UTHealth Houston

Do Pre-operative CT scans Decrease the Risk of Revision surgery in Total Shoulder Arthroplasty? A Matched Cohort Analysis of a National Claims Database

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Introduction

- Successful total shoulder arthroplasty (TSA) relies on appropriate understanding of anatomy.
- Pre-operative CT planning has been shown to increase the accuracy of component placement during TSA. [1-4]
- In limited case series, deviation from this pre-operative plan has been associated with poor clinical outcomes. [5]
- However, even though CT allows for enhanced pre-operative planning and improved component positioning, it remains unclear whether this translates to improved clinical outcomes on a larger scale.
- Consequently, the benefit of pre-operative CT may be challenged within a value-based care setting.

Purpose

To assess whether pre-operative CT planning translates to improved patient outcomes in TSA.

Hypothesis

Patients who received a CT scan prior to TSA would have lower revision an complication rates than those who did not

Methods

- PearlDiver database was queried for patients who had a TSA from 2015 through the first quarter of 2022
  - Using CPT code 23472
  - Exclusion: Any upper extremity fracture
- Primary outcome was revision rate
- Secondary outcome was post-operative infection
- Outcomes were compared across three diagnostic cohorts defined by the following ICD-10 codes:
  - M19.01- primary osteoarthritis of the shoulder
  - M75.1- rotator cuff tear or rupture
  - M12.8- rotator cuff arthropathy

Results – Overall Cohort

- 112,571 patients met inclusion criteria
- 23,212 received a pre-operative CT
- **Overall Data Set**
  - Higher revision and infection rate for CT vs no CT
- **M19.01 Matched Cohort - Primary osteoarthritis of the shoulder**
  - Statistically significant increase in both revision rate and infection rate for CT vs no CT
  - Difference persisted when analyzed with logistic regression
- **M75.1 Cohort - Rotator cuff tear or rupture**
  - Statistically significant increase in both revision rate and infection rate for CT vs no CT
  - Difference persisted when analyzed with logistic regression only for revision rate
- **M12.8 Cohort - Rotator cuff arthropathy**
  - No statistically significant differences in revision or infection rate

Overall Cohort		
	CT	No CT
Total Cohort	n = 23,212	n = 89,359
Revisions	n = 858	n = 2,739
Revision Rate	**3.7%**	**3.1%**
p-value	**p < .001**	
Infections	n = 1,781	n = 5,281
Infection Rate	**7.7%**	**5.9%**
p-value	**p < .001**	

Results – Matched Sub-Groups by Diagnosis

M19.01 Matched Cohort - Osteoarthritis of the Shoulder		
	CT	No CT
Total Cohort	n = 10,130	n = 10,130
Revisions	n = 358	n = 205
Revision Rate	**3.6%**	**2.2%**
p-value	**p < .001**	
Logistic Regression	**OR = 1.2**	
p-value	**p < .001**	
Infections	n = 710	n = 560
Infection Rate	**7.0%**	**5.5%**
p-value	**p < .001**	
Logistic Regression	**OR = 1.7**	
p-value	**p < .001**	

M75.1 Cohort - Rotator Cuff Tear or Rupture		
	CT	No CT
Total Cohort	n = 91	n = 1,152
Revisions	n = 14	n = 31
Revision Rate	**15.4%**	**2.8%**
p-value	**p < .001**	
Logistic Regression	**OR = 5.6**	
p-value	**p < .001**	
Infections	n = 11	n = 52
Infection Rate	**12.1%**	**4.5%**
p-value	**p = .003**	

M12.8 Cohort - Rotator Cuff Arthropathy		
	CT	No CT
Total Cohort	n = 47	n = 625
Revisions	n = 2	n = 24
Revision Rate	**4.3%**	**4.0%**
p-value	**p = 1.0**	
Infections	n = 3	n = 26
Infection Rate	**7.0%**	**4.2%**
p-value	**p = 0.73**	

Discussion

- Statistically higher incidence of revision and infection in patients who underwent CT scans prior to TSA
  - Significantly higher revision and infection rate maintained in the pre-operative CT group in the arthritis cohort and the rotator cuff tear cohort
  - Rotator cuff arthropathy cohort showed no significant differences
- Counter to the hypothesis we developed before conducting the study
- We believe results may reflect selection bias
  - CT scans were not universally ordered
    - Patients who received CT scans may have had more severe underlying bony deformity or case complexity
    - Patients who were presumably less likely to have glenoid deformity (a diagnosis of rotator cuff tear) were less likely to receive a CT scan.
    - Glenoid deformity has been clearly shown to be associated with a higher rate of component migration post-TSA [6]
- Above hypothesis could not be further explored within the limitations of a retrospective database study

Conclusion

- Patients who received CT scan prior to TSA had increased revision rate and complication rate compared to those who did not.
- We believe the inferior outcomes in patients who received pre-operative CTs likely reflects selection bias – more complex cases were more likely to receive a CT scan.
- As policy decisions about value-based care are often made based on clinical outcomes from large databases, our research highlights an important discrepancy between database outcomes and clinical practice
- Further research is needed to define the value of pre-operative CTs by controlling for outcomes based on glenoid deformity.

References

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