The Influence of Patient & Surgeon-Specific Factors on Operative Duration & Early Postoperative Outcomes in Shoulder Arthroplasty

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Introduction

- Operative efficiency is a goal of all surgeons
  - Increased OR time associated with ↑ costs & ↑ risk of complications
  - Surgeon volume correlated to OR time across multiple surgical disciplines

Introduction

- Shoulder arthroplasty is a relatively rare procedure compared to hip & knee arthroplasty
  - More difficult to achieve high surgeon volume
- As of 2003, the majority of surgeons performing shoulder arthroplasty did 1-2 cases per year

What do We Know?

- Hip & Knee Literature
  - Factors *affecting* operative time
    - ↑ operative time with ↑ BMI
  - Factors *affected by* increased operative time
    - ↑ risk of infection in TKA & THA
    - ↑ risk of wound complications in THA
    - ↑ length of stay in THA

What do We Know?

- Shoulder Literature
  - ↑ OR time associated with ↑ incidence of transfusion in revision shoulder arthroplasty
  - No significant effect of obesity on OR time in RSA

What do We Know?

- Surgeon volume inversely correlated to operative duration in TSA, RSA, & HA.
  - High volume surgeons with 30-50 minute shorter OR time compared to low volume
  - Lower EBL with increased surgeon volume in TSA & RSA

Our Questions

- Which patient factors are correlated with ↑ OR time?
- Effect of surgeon volume on operative time?
- Difference in OR time as academic year progresses?

Our Questions

- Perioperative Outcomes
  - Does ↑ OR time influence:
    - Length of stay
    - Readmission within 30 days
    - Risk of blood transfusion

Hypotheses

- Patient factors correlated to ↑ OR time
  - Eccentric OA in TSA
    - Walch B1, B2, C glenoids
  - RSA for proximal humerus malunion
  - Revision shoulder arthroplasty

Hypotheses

- Surgeon factors correlated with ↓ OR time
  - ↑ Surgeon volume
  - Progression through academic year
    - Surrogate for trainee experience

Study Design

- Retrospective review at a single tertiary care institution using EMR

Inclusion Criteria
- Primary TSA
- Primary RSA
- Revision Shoulder Arthroplasty

Exclusion Criteria
- HA
- Resection Arthroplasty
- Multiple concurrent procedures

Subgroup Analysis

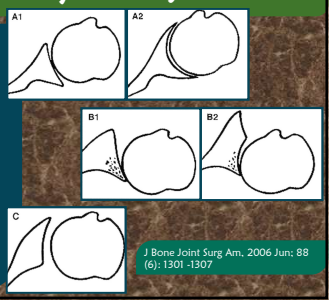
- 3 groups
  - Primary TSA
  - Primary RSA
  - Revision Arthroplasty
    - Defined as conversion of prior TSA, RSA, humeral head resurfacing, or humeral HA to TSA or RSA

Variables (All Subgroups)

- Patient Factors
  - Age
  - Sex
  - BMI
  - Preop range of motion
  - History of previous sx on operative side

Variables (Primary TSA)

- Glenoid Morphology
  - Walch Classification
  - 3 shoulder and elbow surgical fellows reviewed preop imaging
  - Majority-rule for cases of disagreement



J Bone Joint Surg Am. 2006 Jun; 88 (6): 1301 -1307

Variables (Primary RSA)

- Indication for surgery
  - Pre- & postop x-rays & preop notes reviewed
  - Divided into 6 groups based on indication for surgery:
    - Cuff Tear with Arthritis
    - Massive Cuff Tear w/o Arthritis
    - Arthritis with intact cuff
    - Malunion/Nonunion/AVN of Proximal Humerus Fx
    - Acute Proximal Humerus Fx
    - Chronic Instability

Variables (Surgeon Factors)

- Volume
  - Calculated from practice billing database using CPT codes 23472, 23473, and 23474
  - 30 shoulder arthroplasties per year was chosen to distinguish high vs low volume surgeons, based on Singh study

Outcome Measures

- Length of stay
- Transfusion requirement
- Readmission within 30 days

Statistical Analysis

- Performed using SPSS
  - Mean & standard deviations calculated for every parameter
  - Differences between groups evaluated using ANOVA & post-hoc Fisher test
  - Estimation of relationship between continuous variables evaluated using simple linear regression model
  - Significance was set at $\alpha = 0.05$.

Results – Surgeries Performed

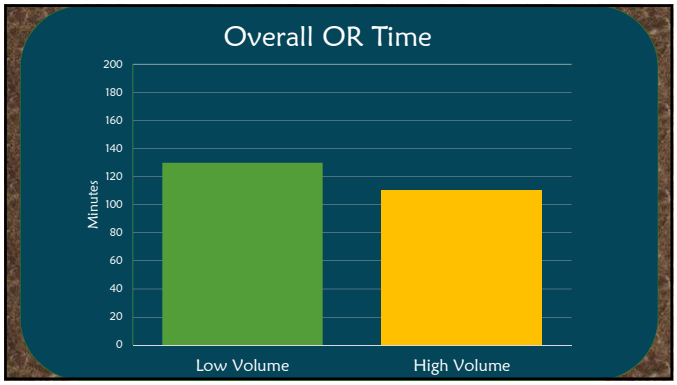
- 637 surgeries with complete data available
  - 315 primary RSA
  - 219 primary TSA
  - 102 revision arthroplasties
  - 1 case excluded for multiple concurrent procedures (polytrauma patient)

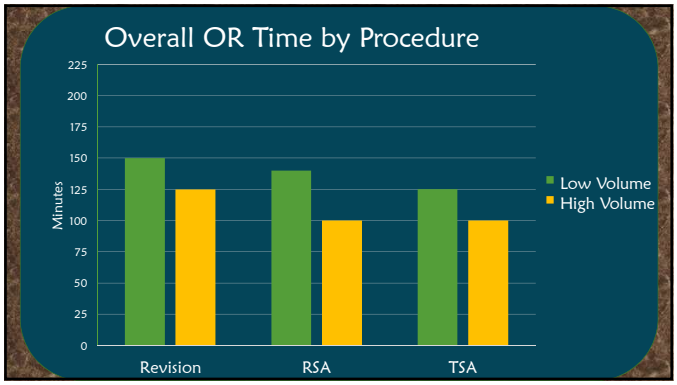
Results – Surgeon Volume

- Highest volume surgeon: 723
- 2nd: 310
- 3rd: 48
- 4th: 11

Overall – Surgeon Volume

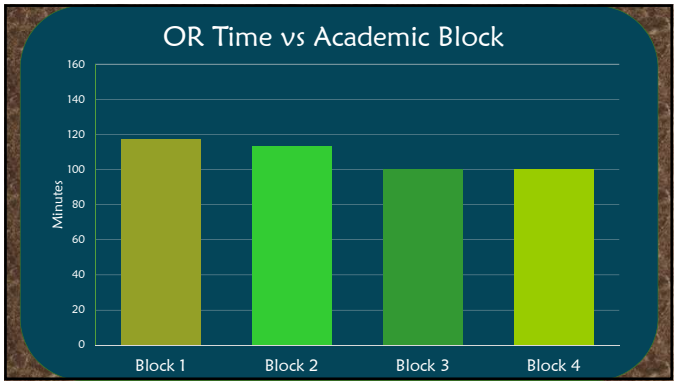
- High volume surgeons had significantly shorter OR time
  - 105.94 vs 133.64 minutes, p <0.0001
    - **26% longer** average OR time for low volume
    - This held true regardless of type of arthroplasty performed

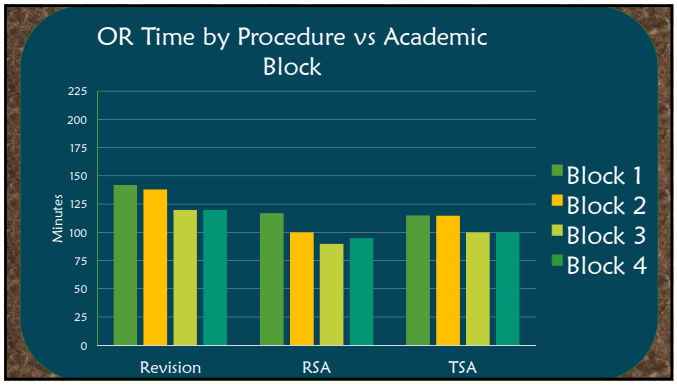




Academic Calendar

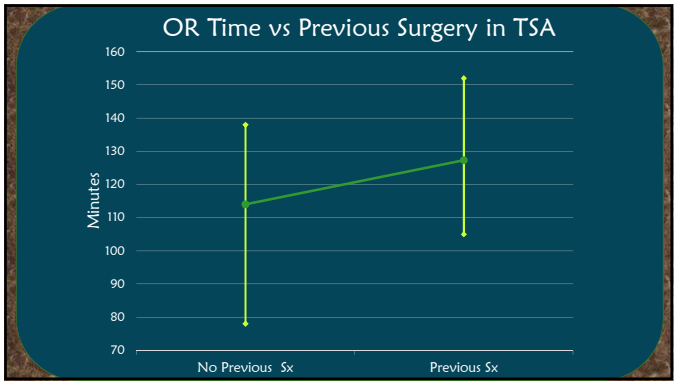
- OR time significantly ↓ through academic year
  - Block 1 (August - October)
    - $\bar{x}$ OR time 116.49 minutes
  - Block 4 (May - July)
    - $\bar{x}$ OR time 100.69 minutes
      - **14% faster average OR time**

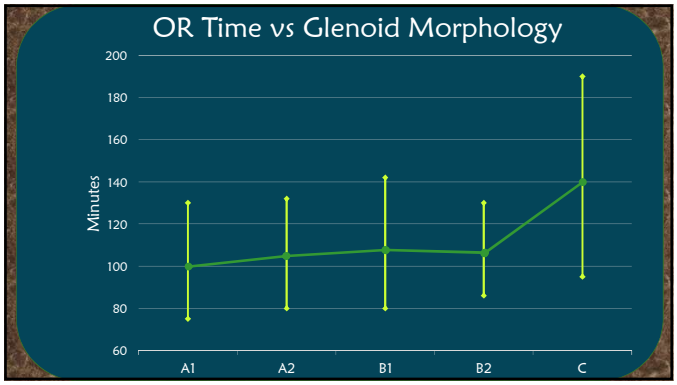




Primary TSA

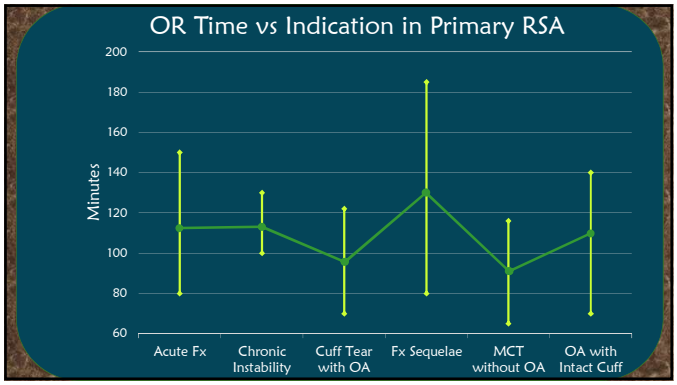
- Patient factors correlated to ↑ OR time:
  - Male sex (16% increase)
  - Previous surgery on the operative side (23% increase)
  - Walch Type C glenoid (30-39% increase compared to A1 - B2)





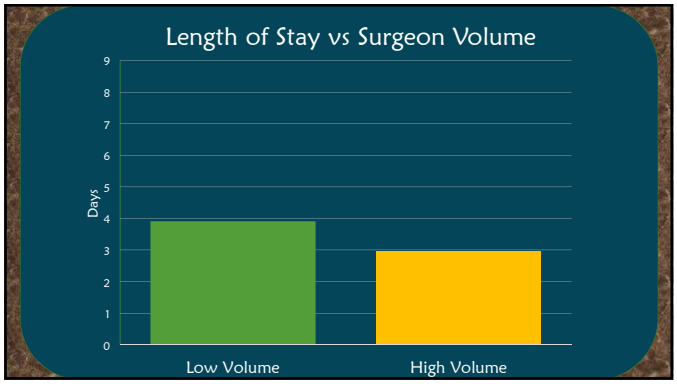
Primary RSA

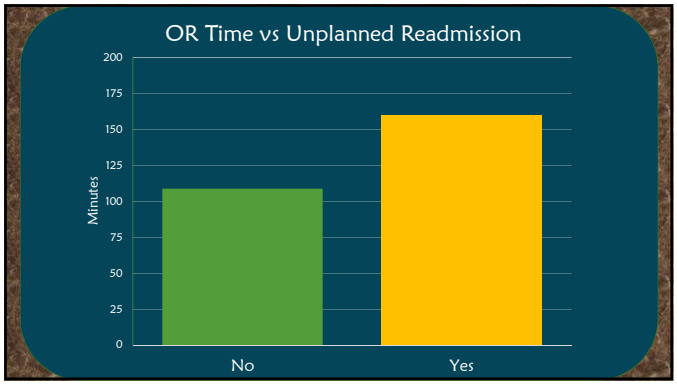
- Patient factor correlated with increased OR time:
  - Indication classified as sequelae of prior fracture
- Patient factor correlated with decreased OR time:
  - Massive rotator cuff tear without arthritis



Perioperative Outcomes

- Length of stay greater for low volume surgeons
  - 3.92 vs 2.95 days
  - **33% increase**
- Longer OR time associated with ↑ risk of readmission within 30 days
  - Mean OR time was **47% longer** on average in readmission group





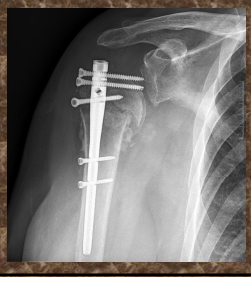
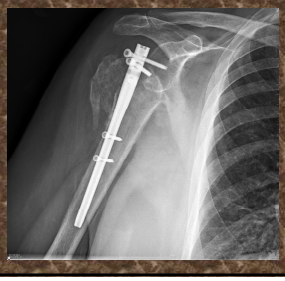
Discussion - Surgeon Factors

- High surgeon volume associated with shorter OR times
- Improved OR times throughout the academic year
  - Correlates with ↑ fellow experience

Discussion – Patient Factors

- Certain cases consistently demonstrated prolonged operative times:
  - RSA for sequelae of prior proximal humerus fracture
    - Abnormal anatomy complicates humeral instrumentation
    - Previously traumatized tissues less compliant making exposure/balancing more difficult

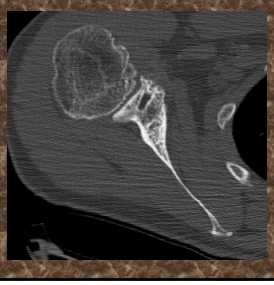
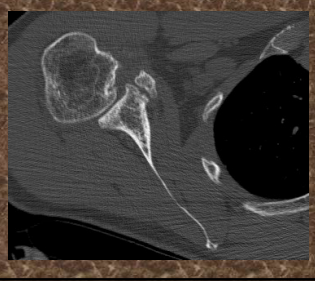
RSA for Nonunion

Discussion - Complex Cases

- TSA with history of previous sx
  - High incidence of prior instability sx in this patient population
    - Often non-anatomic reconstructions
      - Tighten subscap (Putti-Platt, Magnusen-Stack)
      - Transfer coracoid with conjoint tendon (Bristow, Latarjet)
        - Changes normal anatomic relationships & can alter proximity of neurovascular structures

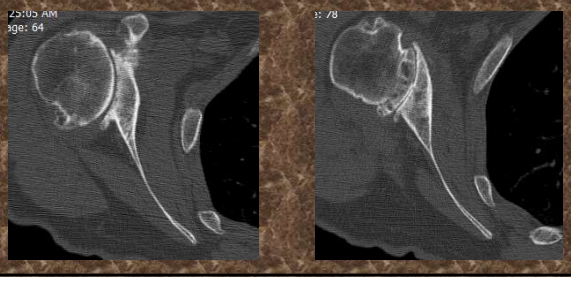
TSA after Instability Surgery

Discussion - Complex Cases

- TSA in Walch C glenoids
  - Retroverted glenoids more difficult to expose and instrument
  - B2 glenoids did not show association with increased operative time
    - Possibly due to intraoperative decision to switch to RSA

TSA in Dysplastic Glenoid



Discussion - Outcomes

- ↑ OR time associated with risk of readmission within 30 days
  - Shorter OR time can lessen risk of costly & potentially dangerous early postop complications
- Average length of stay greater for low volume surgeons
  - Helps control hospital/healthcare costs

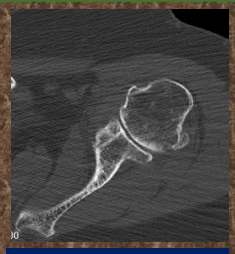
Discussion – Surgeon Education

- Must balance the need for hands-on education with patient safety
- Must strive to match case difficulty to their trainees' current ability level
  - Data supports gradual ↑ of surgical responsibilities with ↑ of trainee experience

Clinical Implications

- May guide surgeons in patient selection for shoulder arthroplasty
  - Less technically demanding cases conducive to faster surgeries
    - Primary TSA in concentric arthritis & primary RSA in MCT without arthritis
    - More appropriate for lower volume surgeons

Less Complex Cases



TSA in Concentric OA

RSA in Massive Cuff Tear

Patient Selection

- High volume surgeons may be better suited for more technically challenging cases with increased OR time
  - Revisions, TSA in dysplastic glenoids, or RSA in the setting of prior proximal humerus fracture

Complex Cases – Revision Arthroplasty

Conclusions

- Increased surgeon volume associated with ↓ operative duration in primary TSA, RSA, & revision shoulder arthroplasty
- Increased surgeon volume associated with ↓ postoperative length of stay
- Surgical times ↓ over the course of the academic year for all procedures


Thank You
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