



THE LINK OF ACROMION MORPHOLOGY TO ROTATOR CUFF TEAR IN ADDIS ABABA: A MATCHED, CASE-CONTROL STUDY IN ADDIS ABABA.

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Acronyms

AHD Acromio-humeral distance

MSK Musculoskeletal

MRA Magnetic Resonance Arthrography

MRI Magnetic Resonance Imaging

PACS Picture Archival and Computer System

RCT Rotator cuff tear

RIS Radiology Information System

SPHMMC St.Paul's Hospital Millennium Medical College

Abstract

Background: Rotator cuff tear (RCT) is a common cause of shoulder pain. Age, sex, side of the shoulder, trauma history, and acromion morphology are among the risk factors of RCT. However, there are controversies in the literature regarding the relationship between acromion morphology and RCT. To my knowledge, there is no study done in Ethiopia that explored the association between RCT and acromion morphology. The link between RCT and other possible risk factors are not evaluated either. Understanding this relationship will help both radiologists and orthopaedists in their choice of appropriate diagnostic and intervention approaches, respectively.

Objectives: To determine the link of RCT to acromion morphology and other possible risk factors using magnetic resonance imaging (MRI).

Methods: This is a retrospective, hospital-based, matched case-control study of patients who underwent shoulder MRI, at St. Paul's Millennium Medical College (SPHMMC) from October 2018 to September 2020. A total of 80 individuals, 40 cases (diagnosed with RCT) and 40 controls (not diagnosed with RCT) were recruited. Shoulder MRI image reports of cases and controls were reviewed from the Radiological Information system, based on which categorization into cases and controls, and characterization of acromion morphology were done. The relation of RCT to acromion morphology and other risk factors were examined using the McNemar test statistics and Conditional logistic regression procedure.

Results : The mean age in years for cases and controls is 42 and 43 respectively. Of those with rotator cuff tear the majority (60%) are between 40 and 60 years of age. Among cases, Type I, Type II, Type III, & type IV acromion account for 32.5%, 55%, 15%, and 2.5% respectively. Acromion Spurs, Os Acromiale, and acromio-humeral distance ≤ 7 mm are observed among cases than controls at McNemar test p value of <0.001 . Supraspinatus tear is the most common type of tear accounting for 81%. The age and sex matched univariate analysis didn't show any statistically significant association between the potential predictor variables and rotator cuff tear.

Conclusion and recommendation:

Side of the shoulder, type of acromion, acromial spur, and os acromiale didn't show any association with rotator cuff tear. Acromio-humeral distance adjusted for the aforementioned variables showed statistically significant association with rotator cuff tear with AOR of 0.6; 95% CI (0.41, 0.89); $p=0.01$.

INTRODUCTION

Shoulder pain is among the commonest presenting complaint at primary and sports-related health care facilities. The magnitude of shoulder pain in the general population is estimated between 16% to 34% (1,2). The supraspinatus, infraspinatus, teres minor, and subscapularis muscles and tendons together constitute the rotator cuff. These shoulder muscle groups stabilize and strengthen the most mobile joint in the human body. Rotator cuff pathologies are the primary reasons for patient visits due to shoulder pain (3,4).

Most RCTs are asymptomatic. And clinical evaluation is best to diagnose full-thickness tears in elder patients. Ultrasound (US) and Magnetic Resonance Imaging (MRI) are the imaging modality of choices to diagnose RCTs. US is the gold standard test to evaluate RCTs with a demonstrated high sensitivity by various studies. It also enables dynamic bedside evaluation of patients (5,6). The roles of MRI include characterization of the morphology of the acromion associated with RCTs (7), diagnoses of RCTs when supportive therapy fails, and evaluation of tears suspected on clinical examination. MRI enables accurate diagnosis of all full-thickness rotator cuff tear and most of the partial thickness tears. Preoperative assessments of the magnitude of the tear, tendon retraction, muscle atrophy, cross-sectional area, and fatty degeneration can be demonstrated by MRI. The standard shoulder MRI protocol usually contains 5 pulse sequences: sagittal oblique T1-weighted and fast spin echo (FSE) T2-weighted with fat saturation, axial FSE proton density and FSE T2-weighted with fat saturation, and coronal oblique FSE T2-weighted with fat saturation. Tendon discontinuity on T1Weighted imaging and high signal intensity on T2 weighted images are evidence for the presence of RCTs. Additional imaging findings include loss of subacromial fat plane on T1 weighted images, T2 high signal intensity in the subacromial space, and proliferative spur of the acromion or acromioclavicular joint (8,9).

Rotator cuff tear (RCT) is likely due to multifactorial causes. Based on cadaveric studies, the prevalence of RCT ranges from 5% to 34% (3, 4). Various studies have shown that both intrinsic and extrinsic factors are responsible for RCT. Accordingly, age, acromio-humeral distance(AHD),tendon hypo vascularity, smoking, tendon overload-overuse, trauma, and anatomic structures are among the main risk factors of RCT(3,10,11).

Statement of the problem

Rotator cuff tear is among the most frequent causes of shoulder pain. It's associated with loss of strength and stability(12). The magnitude of RCTs is different for different population groups. The observed prevalence also varies based on the modality of investigation used. Most patients with rotator cuff tears are asymptomatic. Clinical tests are best to diagnose full thickness rotator cuff tears and in those above the age of 60 years. In the absence of a clinically correlated imaging identification of Partial tears and individual rotator cuff tears is challenging. Most rotator cuff tears are accurately diagnosed by MRI. The sensitivity and specificity to diagnose complete tear is 100% and 95% respectively. The gold standard test for RCT is arthrography. Magnetic resonance arthrography have better sensitivity and specificity for diagnosing partial thickness tear than standard MRI(5,8).

According to one observational study the MRI based prevalence of RCTs among asymptomatic patients was 34%. It was shown to increase with age, observed in only 4 % of people younger than 40 years versus 54% of patients above the age of 60. Cadaver based studies, most of which don't specify, age groups reported a wide variability in the prevalence of rotator cuff tears which ranges between 5% to 34%(3,13).

Rotator cuff tears are multifactorial in etiology and the tears can be partial thickness or full thickness. It can be acute or chronic. Chronic tears can represent the combined effect of impingement and degenerative changes. Age, tendon hypo vascularity, smoking, tendon overload-overuse, trauma, and anatomic structures are the risk factors for RCT(3,10,11).However, there are controversies in the literature regarding the relationship between acromion morphology and rotator cuff tear. Based on one systematic review type III acromion or the hooked type is highly associated to rotator cuff tear than type I and II acromion types (14).Incidence of acromial types doesn't have any significant relationship with rotator cuff tear(15). According to our literature search, there is no study done in our setting that explored the association between rotator cuff tear and acromion morphology. Other possible risk factors are not evaluated either. Understanding this relationship will help both radiologists and orthopaedists in the choice of diagnostic and interventional approaches.

Significance of the study

Rotator cuff tear is caused by both intrinsic and extrinsic causes. There is an inconclusive relationship between types of acromion and rotator cuff tear. In our setting there is paucity of literatures on risk factors to rotator cuff tear, including the shape of the acromion. Hence the purpose of this study is aimed to provide evidence on the relationship between rotator cuff tear, acromion morphology and other predictor variables. The findings of this study will benefit both

radiologists and orthopaedists to ease the diagnostic and management choices of patients with rotator cuff tear respectively.

LITERATURE REVIEW

Rotator cuff tears are tears of either a single or a combination of the rotator cuff tendons- supraspinatus, infraspinatus, teres minor, and subscapularis tendons. The tear can be either full thickness or partial thickness. Partial thickness tears can further be divided into articular side (which is the most common), interstitial or bursal side tears(16,17).

The list of parameters that help determine treatment and predict prognosis of rotator cuff tear includes the length, depth or thickness and shape of the tear. The greatest dimension or length of a full thickness tear can be classified as small(<1cm), medium(1cm to 3 cm), large(3-5 cm), or massive(>5cm). The normal rotator cuff is 10-12 mm thick. Partial thickness tears are graded based on their thickness as grade 1(<3mm), grade 2(3 -6mm), or grade 3(>6mm).

Grade 3 partial thickness tears involving more than 50% of the tendon thickness require surgical repair. The effect of the tear on adjacent structures, the presence of muscle atrophy, the size of muscle cross sectional area, presence of fatty degeneration influence the functional status of the rotator cuff(18).

Most RCTs are asymptomatic and hence their true magnitude is little understood(19,20). The prevalence shows wide variability across diagnostic modalities or population groups(8). Based on one observational study using MRI the prevalence of RCTs among asymptomatic patients was 34%. It was shown to increase with age, observed in only 4 % of people younger than 40 years versus 54% of patients above the age of 60. Tear of the supraspinatus tendon is the most common accounting for about 75% among rotator cuff tendon tears. Cadaveric analysis, most of which don't specify age groups, reported a wide variability in the prevalence of rotator cuff tears which ranges between 5% to 34% (4,13). Another MRI based study done in Kenya revealed 27.8% prevalence of rotator cuff tear among patients with shoulder pain. Supraspinatus tear was found to be the most common(21).

Though multiple risk factors have been identified as a cause to rotator cuff tear there is still no consensus statement regarding the pathogenesis(22). The risk factors can be intrinsic, extrinsic or both. They include, tendon hypo vascularity, degenerative changes, hand dominance, older age, acromio-humeral distance, smoking, tendon overload-overuse, trauma, shape of the acromion, and spur formation (10,11,23). Reduced acromio-humeral distance (AHD) which is ≤ 7 mm is correlated with tendon tear and fat muscle atrophy(24).

There are four types of acromial morphology. Type I describes a flat shape, Type II is curved, and Type III is hooked, and Type IV describes a convex inferior surface. The respective magnitude of this acromion types is 40.1%,28.2%,23.8%,and 7.9% respectively. Various studies have investigated the relationship between acromial morphology and rotator cuff tear and findings are inconsistent(17,25). In one systematic research, it was stated that patients with a Type III (hooked) acromion are three times more likely to experience RCTs than patients with Type I or Type II acromia(26).

Considering accuracy, cost, and safety Ultrasound is regarded as the best non-invasive option to diagnose rotator cuff tear(6) a recent metanalysis concluded that highest diagnostic value is accrued using Magnetic Resonance Arthrography, and high field MRI was found to be superior to Ultrasound. Given the potential risk/cost of MRA, the operator dependency and the steep learning curve of US, MRI is considered as the modality of choice to diagnose rotator cuff tears(27).

Based on literature reviews, there is no published study on the relationship between rotator cuff, acromion morphology and other risk factors in an Ethiopian population. Hence the present study is aimed to analyse this relationship among adult patients who underwent Shoulder MRI examination in St. Paul's Hospital Millennium Medical College.

OBJECTIVES

General Objectives

- To determine the link of RCT to acromion morphology among patients who presented with shoulder pain and underwent MRI at SPMHMC, Addis Ababa, from October 2020 to September 2020.

Specific objectives

- To determine the distribution of acromion types among patients who present with shoulder pain and underwent shoulder MRI.
- To determine the relationship between acromion types and rotator cuff tear.
- To determine the relation of patients' sociodemographic factors to RCT.

METHODOLOGY

a) Study setting

The study is conducted at SPHMMC, which is one of the tertiary referral hospitals directly under the Federal Ministry of Health. It provides clinical (medical) services as well as teaching and training on various health fields at both undergraduate and postgraduate levels. The hospital serves about a quarter of a million people annually who are referred from all parts of the country. The department of diagnostic and interventional radiology provides service to about 20% of the annual outpatient visits. Of the available diagnostic modalities, MRI examination carries about a fifth of the patient burden to the imaging unit. The annual average number of shoulder MRIs performed accounts to about 1% of patient visits to the MRI unit.

b) Study population

- **Source Population:** All patients who undergo Shoulder MRI examination for shoulder pain in Ethiopia
- **Target Population:** All patients who undergo shoulder MRI examination in SPMMC and its catchment facilities.
- **Study Population:** All patients who undergo shoulder MRI examination at SPMMC between October 2020 and September 2020.

c) Study Design, Sample Size and Sampling Procedure

The design of the study is case-control, i.e. a hospital-based, retrospective, matched case-control study of patients who came for Shoulder MRI to SPMMC between October 2018 and September 2020.

The study includes a total sample of 80 individuals, 40 cases and 40 controls, who presented at SPMMC with shoulder pain complaint. The assumptions used in the sample size calculation are: a) case:control ratio: 1 to 1, b) power 80%, c) two-tailed 95% confidence interval (0.05 type I error), and d) acromion hooked acromion morphology considered as the main exposure variable of interest and its prevalence has been reported to 44% and 20% among individuals with and without RCT, respectively. Our selection of hooked acromion morphology as the main exposure variable is guided by the literature. The following formula is used for the statistical calculation of the sample size.

$$n = \left(\frac{r+1}{r}\right) \frac{(\bar{p})(1-\bar{p})(Z_{\beta} + Z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

$$p_{caseexp} = \frac{OR p_{controlsexp}}{p_{controlsexp}(OR-1)+1}$$

Where

n= sample size for cases

For 80% power, $Z_{\beta}=0.84$

For 0.05 significance level, $Z_{\alpha}=1.96$

$r=1:1$ (controls:cases) ratio of controls to cases

The proportion exposed in the case group (hooked morphology among cases) is 44% - P_1 (case exposed)

The proportion of controls exposed(hooked morphology among controls)= 20%- P_2 (controls exposed)

Average proportion (case and control) exposed = $(.44+.20)/2=.64/2=0.32$ - $\bar{p}$

According to one systematic review, the odds of individuals with hooked acromion is three times more than type I or type II acromia- OR

$$n = \left(\frac{4+1}{1}\right) \frac{(0.32)(1-0.32)(0.84+1.96)^2}{(0.44-0.2)^2}$$

Sample size for controls (ncontrols) is four times sample size for case: (ncases) ncases=40 and ncontrols=40

d) Selection of cases and controls

Classification of study participants into cases and controls was done based on whether the study participants were diagnosed with RCTs during the study period, October 2018 to September 2020. The diagnosis of rotator cuff tear was done by evaluating the patients' images of shoulder MRI, based on the result of which individuals with RCT were categorized as cases and individuals with no RCT categorized as non-cases (potential controls). The evaluation of shoulder MRI images was done by the principal investigator radiologist, checked and confirmed by a senior expert. Any disagreement between the two evaluators was resolved by consensus or invitation of a third evaluator. In addition to the shoulder MRI images, the patients need to fulfil the study's predefined inclusion and exclusion criteria to be included in the study.

Inclusion Criteria:

- Shoulder MRI examination of patients at SPHMMC between October 2020 and September 2020.

Exclusion criteria:

- Poor quality patient records (poor quality shoulder MRI, inappropriately protocolled shoulder MRI), irretrievable shoulder MRI images and reports from the PACS (picture archival and computer system) and the RIS (radiology information system) respectively

Cases who fulfilled all eligibility criteria were included sequentially. For each case included in the study, one control (matched by age and sex) was selected from those diagnosed with no RCT and fulfilled the study's eligibility criteria. The age matching was done by 5-years intervals.

e) Variables definitions

The outcome variable of the study is RCT. The main exposure variables are a) age, b) sex, c) acromion morphology and d) other information as shown in the questionnaire annexed with this proposal. The relation of the exposure variables to the outcome variable (RCT) as well as among themselves is shown by figure 1 (conceptual framework of variables relationship). Besides, a detailed operational definition of the variables is provided in the following table 1.

Table 1. 1Operational Definition of Variables

Variable	Definition	Measurement method	type	scale	Scale range
Rotator cuff tear	Rotator Cuff Tear: - tear of one or a combination of the four rotator cuff tendons supraspinatus, infraspinatus, teres minor, and subscapularis tendons. It can be: - a) Full Thickness Tear or Partial Thickness tear which is either articular sided or interstitial or else bursal sided		Nominal	Categorical	2 categories
Age	Age of the patient	years	Ratio	Continuous scale	Continuous
Sex	Sex of the patient		Nominal	Categorical	2 categories
Acromion Morphology	refers to the shape of the acromial surface that is described as flat (Type I), curved (Type II), hooked (Type III), or convex (Type IV)		Nominal	Categorical	4 categories
Side of the sholder	Refers to the affected side of the sholder		Nominal	Categorical	2 categories

Acromion spur		Nominal	Categorical	2 categories
Acromio-humeral distance	The shortest interval between the acromion and humeral head. It can be measured either in coronal or sagittal oblique views of T1 MR images	Scale	Continuous	Continuous
Muscle atrophy		Nominal	Categorical	2 categories
Fat infiltration		Nominal	Categorical	2 categories

f) Data Collection Procedure and quality assurance

Tool (Questionnaire) development: guided by the literature a data extraction sheet was developed in English language. The tool included the main variables of interest and other information like information about the purpose of study, ethical approval status and the researchers involved in the study.

Data abstraction: Shoulder MRI examination reports from the radiology information system was retrieved, images of respective patients was reviewed by the principal investigator and the MSK radiology subspecialist. The MRI images were examined by two experts, working together independently. Any discrepancy between the two evaluators was resolved by consensus or invitation of a third evaluator. Existing reports of the images was handled in a blinded fashion to determine if and whether the findings exist.

Data quality assurance: Before starting the data extraction, a brief orientation was done on the contents of the tool and how to use it in a uniform and standardized way.

g) Data management and Analysis Approaches

The data was entered and cleaned using Statistical Package for the Social Sciences (SPSS version 23) for statistical analysis.

Before running any statistical test of association, the fulfilment of valid statistical assumptions were checked first. These assumptions included normality test for the logit transformation of RCT, normality of distribution for continuous variables, multi-collinearity among continuous independent variables, and homogeneity of variance. Then, bi-variable analyses was done between rotator cuff tear and each exposure variable of interest, using independent t-test for continuous variables and Chi-square test of association for categorical variables. The bi-variable analyses were used to determine the unadjusted relationships between the exposure variables and RCTs. It also serves to select variables that need to be

included in the final analyses, multivariable logistic regression analysis. Variables which demonstrated p-values ≤ 0.20 during the bi-variable analyses were included in the final multiple logistic regression analysis. The variables were entered into the model based on their inter-relationships as shown in figure 1. Potential interactions among the exposure variables were checked and interaction terms added in the model if statistically necessary, to provide estimates by subgroups if an interaction was found. Where no adequate evidence of interaction is observed, only the main variables were entered in the multiple regression model. McNemar test statistics and Cox regression procedures were used to handle the 1-1 matched case control data. Statistical significance of variables in the final model were determined at p-value < 0.05 . Adjusted odds ratios (AORs), with 95% CI, were reported on the link of the exposure variables to rotator tear.

h) Ethical clearance

Ethical clearance was obtained from SPHMMC's research review board. As this is a record review anonymity, privacy and confidentiality of records was respected. There was not any risk or benefit that went to individuals of the record.

i) Dissemination of Results

The findings of this study will be shared with all relevant bodies at SPHMMC and other health facilities. The key findings will be shared with the Federal Ministry of Health of Ethiopia and other stakeholders. Poster/Oral presentations will be made to Ethiopian Society of radiologists /Orthopedists. Publications will be made in a peer-reviewed international journal.

RESULTS

Sample characteristics of Cases and Controls

Forty patients with rotator cuff tear were included in this study. They were 21 males and 19 females. A control group of forty controls matched for age and sex with normal shoulder MRI were included in the study. The age matching was done by 5-years intervals.

A Shapiro-Wilk's test and a visual inspection of their histograms, normal Q-Q plots and box plots showed that the length and thickness of rotator cuff tears were approximately normally distributed for both males and females.

The mean age in years for cases and controls is 42 and 43 respectively. Of those with rotator cuff tear the majority (60%) are between 40 and 60 years of age. Among cases, Type I, Type II, Type III, & type IV acromion account for 32.5%, 55%, 15%, and 2.5% respectively.

Acromion Spurs, Os Acromiale, and acromio-humeral distance ≤ 7 mm are observed among cases than controls at McNemar test p value of <0.001 . Supraspinatus tear is the most common type of tear accounting for 81%. Partial thickness tear was more common than full thickness tear with a percentage of 34% and 8.8% respectively. Articular sided partial thickness tears account for 50% of partial thickness tears.

Table 2. 1 Sociodemographic and Morphologic Profile of Cases and Controls

Variable		Cases(%)	Control(%)	p-value (McNemar-Bowker test)
Age Category in Years	<40	14(35)	16(40)	
	40-60	24(60)	23(57.5)	
	> 60	2(>2.5)	1(2.5)	
Sex	Male	21(52.5)	21(52.5)	0.88
	Female	19(47.5)	19(47.5)	
Side of the Shoulder	Right	27(67.5)	27(67.5)	0.04
	Left	13(32.5)	13(32.5)	
Acromion Type	Type I	13(32.5)	16(40)	
	Type II	22(55)	16(40)	
	Type III	6(10)	6(15)	
	Type IV	2(2.5)	2(5)	
Acromion Spurs	No	29(72.5)	35(87.5)	<0.001
	Yes	11(27.5)	5(12.5)	
Os Acromiale	No	37(92.5)	40(100)	<0.001
	Yes	3(7.5)	0(0)	
AHD Category	> 7 mm	27(67.5)	39(95.5)	<0.001

≤ 7 mm	13(32.5)	1(2.5)
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Value of p is significant at $p < 0.05$; highly significant at $p < 0.001$

Table 3. 1 Factors by Rotator Cuff tear

Variables		Supraspinatus tear		Type of rotator cuff tear				Type of partial tear					
				Full thickness		partial thickness		articular side		interstitial		bursal side	
		n	%	n	%	n	%	n	%	n	%	n	%
Age category	<40	13	43	2	14	12	86	3	25	2	17	7	58
	40-60	19	40	4	17	17	71	11	73	2	13	2	13
	>60	2	67	1	50	1	50	0	0	1	100	0	0
sex	male	17	45	4	21	14	74	6	43	1	7	7	50
	female	17	40	3	14	16	76	8	57	4	29	2	14
Acromion type	type 1	11	38	1	8	11	85	4	44	1	11	4	44
	type 2	20	53	4	18	16	73	8	50	4	25	4	25
	type 3	3	30	1	25	3	75	2	67	0	0	1	33
	type 4	0	0	1	100	0	0	0	0	0	0	0	0
AHD category	>7 mm	22	33	3	11	21	78	11	58	2	11	6	32
	≤ 7 mm	12	86	4	31	9	69	3	33	3	33	3	33
Side of Shoulder	left	14	54	12	45	1	8	2	15.4	6	60	1	10
	right	22	41	6	22	20	74	8	44	4	22	6	33

AHD-acromio humeral distance

Univariable Conditional Logistic Regression Analysis

The age and sex matched univariate analysis didn't show any statistically significant association between the potential predictor variables and rotator cuff tear (Table 3).

Multivariable Conditional Logistic Regression Analysis

Side of the shoulder, type of acromion, acromion spurs, and os acromiale don't show any statistically significant association with rotator cuff tear. Acromio-humeral distance adjusted for the aforementioned variables show statistically significant association with rotator cuff tear with AOR of 0.6; 95% CI (0.41, 0.89); $p = 0.01$. Os Acromiale which is observed in 7.5% of the cases but not among controls showed a very large odds ratio possibly due to small data or sparse data bias. This is also observed under univariate conditional logistic regression.

Table 3. 2 Distribution of Potential Risk Factors among Cases and Controls

Variable		Cases (%)	Control s(%)	Univariate Analysis			Multivariate Anallysis		
				COR	95% CI		AOR	95% CI	
Side of Shoulder									
	Left	27(67.5)	27(67.5)						
	Right	13(32.5)	13(32.5)	1	0.35	2.85	2.41	0.44	13.42
Acromion Type									
	Type I	13(32.5)	16(40)						
	Type II	22(55)	16(40)	1.73	0.66	4.57	2.20	0.64	7.60
	Type III	6(10)	6(15)	0.78	0.21	2.87	0.47	0.08	2.87
	Type IV	2(2.5)	2(5)	0.71	0.06	8.66	0.92	0.06	14.81
Acromial Spurs									
	No	29(72.5)	35(87.5)						
	Yes	11(27.5)	5(12.5)	3	0.81	11.08	4.32	0.71	26.44
Os Acromiale									
	No	37(92.5)	40(100)						
	Yes	3(7.5)	0(0)	65	0.01	70k*			
AHD				0.61	0.42	0.86	0.60	0.41	0.89

AOR-adjusted Odds Ratio; COR-Crude Odds Ratio at level of significance $p < 0.05$; Cases and controls matched for Age (± 5 years) and Sex AHD acromio humeral distance

*sparse data bias

DISCUSSION

Single tendon or a combination of rotator cuff tendon tears are observed in the present study. The tendon affected the most is supraspinatus. Partial thickness tears are more prevalent than full thickness tears. Of these, the acromioclavicular joint is observed to be the most common. These observations have similarly been observed in other studies(16,17).

According to this study the majority of patients with RCT (60%) are between 40 and 60 years of age, and 35% were among those below 40 years, and this finding is contrary to literatures that showed a 4 % and 54% magnitude of RCT among patients below 40 years and above the age of 60 respectively(13).

Based on this study the most common type of acromion shape is the curved one constituting 55% and this is unlike the review of literature that showed the flat type to be the most common accounting for 40.1%(25).

Several variables, including acromion shapes, didn't show any statistically significant association with rotator cuff tear .except acromio-humeral distance which showed statistically significant association with rotator cuff tear with AOR of 0.6;95% CI (0.41,0.89);p=0.01.

Limitation

Cases were selected from St.Paul Hospital only, and though the prevalence of Rotator cuff tears is reportedly not low, the available number of cases included in this study was small. Even a matched case control study which is handled by conditional logistic regression suffers from biases related to small sample size and sparse data. As a possible consequence to the small sample size the calculated power of the present study is below 80%. Hence, to understand the link between types of acromion and other potential factors to rotator cuff tear there is a need to add more cases waiting for more time or include patients from other centers.

CONCLUSION AND RECOMMENDATION

This study has identified the association between acromio-humeral distance and rotator cuff tear. No association is identified between acromion shape and rotator cuff tear; Side of the suspected shoulder, Acromial spurs, and Os acromiale were also found to have no link with rotator cuff tear. The failure to observe a potential association might have resulted from problems related to small sample size and sparse data. Given their contribution to evidence based medicine or public health, the potentially unobserved findings, of this study call for further research work on the same. The evidence will have solid contribution in the treatment of a particular patient, or in the introduction of public health measures to prevent or introduce interventions

ANNEX

Annex I:

A. Questionnaire

Purpose of the study : To determine the link of RCT to acromion morphology among patients who presented with should pain and underwent MRI at SPMHMC, Addis Ababa, from October 2020 to September 2020.

Investigator(s): PI and Adviors -Drs.Kumlachew Abate and Shewalem Negash respectively

S N	Card #	Age (in yrs.)	Sex	Side of the shoulder	Acromi al spurs	Os Acr omi ale	Acromion Type	Acromio- humeral distance in mm	Muscle atrophy	Rotator Cuff Tear		Length of FTT in cm	ACjoin t degener ation	Biceps tendon
									Fat Infiltrati on			Thickn ess of PTT in mm		
			1. M 2. F	1.Right 2.Left	1. Yes 2. No	1 . Y e s 2 . N o	1. Type I 2. Type II 3. Type III 4. Type IV		1. Yes 2. No 1. Yes 2. No	1. Supraspinatus 2. Infraspinatus 3. Teres minor 4. Subscapularis 5. Two or more of the above (specify)	1.Fulll thickness(FTT) 2.Partial thickness (PTT) If 2;specify a. Articular side b. Interstitial c. Bursal side		Normal mild modera te severe	Normal Split tendino sis
1.														
2.														
3.														
4.														
5.														

B. Data Abstraction Tool-Shoulder Joint MRI Reporting Checklist *

- Humeral head -configuration and articulation status with the normally developed glenoid.
- Articular surfaces- smoothness and cortical thickness.
- The width of the joint space and presence of fluid
- Bone marrow-homogeneity, fat-equivalent signal intensity.
- Glenoid labrum- intactness on all sides.
- Acromioclavicular joint-configuration, hypertrophy of capsule, joint space narrowing, and or osteophytes
- Subacromial fat- intactness.
- Muscles comprising the rotator cuff-course, configuration, and signal characteristics. Muscle atrophy/fat infiltration
- Biceps tendon-intactness, position in the bicipital groove; split; tendinosis
- Status of other muscles that cover the shoulder joint and other imaged portions of the lungs and soft tissues-shape, position, and signal abnormality

**report checklist is modified from the St.Pauls reporting template in the radiological information system, and aligned with normal Findings in CT and MRI ,2000*

Annex II: Common Types of Rotator Cuff Tears

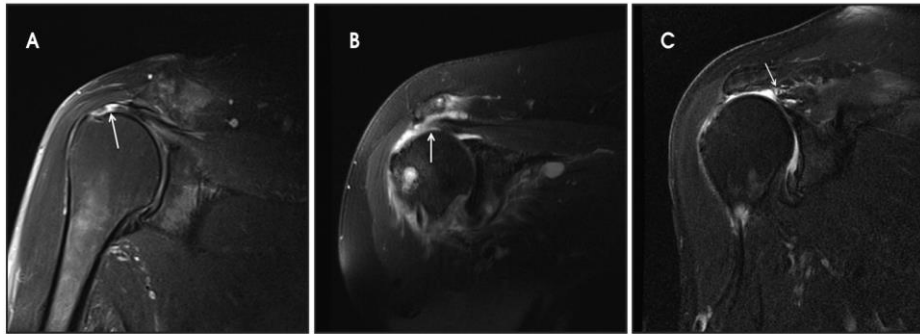


FIGURE 1. (A) Coronal oblique T2-weighted (T2W) images demonstrate full thickness tears (arrow) near the humeral insertion, (B) with tendon retraction to the level of the humeral dome (arrow), and (C) with tendon retraction to the level of the glenoid (arrow).

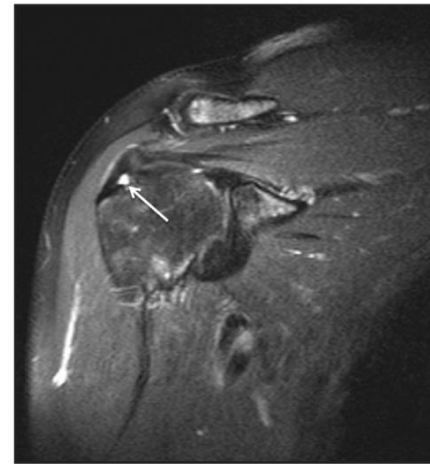


FIGURE 2. Coronal oblique T2W image shows a partial thickness tear (arrow) of the articular-sided fibers that involves <50% of the tendon; overlying bursal-sided fibers remain intact.

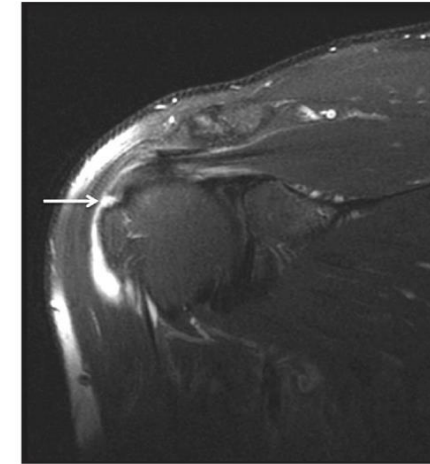
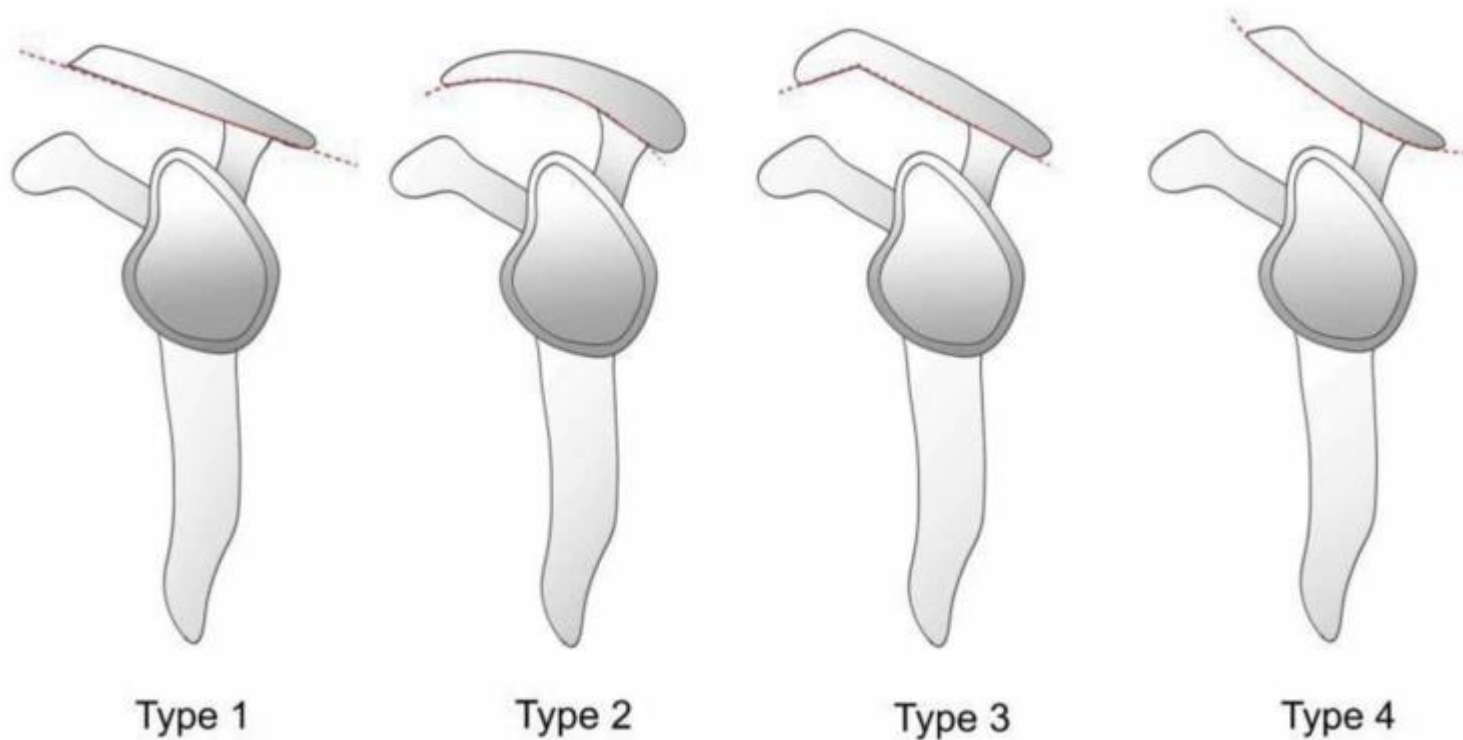


FIGURE 3. Coronal oblique T2W image demonstrates a large partial thickness tear of the bursal-sided fibers (arrow) that involves >50% of the tendon; a few remaining articular-sided fibers remain intact.

Annex III: Types of Acromial Shapes



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