

Use of In-Office Shoulder Ultrasound Increases Efficiency of Care in Surgical Treatment of Full Thickness Rotator Cuff Tears

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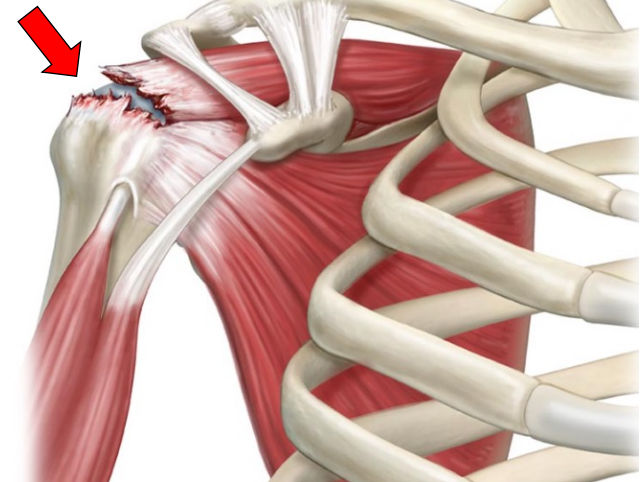
I (or my coauthors) have nothing to disclose.

Background

- Rotator cuff tears- common cause of shoulder pain and dysfunction
 - surgical repair within 4 months from injury results in better functional outcomes than surgery later.
 - best functional outcomes if surgery within 3 weeks ¹⁻⁴
- **Timely diagnosis is essential!**

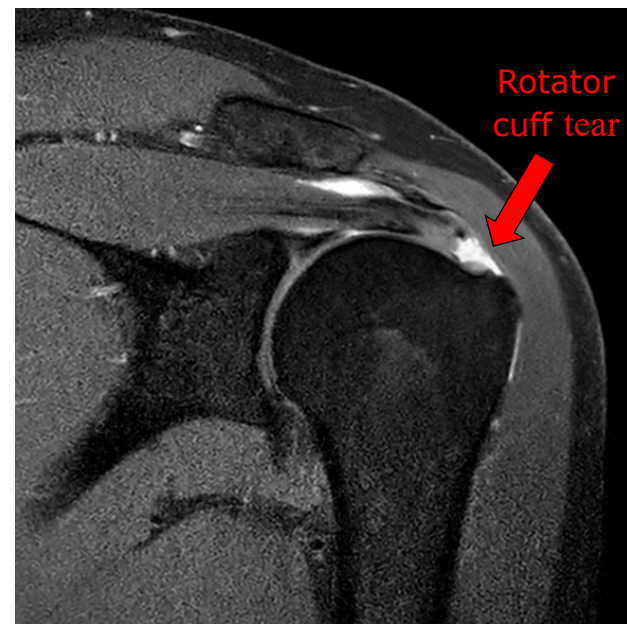


Rotator cuff tear



MRI

- Non-invasive, no radiation, minimal risk
 - Contraindicated with some implants
- Anxiety / claustrophobia issues, noisy
 - Motion degrades image quality
- Approx 30 minutes



Shoulder Ultrasound (US)

- Real time images, dynamic exams
 - 5 min
- Minimal side effects / risks / contraindications
- Fast and reliable
 - Meta analysis- ultrasound has statistically equivalent capability to MRI in the diagnosis of both full- and partial-thickness rotator cuff tears ⁵
 - learning curve- 100 shoulders ⁶
- Diagnose pathologies in clinic
 - ultrasound guided injections

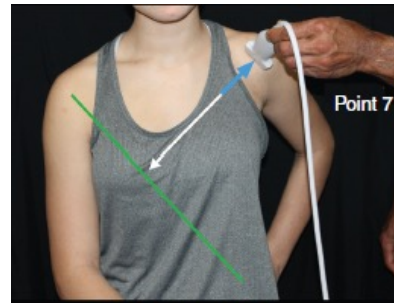


Fig. 49.17 Point 7 positioning.

Rockwood and Matsen's the Shoulder

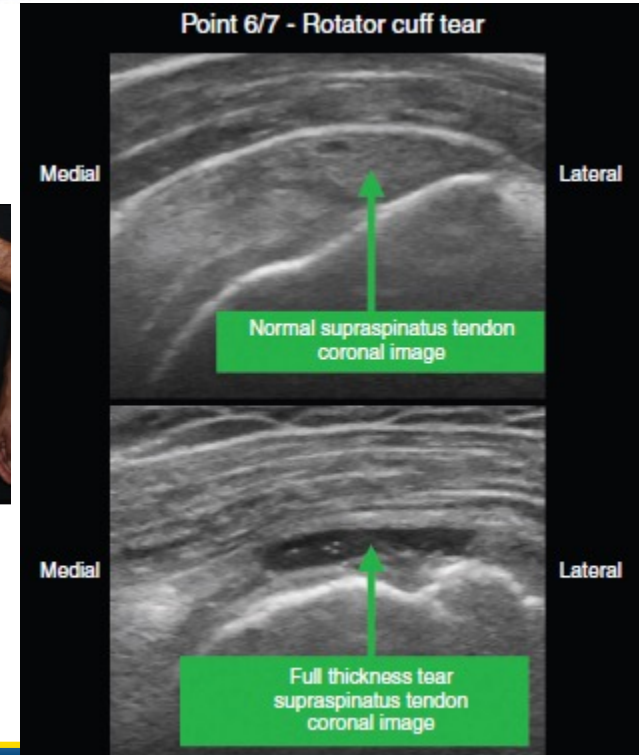


Fig. 49.16 Point 6 supraspinatus tendon tear—long axis.

Rockwood and Matsen's the Shoulder

Purpose/Hypothesis

- Both ultrasound and MRI have been shown to be highly sensitive and specific diagnostic modalities for rotator cuff pathology (although MRI is currently preferred in the United States).⁵
- **Purpose:** Investigate if the use of diagnostic shoulder ultrasound in the orthopedic surgeon's office increases the efficiency of care in the surgical treatment of full thickness rotator cuff tears.
- **Hypothesis:** Use of diagnostic shoulder ultrasound in the office increases the efficiency of care of traumatic full thickness rotator cuff tears compared to the standard diagnostic pathway with MRI.

Materials and Methods

- Retrospective analysis of medical records comparing practices of two surgeons
 - Similar practices but one utilizes ultrasound, and one utilizes MRI
- CPT codes used to identify patients who underwent rotator cuff repair by either Surgeon A or Surgeon B between 1/1/2014 to 12/31/2019
 - 23410 (repair of ruptured musculotendinous cuff (eg, rotator cuff) open; acute)
 - 23412 (repair of ruptured musculotendinous cuff (eg, rotator cuff) open; chronic)
 - 23420 (reconstruction of complete shoulder (rotator) cuff avulsion, chronic (includes acromioplasty))
 - 29827 (arthroscopy, shoulder, surgical; with rotator cuff repair)
- Chart review of clinic notes, demographic data, insurance status, zip code

Inclusion Criteria

- Subjects \geq 18 years of age
- rotator cuff repair surgery performed between 1/1/2014 to 12/31/2019
- Surgery performed by Surgeon A or Surgeon B
- full thickness rotator cuff tear on ultrasound or MRI
- clinical depiction of a significant traumatic event
- surgery within 12 months of injury

Exclusion Criteria

- age less than 18 years
- worker's compensation insurance
- imaging completed and diagnosis made before initial ortho evaluation
- revision rotator cuff repair
- shoulder instability
- patient elected to delay surgery

Statistical Analysis

- Cumulative number of days between events was calculated
 - Injury date
 - Initial evaluation by orthopedic surgery provider
 - Imaging obtained (MRI or ultrasound)
 - Booking sheet submitted by surgeon
 - Surgery for rotator cuff repair
- Mixed effects model with an interaction term was used to compare the number of days between each event for MRI and US imaging modalities.
 - Multiple measurements are obtained over time
 - Accounts for item-level variability within subjects and subject-level variability within groups

Characteristics of patients who underwent surgical repair of a full thickness rotator cuff tear by one of two surgeons between 1/1/2014-12/31/2019

	MRI	US	Total	P-Value
Total, N (%)	133 (63.64)	76 (36.36)	209	
Race, N (%)				0.244
White or Caucasian	119 (89.47)	73 (96.05)	192 (91.87)	
Black or African American	10 (7.52)	2 (2.63)	12 (5.74)	
Other	4 (3.01)	1 (1.32)	5 (2.39)	
Ethnicity, N (%)				0.021
Not Hispanic or Latino	133 (100.00)	73 (96.05)	206 (98.56)	
Hispanic or Latino	0 (0.00)	3 (3.95)	3 (1.44)	
Age, Mean (SD)	61.10 (9.10)	62.35 (7.03)	61.56 (8.41)	0.285
Gender, N (%)				0.762
Female	34 (25.56)	18 (23.68)	52 (24.88)	
Male	99 (74.44)	58 (76.32)	157 (75.12)	
Insurance, N (%)				0.921
Commercial	65 (48.87)	39 (51.32)	104 (49.76)	
Government	52 (39.10)	29 (38.16)	81 (38.76)	
Other	16 (12.03)	8 (10.53)	24 (11.48)	
Laterality, N (%)				0.916
Left	57 (42.86)	32 (42.11)	89 (42.58)	
Right	76 (57.14)	44 (57.89)	120 (57.42)	
Surgeon, N (%)				0.000
Surgeon A	81 (60.90)	11 (14.47)	92 (44.02)	
Surgeon B	52 (39.10)	65 (85.53)	117 (55.98)	
BMI, Mean (SD)	30.49 (5.03)	29.02 (4.19)	29.95 (4.79)	0.017
State-specific ADI decile, Mean (SD)	7.89 (1.31)	7.95 (1.38)	7.91 (1.33)	0.562

Abbreviations: N: Number, SD: Standard Deviation, %: Column percentages

Notes: p-values are from comparing the distribution of characteristics between the MRI and Ultrasound (US) cohorts.



Results

	MRI	US	P-value
Number of clinic visits before surgery	2.30 (0.52)	1.16 (0.37)	< 0.0001
Days from Injury to Evaluation	10 (2, 31)	22.5 (7, 60)	< 0.0001
Days from Injury to Imaging	21 (12, 38)	22.5 (7, 61)	0.896
Days from Injury to Booking for Surgery	35 (21, 51)	26.5 (9, 61)	0.071
Days from Injury to Surgery	64 (45, 91)	64.5 (37, 102.5)	0.659
Days from Evaluation to Imaging	7 (5, 10)	0 (0, 0)	< 0.0001
Days from Evaluation to Booking for Surgery	17 (12, 25)	0 (0, 0)	< 0.0001
Days from Evaluation to Surgery	47 (33, 67)	33 (21.5, 50)	< 0.0001
Days from Imaging to Booking for Surgery	9 (5, 14)	0 (0, 0)	< 0.0001
Days from Imaging to Surgery	37 (26, 57)	31.5 (20, 50)	0.051
Days from Booking to Surgery	26 (16, 40)	31 (19, 48)	0.121

Values are formatted Mean (Standard Deviation) or Median (Interquartile range)

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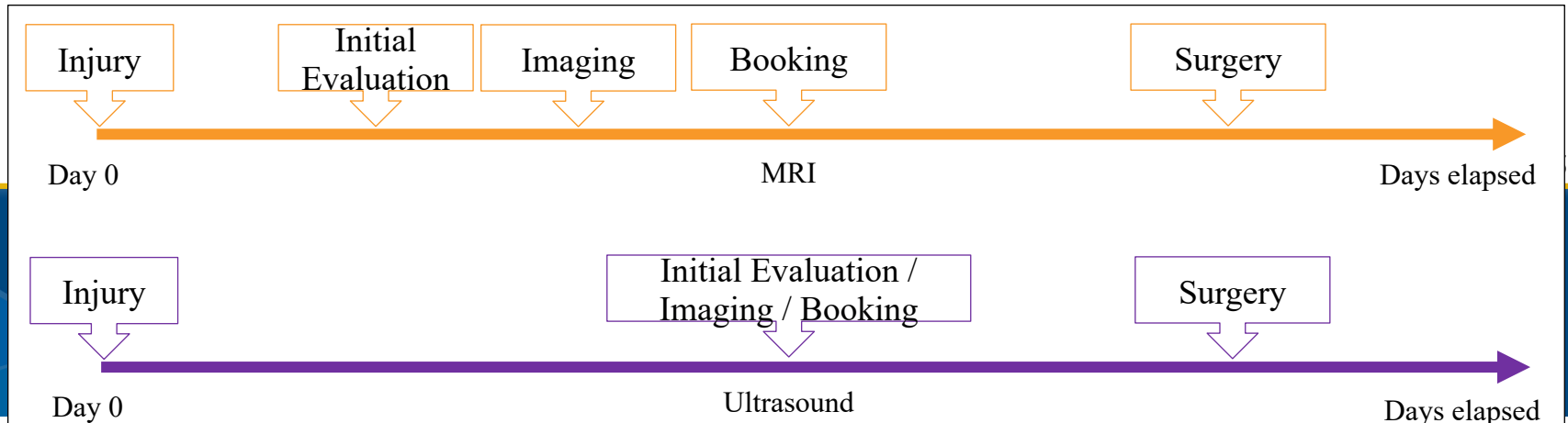
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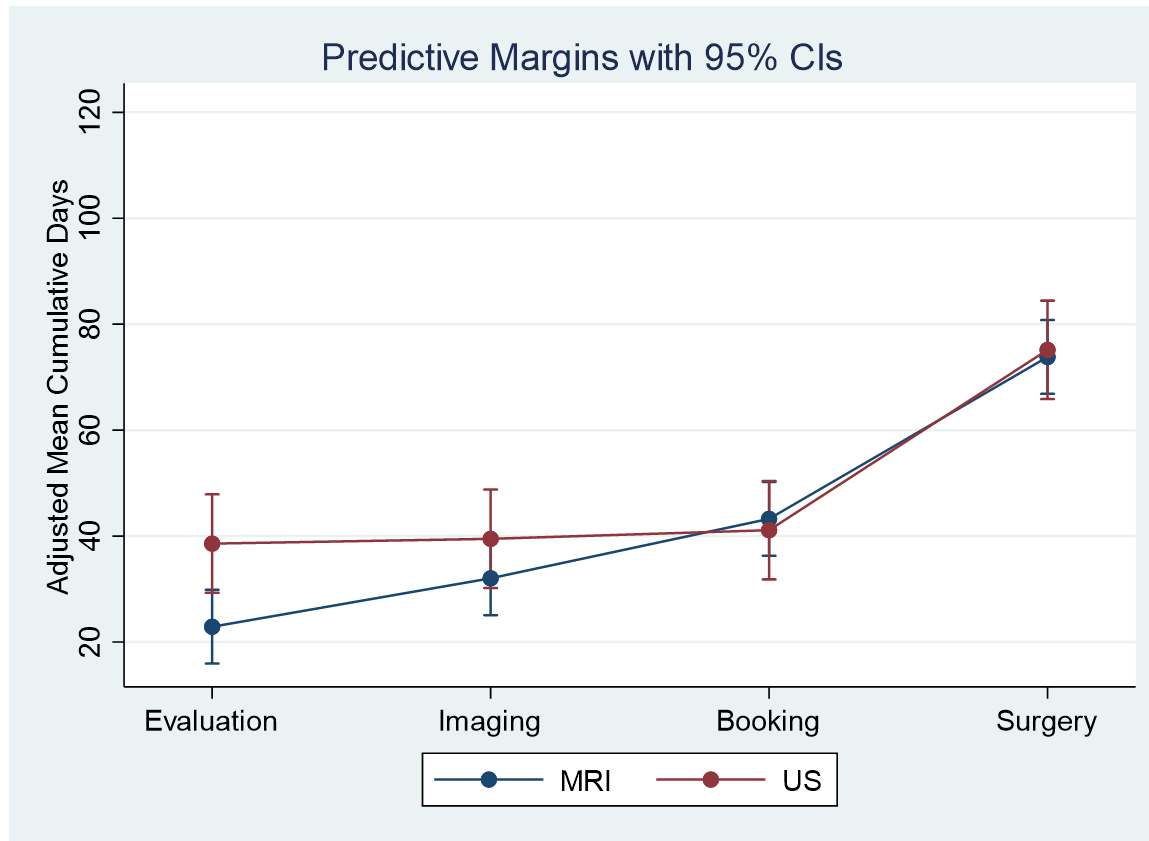
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Predictive Margins with 95% Confidence Intervals for adjusted mean cumulative days between events for MRI and US cohorts



Conclusion/Significance of Findings

- **Use of diagnostic shoulder ultrasound in the office increases the efficiency of care of traumatic full thickness rotator cuff tears compared to the standard diagnostic pathway with MRI.**
 - Approx 2 weeks time saved in our study (evaluation to surgery)
 - Average 1 clinic visit saved in our study
- **Future Directions:**
 - Investigate cost savings:
 - MRI \$1895 vs \$256 ultrasound
 - Less clinic visits
 - Less time off of work traveling to imaging clinical appointments, etc.
 - Determine accuracy at our institution
 - Train additional orthopedic surgeons in diagnostic shoulder ultrasound and study the learning curve
 - Compare patient outcomes

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MEDICINE *of* THE HIGHEST ORDER