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Title: Comparison of Tear Characteristics, Outcome Parameters and Healing In Traumatic and Non-Traumatic Rotator Cuff Tear: A Prospective Cohort Study

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Introduction

- Acute traumatic tears and chronic degenerative tears are different entity
- Chronic degenerative tears ^{1,2}

- 1. Alteration of rotator cuff morphology or vascularity by extrinsic or intrinsic factors**
- 2. Older age group**
- 3. Chronic shoulder pain**

Traumatic tears^{3,4}

- 1. Acute traumatic event inciting tear**
- 2. Younger age group**
- 3. No previous shoulder pain**



Methods

- Patients undergoing arthroscopic repair of rotator cuff tears from July 2018 to April 2020 prospectively
- Group 1 - **Traumatic tears**: History of fall on outstretched arm or directly over shoulder, followed by pain and inability to abduct the shoulder joint
- Group 2 - **Non traumatic/degenerative**: rotator cuff tears with no clear history of trauma
- 69 patients(Group 1: 28, Group 2: 33) with MRI-proven full-thickness rotator cuff tears included
- Excluded 8 patients : 1) fracture around the shoulder, 2) received local steroid injections, 3) previous rotator cuff surgeries, 4) rheumatological disorders, 5) stiff shoulder or gleno-humeral arthritis



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Outcome parameters

- Clinical assessment:
 - Active abduction and active external rotation using a handheld goniometer
 - Shoulder abduction and external rotation strength measured by Isometer
 - Shoulder functional scores noted (Constant score), University of California at Los Angeles (UCLA) score, Disabilities of Arm Shoulder Hand (DASH) score, American Shoulder and Elbow Surgeons (ASES) scores)
 - MRI preoperatively and 2 years after surgery:
 - 1) Tear size (cm)⁵,
 - 2) Fatty degeneration (Goutallier grade)⁶,
 - 3) Muscle-tendon retraction (mm)⁷,
 - 4) Atrophy of supraspinatus.⁸



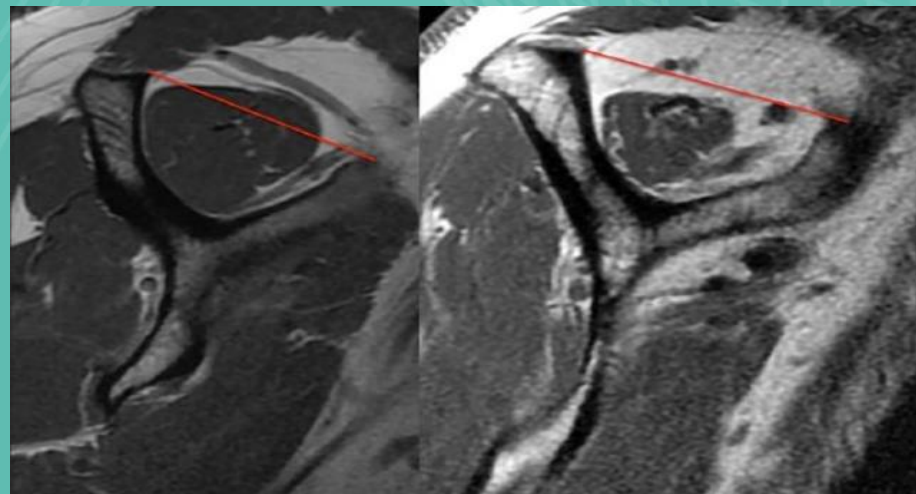
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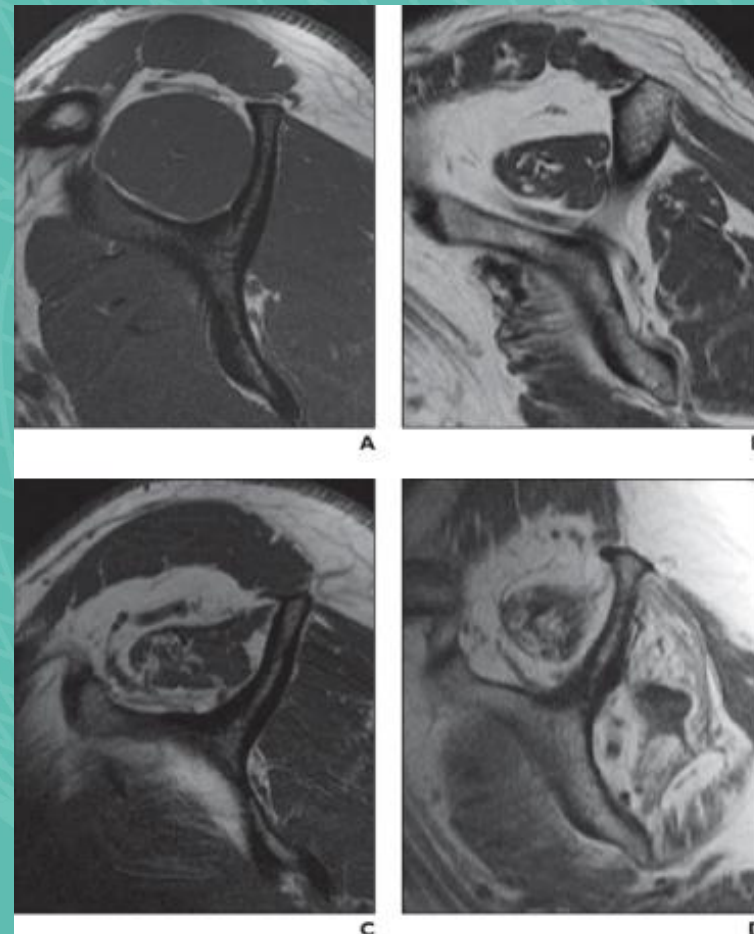
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Outcome parameters

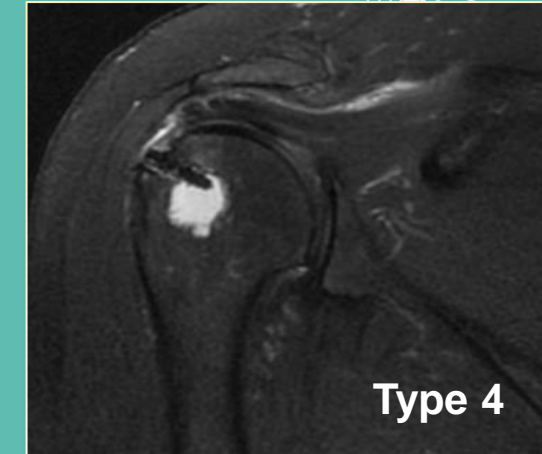
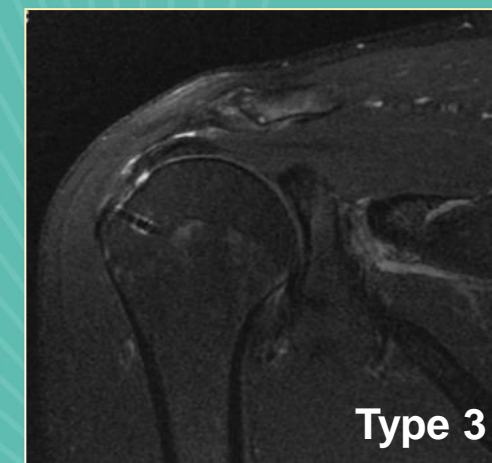
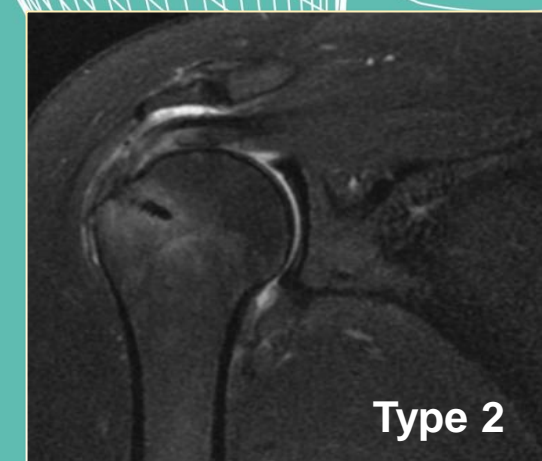
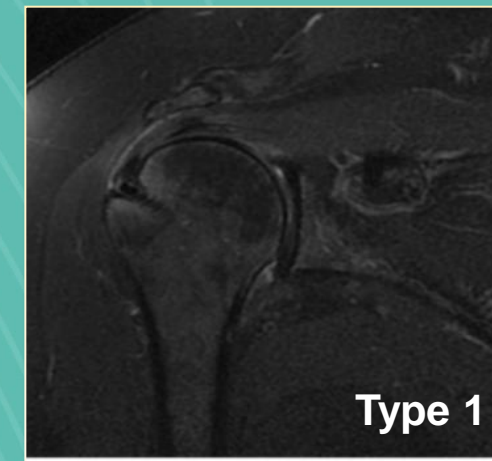
Atrophy of supraspinatus muscle by drawing tangent sign on the most lateral of the oblique sagittal image of MRI



Goutallier grading of fatty atrophy :
Grade 0-4
(A-D in picture)



Sugaya et al grading for rotator cuff repair healing in postoperative MRI



Sample size

- “a priori” power analysis
- Power of study ($1 - \beta$) was set at 80% and α at 0.05
- Minimum clinically significant difference in Constant score 10 points with a standard deviation of 10 points between subjects according to a previous study
- Minimum sample size for the constant score was 16 in each group

Table 1:
Demographic
table

	Traumatic (n=28)	Degenerative (n=33)	p value
Male	21	12	0.003
Female	7	21	
Age (Mean ± SD)	33.8 ± 12.4	51.3 ± 10.9	0.001
Duration of symptoms in months ((Mean ± SD)	4.5 ± 4.2	8.2 ± 6.7	0.01
Dominant, nondominant shoulder	20,8	18,15	0.494
SS, IS, SC tears	28, 11, 4	33, 15, 1	0.216

Footnote: SS-Supraspinatus, IS-Infraspinatus, SC- Subscapularis, SD- Standard deviation

Table 2:
Comparison of
tear
characteristics

Preoperative tear characteristics				
		Traumatic	Degenerative	p value
Tear size in cm (mean ± SD)		3.2 ± 1.29	2.57 ± 1.05	0.03
Tendon retraction in mm (mean ± SD)		8.7± 6.1	13.0 ± 7.3	0.01
Muscle atrophy according to tangent sign	Normal	5	2	0.001
	Mild	17	7	
	Moderate	3	18	
	Severe	3	6	
Fatty degeneration (Goutallier grade)	0	10	0	0.002
	1	3	4	
	2	15	27	
	3	0	2	
	4	0	0	
Postoperative tear characteristics				
Muscle atrophy according to tangent sign	Normal	7	2	0.001
	Mild	17	10	
	Moderate	2	15	
	Severe	2	6	
Fatty degeneration (Goutallier grade)	0	10	0	0.001
	1	3	8	
	2	15	23	
	3	0	2	
	4	0	0	

Table 3: Comparison of healing of rotator cuff			
Sugaya grades	Traumatic tears	Non-traumatic tears	p value
1	12	7	0.13
2	13	16	
3	2	6	
4	1	3	
5	0	1	

Table 4: Comparison of functional outcomes between the traumatic and non-traumatic group				
		Traumatic tears	Non-traumatic tears	p value
Constant score (mean ± SD)	Preoperative	33.82 ± 9.3	36.82 ± 7.9	0.179
	At 2 years follow up	82.64 ± 7.34	75.58 ± 9.56	0.002
UCLA score (mean ± SD)	Preoperative	15.21 ± 4.97	15.76 ± 6.0	0.705
	At 2 years follow up	32.3 ± 1.6	29.15 ± 3.2	<0.001
ASES score (mean ± SD)	Preoperative	35.2 ± 11.0	30.9 ± 11.0	0.136
	At 2 years follow up	85.4 ± 8.1	80.8 ± 8.0	0.028
DASH score (mean ± SD)	Preoperative	22.1 ± 15.11	25.94 ± 17.9	0.381
	At 2 years follow up	12.4 ± 6.1	15.8 ± 8.1	0.074
VAS score (mean ± SD)	Preoperative	6.9 ± 1.8	5.8 ± 1.7	0.01
	At 2 years follow up	2.2 ± 0.9	2.8 ± 1.1	0.02
Active abduction (degrees) (mean ± SD)	Preoperative	82.86 ± 43.3	97.4 ± 30.6	0.131
	At 2 years follow up	146.43 ± 14.4	135.1 ± 15.8	0.005
Active ER (degrees) (mean ± SD)	Preoperative	47.8 ± 22.2	58.48 ± 24.0	0.081
	At 2 years follow up	75 ± 12.76	70.9 ± 15.8	0.268
Abduction strength (pounds) (mean ± SD)	Preoperative	4.49 ± 2.19	5.4 ± 2.18	0.110
	At 2 years follow up	14.5 ± 2.68	12.67 ± 3.0	0.013
ER strength (pounds) (mean ± SD)	Preoperative	2.7 ± 1	2.88 ± 1.4	0.57
	At 2 years follow up	9.3 ± 2.4	7.5 ± 2.8	0.027
Footnote: SD- Standard deviation				

Discussion

- Higher proportion of male patients, patients with a lower mean age ($p=0.01$), and lesser duration of symptoms ($p=0.01$)
- **Most common mechanism of injury was fall**, in 15 out of 28 cases, followed by road traffic accidents (9 cases) and sports injuries (4 cases)
- Patients in group 1 had **significantly higher tear sizes ($p=0.03$)**, and **significantly lesser tendon retraction ($p=0.01$)**, **preoperative muscle atrophy ($p=0.001$)** and **preoperative fatty degeneration ($p=0.002$)**
- Postoperative mean active range of abduction ($p=0.005$), abduction strength ($p=0.013$), external rotation strength ($p=0.027$), UCLA score ($p<0.001$), Constant score ($p=0.002$), ASES ($p=0.028$) and Visual Analog Scale for pain ($p=0.02$) **were significantly better in group 1 as compared to group 2.**
- The postoperative structural integrity of the cuff on MRI was better in group 1 as compared to group 2, but the values didn't reach statistical significance ($p=0.13$).
- Tear size was found to be negatively correlating with postoperative Constant, ASES, and UCLA scores in both groups

Limitations

Relatively smaller sample size.

Overlap of acute on chronic tear cases in traumatic tear group.

Conclusion

Traumatic tears affect younger patients and while having larger tear size.

They have lesser muscle atrophy, fatty degeneration and tendon retraction.

Functional outcomes are better after treatment of traumatic tears as compared to degenerative tears.

Chronicity of the tear and tendon retraction negatively affected healing in traumatic cuff tears.

Muscle atrophy was found to be associated with poorer healing in non-traumatic tears, but tear size was not associated with healing.

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