0.31</td>
</tr>
<tr>
<td>Emotions</td>
<td>87.1 ± 23.7</td>
<td>97.0 ± 4.6</td>
<td>0.11</td>
</tr>
</tbody>
</table>

*The values are given, in points, as the mean and one standard deviation.

(Lo, et al. 2005)
### TABLE V Two-Year Secondary Outcome Scores Following Hemiarthroplasty and Total Shoulder Arthroplasty

<table>
<thead>
<tr>
<th>Evaluation Tool</th>
<th>Hemiarthroplasty*</th>
<th>Total Shoulder Arthroplasty*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>McGill pain questionnaire</td>
<td>2.7 ± 6.8</td>
<td>0.9 ± 1.4</td>
<td>0.27</td>
</tr>
<tr>
<td>McGill pain visual analogue scale</td>
<td>13.9 ± 27.4</td>
<td>6.1 ± 13.5</td>
<td>0.28</td>
</tr>
<tr>
<td>Short Form-36 (SF-36) mental component scale</td>
<td>57.4 ± 10.9</td>
<td>58.4 ± 9.1</td>
<td>0.78</td>
</tr>
<tr>
<td>Short Form-36 (SF-36) physical component scale</td>
<td>42.9 ± 10.9</td>
<td>42.1 ± 13.2</td>
<td>0.84</td>
</tr>
<tr>
<td>Range of motion</td>
<td>26.8 ± 9.3</td>
<td>29.2 ± 8.3</td>
<td>0.40</td>
</tr>
<tr>
<td>American Shoulder and Elbow Surgeons (ASES) eval.</td>
<td>83.1 ± 25.6</td>
<td>91.1 ± 14.3</td>
<td>0.25</td>
</tr>
<tr>
<td>Constant score</td>
<td>67.1 ± 19.6</td>
<td>70.8 ± 17.2</td>
<td>0.55</td>
</tr>
<tr>
<td>University of California at Los Angeles (UCLA) sh.</td>
<td>24.2 ± 5.0</td>
<td>26.7 ± 3.8</td>
<td>0.10</td>
</tr>
</tbody>
</table>

*The values are given, in points, as the mean and one standard deviation.

(Lo, et al. 2005)
Conclusions

- Both TSA and hemiarthroplasty improve disease specific and quality of life measurements
- No significant measurement differences between the two groups
Thank You!
TSA Rehabilitation

Precautions

First 48 hours (until cleared by surgeon)
- Arm in sling
- Limited active use of arm (e.g. eating) as comfortable
- No external rotation past neutral
- No active internal rotation
- No driving

No driving
TSA Rehabilitation

- 2 days *unless specified by surgeon

- PROM
  - Pendulum exercises
  - External rotation to the **neutral only** unless stated otherwise
    - Until scapular insertion heals
  - Forward flexion to 90 degrees

- AROM exercises begin immediately after surgery*
  - Full ROM to elbow, wrist and hand
  - Scapular exercises
  - Forward flexion to 90 degrees to pain tolerance
TSA Rehabilitation

- 3 weeks
  - Begin pulley and t-band exercises as tolerated
  - May lift nothing heavier than coffee cup
  - Begin aerobic exercise

- Goal:
  - Forward flexion to 90 degrees
  - External rotation to neutral
  - Scapular awareness
TSA Rehabilitation

- 6 weeks
  - Increase external rotation beyond neutral as tolerated
  - No limit to active forward flexion.
  - Active assisted internal rotation as tolerated
  - Wall walks
  - Active elbow flexion and extension
  - Scapular strengthening exercises

Goal:
  - Elevation to 120 degrees, external rotation to 25 degrees
TSA Rehabilitation

- After 12 weeks
  - Continue range of motion exercises and strengthening exercises to full movement as tolerated.
  - Continue strengthening of all rotator cuff muscles.

- Full recovery 12 to 18 months
References


