Total Shoulder Arthroplasty: Results, Outcomes and Expectations

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Disclosure

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General

• The literature is replete with data demonstrating the superiority of TSA vs hemiarthroplasty
  – A study by Edwards et al compared 602 TSA's with 89 hemi's and found that the TSA's had better outcomes scores, ROM, and satisfaction but also found that 56% of the glenoids had radiolucent lines (Edwards JSES 2003)
  – Pfahler et al compared 703 TSA's and 469 hemi's and found better subjective outcomes and Constant scores with the TSA's. However 68% of the glenoid components had radiolucent lines and the outcomes decreased with the severity and grade of these lines (Pfahler JSES 2004)
TSA Results

• The results for TSA are good with most studies reporting 90%-95% good to excellent results with about a 15% complication rate (Norris JSES 2002)
• The areas upon which we need to focus are
  – Disparity between expected outcomes and functional results
  – Factors that affect the outcomes
    • Patient
    • Pathology
    • Implants
    • Surgical technique

Patient related factors

• What the patient brings to the table matters
• Matsen evaluated 134 consecutive TSA’s and found that postoperative function most significantly correlated with higher preoperative physical function, social function and mental health ( JSES 2000)
• We know a good result preoperatively

• Patients on chronic narcotics preoperatively had reduced outcome measures and satisfaction (Morris JSES 2015)
• Patients receiving workman’s compensation had lower ASES scores (Jawa JSES 2015)
  – Compared 13 WC pt’s (average age 56) with 63 non-WC (average age 63)
Pathologic factors that negatively affect outcomes

- Capsulorraphy arthropathy (Green JSES 2001)
- Post-traumatic osteonecrosis
  - Although TSA performed better than hemi’s, TSA’s only had a 57% satisfaction rating (Schoch JSES 2015)
- Proximal humeral malunions (Jacobsen JSES 2014)

Implant related factors-the glenoid

- Gartsman et al (JSES 2005) prospectively randomized 43 TSA’s to either a pegged or keeled glenoid component and found on immediate postop radiographs that radiolucent lines were present in 39% of keeled and only 5% of pegged
- Edwards et al (JSES 2010) prospectively randomized 53 TSA’s in the same fashion with radiographs obtained at 2 years
  - Radiolucent lines found in 13% of keeled and 4% of pegged immediately
  - At 2 years follow up lucent line found in 46% keeled and 13% pegged

The glenoid is the weak link in TSA as the most common complication is glenoid loosening and wear

There has been an evolution of the glenoid from keeled to pegged to some form of bone ingrowth ploy.
Glenoid Evolution

• Churchill et al (JSES 2010) Evaluated 20 TSA’s with minimum 5 year follow up with plain films
  – 20% had lucent lines immediately and progressed to 25% at 5 years
  – 85% of central pegs had bone incorporation
• Arnold et al (JSES 2011) Evaluated 35 TSA’s with fine cut CT scans at 2 year follow up
  – Bone circumferentially present in 6/8 compartments in 23/35 and 4.5 in all 35
  – Overall Lazarus score 0.45 and Yian score 3.29
• Noyes et al (JSES 2015) evaluated 22 TSA’s with average 7 year F/U with 82% bone incorporation of the anchor peg and 19% demonstrating some lucencies with 97% survivorship

Glenoid Evolution

• Although glenoid lucencies have decreased with the evolution of the glenoid designs, we still have to have longer term data to assess the glenoid component survivorship
  • Clearly there are other factors that affect the glenoid
    – Materials properties
    – Support of host bone
    – Quality of host bone
    – Orientation
  • This is especially true in the B type glenoids where our results are significantly diminished compared to A type glenoids

Glenoid Evolution

• Materials properties
  – Noyes et demonstrated a significant reduction in lucent lines with highly cross-linked poly
  – Would other materials like pyrocarbon or ceramic improve wear rates?
Our most difficult situations- The B Glenoid

- The B type glenoids
  - Levine et al evaluated 31 hemis for OA and found 86% satisfactory results with concentric wear while only 63% had satisfactory results with posterior wear
  - Iannotti et al reviewed 128 arthroplasties and found that TSA's had better function than hemis with B2 glenoids, however TSA's with B2 glenoids had lower ASES scores than those without posterior wear
  - The patient that is 55yo with OA

Four Tenets of Glenoid Management

- Axial Orientation: Neutralize the glenoid surface to mitigate posterior subluxation
- Bone support: Completely support the glenoid component with host bone
- Bone support: Support the glenoid component with good hard subchondral bone (do not ream through the subchondral bone...soft cancellous bone will subside)
- Glenoid inclination: Do not superiorly incline the glenoid and place greater loads on the rotator cuff

Axial Orientation

- Ho et al evaluated 66 TSA's performed with all poly bone in growth component and found that osteolysis around the central peg correlated with 15° of postop retroversion
  - IJRS 2013
- Bryce et al found that as little as 5° of retroversion was associated with increased posterior humeral head subluxation and asymmetric loading of the glenoid component
  - IJRS 2014
- A more neutral surface is mechanically advantageous
Bone Support

- Walch et al. reviewed 518 TSA's performed with an all poly keeled glenoid and found that 32% of glenoids were loose (>2mm complete lucent line) at 5 years.
- Also found that subsidence (medial migration) was associated with corrective reaming and loss of the subchondral plate.
- This emphasizes the importance of preserving the subchondral bone.

Bone Support

- A recent study of 104 TSA's found that 8 glenoids were common (50%) and that despite all measures of obtaining full support by the host bone (eccentric reaming, leaving the component a little retroverted, down sizing the component), almost 50% were not completely supported by host bone.

Balancing Act

- Therefore we must balance the art of:
  - Neutralizing the glenoid surface
  - Maintaining the hard subchondral bone
  - Completely supporting the component with bone
  - Maintaining neutral inclination
  - This is where patient specific instrumentation and planning and augmented components may change our future.
Satisfaction vs Outcomes

• The patient population where we have the greatest chasm between satisfaction and outcomes, is the arthritic patient under 55yo
• This is clearly multifactorial
  – Patient expectation not aligned with surgeon expectation
  – Increased physical demand of the working population
  – Difficult pathology

Can’t get no satisfaction

• Golant et al polled the ASES regarding return to sport and found that 60% of respondents would allow TSA pt’s to return to low impact sports while 80% would allow hemi’s to do the same
• However a poll of young arthritic patients by Henn et al found that participation in sport and exercise was “very important”

Can’t get no satisfaction

• I tell my patients that surgery is half art, half science, half blood sweat and tears (math courtesy Yogi Bara)
• The real art is aligning the expectations of the patient with realistic outcomes based on the pathology, demands, and the current limitations of the products used
Can’t get no satisfaction

• Sperling et al reported unsatisfactory outcomes in 48% of 25 TSA’s performed in patients under 55yo at a minimum 10 year F/U with 76% demonstrating evidence of radiographic loosening (Sperling JSES 2004)

Can’t get no satisfaction

• A more recent study compared 46 TSA’s and 20 hemi’s in patients under 55yo at an average 7 year F/U and found that TSA’s had less pain, greater ROM and better satisfaction with 92% survivorship while the hemi’s had a 72% survivorship (Bartelt JSES 2011)

Other options?

• So if TSA is still better than a hemi in younger patients yet we have concerns about glenoid failure, is there something else that we can do?
  • Soft tissue interposition
  • Concentrically reaming the glenoid
Soft Tissue Interposition

- Puskas evaluated 17 patients with 3 different types of interpositions (6 Garf jacets, 5 meniscal grafts, and 6 capsular interpositions)
  - Found that the revision rate was very high
    - Garf jacket: 5/6 revised by 16 months
    - Meniscal: 3/5 revised by 22 months
    - Capsular: 4/6 revised by 34 months

Options for the future

- Since TSA performs better than hemiarthroplasty in younger patients and those with a B type glenoid, maybe we should design a better glenoid that adheres to the 4 tenets of glenoid management
- There are several posteriorly augmented glenoids on the market, yet there is no long term data on their results

55yo with OA
Conclusions

- TSA is clearly better than hemiarthroplasty in almost every situation.
- Our problem with TSA resides with the glenoid and is magnified in situations like the B type glenoids and in younger patients.
- It is therefore incumbent that we identify the pathology that requires special attention and utilize all our resources to address it.
- We also need to make sure that our expectations are aligned with those of our patients.