Orthopedics Update
«Reverse Total Shoulder Arthroplasty»

Stability and Instability of RTSA

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Disclosures

I have no potential conflicts with this presentation
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• Causes
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Prevalence

- **3.4%\(^1\)-5%\(^3\)**

- Early complication 61% in the first 3 months\(^2\)
  - Surgical error

- Late
  - PE wear, trauma, hematogenous infection

- Anterior, posterior, lateral

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Causes

*The further backward you look, the further forward you can see.*

Winston Churchill

"Stability and Instability of RTSA"
Causes

• At least 7 causes

1. Failure to restore intraoperatively length of humerus¹

¹ Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009
Causes

• Biomechanics changes produced by the design: secondary complications¹

• Displacement in the frontal plane of the center of rotation:
  – Shortening:
    dislocation²
    poor function³

1. Farshad M, Gerber C. Reverse total shoulder arthroplasty: from the most to the least common complication. International Orthopaedics 2010; 34: 1075-82.
2. Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009
• Control of lengthening is thus the key to avoid many complications.

• You really control only few factors that determine arm lengthening:
  – Position of the glenosphere in the vertical plan (you do not choose)
  – Glenosphere size (3 mm) arm > 300 mm, 1%
  – Eccentric glenosphere (2-4 mm) 1%
  – Humerus length (cut, spacer, poly) (several cm, >10%) Key!
Cause

• No standardized technique to determine deltoid tension (arm lengthening).

• Rely on intraoperative factors?:
  – Difficult reduction
  – No pistoning
  – Tight conjoint tendon
  – No asymmetric subluxation
  – Tilting during adduction…

• Safer to use «Jedi skill that involves using the force»

Causes

- Documentation included preoperative, postoperative and contralateral AP scaled radiographs of humeri.

1. Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009
Causes

• Measure in 58 patients

Humeral lengths:
• Difference in pre-postoperative (CP-CHipsi): 2 ± 7 mm (range: -9 to 16, \( p=0.243 \)).

• Postoperative shortening (observed in all dislocations \( n=6 \)) was -30 ± 18 mm (range: -50 mm to -10 mm, \( p<0.0001 \)).

Arm lengthening:
• Compared to preop ipsi side: arm lengthening 23 ± 12 mm (range: 1 to 47, \( p<0.001 \)), correspond to deltoid re-tensioning.

• Compared to contralateral: arm lengthening 20 ± 11 mm.

1) Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009
Discussion

Technique of preoperative measure to objectively determine the height of RSA.

1. Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009
Causes

2. Failure to restore postoperatively length of humerus

Acromial/spine fractures

• Not described in series,1-2 but personal communications3 and case report4

2. Wahlquist TC. Acromial base fractures after reverse total shoulder arthroplasty: report of five cases. JSES 2011.
4. Levy JC. Postoperative acromion base fracture resulting in subsequent instability of reverse shoulder replacement. JSES 2012
Causes

3. Impingement

• Biomechanics changes produced by the design: secondary complications

• Medialization center of rotation:
  - Notching
    (inferior impingement)
  - No neck (AP impingement)

Importance of humeral version

1) Farshad M, Gerber C. Reverse total shoulder arthroplasty: from the most to the least common complication. International Orthopaedics 2010; 34: 1075-82.
3) Favre et al. The effect of component positioning on intrinsic stability of the reverse shoulder arthroplasty. JSES 2010
4. Muscle insufficiency

• Main cause of instability of the RSA is the large anteroinferior release performed through the DP approach (subscapularis and inferior GH ligament)

• Subscapularis
  • Absence or failure of repair¹ (1-12%)
  • Grade 3 FI²
  • Imbalance
    • LDT without subscapularis

• Deltoid?³

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3) Lädermann A. Reverse shoulder arthroplasty with deltid insufficiency. In press
5. Humeral bone insufficiency
6. Infection

- Instability accompanied by infection in 44% cases.

1. Gallo et al. Instability after reverse total shoulder replacement. JSES 2011
Causes

7. Neurological lesions

• Biomechanics changes produced by the design: secondary complications¹

• Displacement in the frontal plane of the centre of rotation:
  Lengthening:
  – Acromial fracture
  – Neurological lesions
  – Permanent arm abduction…

¹ Farshad M, Gerber C. Reverse total shoulder arthroplasty: from the most to the least common complication. International Orthopaedics 2010; 34: 1075-82.
Causes

Prospective. Same operative technique. Control EMG 3.6 weeks postoperative

<table>
<thead>
<tr>
<th>Recent postoperative lesion</th>
<th>RSA group (n=19)</th>
<th>ASA group (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axillary n.</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Suprascapular n.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Musculocutaneous n.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Ulnar n.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Plexus lesion</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total (patients)</strong></td>
<td><strong>12 / 9 patients</strong></td>
<td><strong>1 / 1 patient</strong></td>
</tr>
</tbody>
</table>

45% acute, 18% worsening, 63% neurological impairment!

Lädermann A et al. Prevalence of neurological lesion after total shoulder arthroplasty. JBJS Am 2011
Results

- Significantly increased risk for a neurological lesion with increasing arm lengthening (p<0.001)
Prevention

1. Baseplate positioning:
   • Low position frontal plane
   • Inferior tilt?

2. Glenosphere design:

- **Eccentric**
  - Does not prevent but decreases notching

- **Tilt**

1. Mizuno. The clinical and radiographical results of reverse total shoulder arthroplasty with eccentric glenosphere. Int Orthop 2012
Prevention

2. Glenosphere design:
   • Eccentric
   • Tilt
   • Size (36 vs 42)
     – Instability rate with 42: 0%
     – Instability rate with 36: 4.3%

Prevention

2. Glenosphere design:
   • Eccentric
   • Tilt
   • Size (36 vs 42)

   • Glenoid lateralization (less notching/impingement? Less tension (less neurological lesion?)

3. Humeral design:
• Lower inclination angle limits notching

but

• Easier lateral dislocation
Prevention

4. Approach
• Superior approach have less dislocation
  – 5% with DP approach
  – 1% with superior approach

• Role of the subscapularis

My philosophy

- Restore humeral length for stability
- Restore arm length for function
  - Aim 0-2 cm
- Subscapularis lesion
  - DP, repair if possible
- Intact subcapularis
  - Superior approach
- Glenoid lateralization with both approach
- Large head according to the size of the patient
"Stability and Instability of RTSA"
Stability and Instability of RTSA
"Stability and Instability of RTSA"
Treatment

- Analyze (surgical error)
- 1st episode
  - Close reduction, abduction sling 4w
  - Note efficient most of the time
- Recurrence: surgical management
  - Deltoid/soft-tissue tension is the key
  - Scaled X-ray both humeri
  - Restore humeral length (PE, spacer)
    - Think about the glenoid!
Teamwork

• Alone we can do so little, together we can do so much.

Helen Keller

Thank you to Gilles Walch
Thank you for your attention.