Objectives

- History of shoulder arthroplasty
- Unique biomechanics
- Shoulder anatomy
- Results
- Current indications

History of Shoulder Arthroplasty

- 1893: 1st total shoulder performed by Péan in Paris
- Designed for young man with TB of proximal humerus

Jules Émile Péan, 1860
The 1st Total Shoulder Arthroplasty

- Implant construct:
  - platinum
  - hardened rubber boiled in paraffin
  - Muscles attached with horsehair suture
- Patient demonstrated improved limb function


Charles S. Neer II, MD

- 1950s: Proximal Humeral Arthroplasty
  - Superior Migration with cuff deficiency
  - Proposes TSA to stabilize humeral head in glenoid

Constrained Shoulder Arthroplasty

- 1970s: Constrained TSA
  - Major complications with glenoid loosening (20%)
  - Failure of fixation due to concentration of force at glenoid/bone interface
Neer Unconstrained Total Shoulder

- 1972: Neer introduces unconstrained TSA with polyethylene glenoid
  - Lucent lines around glenoid common (30-93%)
  - Rate of glenoid loosening only 3.6%

The problem defined: Cuff Tear Arthropathy

- “Senile haemorrhagic caries of the shoulder”
- “Senile joint haemorrhage”
- “Fast destructive arthropathy”
- “Cuff Tear Arthropathy”

CTA - Neer

- Noticed a common pattern of wear and unique complications
CTA – Radiographic Findings

- Collapse of proximal humeral articular surface
- Ant/Post subluxations common
- Glenoid erosion to coracoid (11 patients)
- Rounding off of GT
- Acromiohumeral distance reduced to <2mm (in all but 3 pts)
- Erosion of anterior acromion and AC joint

Pre-Collapse

Cuff-Tear Arthropathy

Background

• Reverse TSA
  – Approved by FDA in 2004
  – ~2,000 performed in 2004
  • Has increased Almost 10 fold per year now
Statistics

– Hip and Knee Replacements
  • ~700,000 yearly (and increasing)
– Shoulder replacements
  • ~23,000 in 2002 and expect 63,500/yr by 2020


Anatomy of the Shoulder

Bony Anatomy & Landmarks
  • Scapula
    – Acromion
    – Coracoid
    – Spine
  • Clavicle
    – AC Joint
  • Proximal Humerus
    – Bicipital Groove
    – Tuberosities
Anatomy of the Shoulder

**Muscular Anatomy**
- Deltoid
- Rotator Cuff
  - Subscapularis
  - Supraspinatus
  - Infraspinatus
  - Teres Minor
- Conjoined Tendon
  - Short Head of the Biceps
  - Coracobrachialis
- Long Head of the Biceps

**Biomechanics**

**ROM**
- Referenced typically in the plane of the scapula
- 30 degrees off the coronal plane
- "Shoulder Motion"
- Combined motion of Glenohumeral (GH) joint and scapulothoracic (ST)
- GH to ST motion ratio ~ 2:1

**Biomechanics**

**ROM**
- Forward Flexion (FF) - 180
- Abduction (ABD) - 180
- External rotation at the Side (ER0) - 70
- Internal rotation (IR) - T7
- Extension (EX) - 60

• Always compare to normal side if present
Surgery

- Indication for TSA
  - Failure of non-operative treatment
  - Done to relieve pain
- Contraindications
  - Active infection
  - Non-repairable rotator cuff tear
  - Failure of previous TSA due to instability
  - Inadequate glenoid bone

Surgery

- Indications for Reverse TSA
  - Age >70 and
  - Cuff Tear Arthropathy (CTA)
  - Severely comminuted Proximal humerusFx
  - Failed Primary TSA or Hemiarthroplasty because of instability
- Contraindications
  - Infection
  - Inadequate glenoid bone
  - Axillary nerve

Surgical Technique

- Approach
  - Splits superficially between Deltoid (Ax) and Pectoralis Major (MPN, LPN)
  - Deep – subscapularis removed
    - Osteotomy, tenotomy, peel
  - Long head of the biceps released if present
  - Subscapularis repaired at end of case (not always for a reverse)
    - Biggest limiting factor during rehab after
Reverse TSA biomechanics

- Design changes deltoid force from translational to rotational
- Highly congruent fit
  - Increases stability
- lowers humerus
  - Increases tension on deltoid

- Medialize Center of Rotation 10mm
  - Increases Deltoid force by 20%
- Moving Center of Rotation 10 mm Distally
  - Increases Deltoid force by 30%
Sole Deltoid

Stability

• Correct tensioning difficult to assess intraop
  – Inadequate deltoid tension allows dislocation (6-8%)
  – Excessive tension may lead to acromial fracture (4-6%)
• Boileau: 3 dislocations, 2 fractures (series of 45 pts)
• Werner: 5 dislocations, 4 fractures (58 pts)

Out of the OR

• Abduction sling
• Ice Machine
• PT POD#1 in hospital
• D/C home between day 0 and 1
• TENS/inferential for pain/swelling control given to patient at first post op visit
Post-op “Do’ and Don’ts”

- Warnings given to patient
  - Don’t use the arm to push yourself up in bed or from a chair because this requires forceful contraction of muscles.
  - Do follow the program of home exercises prescribed for you. You may need to do the exercises 4 to 5 times a day for a month or more.

Post-op “Do’ and Don’ts”

- Don’t overdo it! If your shoulder pain was severe before the surgery, the experience of pain-free motion may lull you into thinking that you can do more than is prescribed. Early overuse of the shoulder may result in severe limitations in motion.
- Don’t lift anything heavier than a glass of water for the first 6 weeks after surgery.
- Do ask for assistance. Your physician may be able to recommend an agency or facility if you do not have home support.

Post-op “Do’ and Don’ts”

- Don’t participate in contact sports or do any repetitive heavy lifting after your shoulder replacement.
- Do avoid placing your arm in any extreme position, such as straight out to the side or behind your body for the first 6 weeks after surgery.
Reverse Results

- 95% of patients satisfied with result
  - Frankle 2005
- Constant score Average
  - Pre-op  24
  - Post-op  62
- Forward Elevation Average
  - Pre-op  71 degrees
  - Post-op  130 degrees (typical to get 150 + with TSA)

Conclusion

- Reverse TSA is a good procedure for older patients with non functional rotator cuffs and pain
- Pain relief with the procedure is very reliable
- Function reliably improves but does not return to normal