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MRI EVALUATION OF ROTATOR CUFF BETWEEN DIABETIC AND NON-DIABETIC PATIENTS WITH SHOULDER PAIN

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Abstract

Background: *The rotator cuff is a group of muscles and tendons that stabilize the shoulder joint and enable its movement. Rotator cuff disorders, including tendon tears, degeneration, and fatty infiltration, are common causes of shoulder pain, particularly among diabetic individuals. Diabetes mellitus (DM) is a key risk factor, as chronic hyperglycemia and metabolic dysfunction can accelerate tendon degeneration and impair healing. The rising prevalence of DM and its impact on musculoskeletal health underscores the need for early detection and targeted interventions.*

Objective: *To evaluate the structural differences of the rotator cuff on MRI between diabetic and non-diabetic patients with shoulder pain and to assess the prevalence and severity of tendon pathology.*

Methodology: *This cross-sectional comparative study was conducted at [Obaid Noor Hospital, Mianwali. A total of 52 participants with shoulder pain were enrolled using convenient sampling. After obtaining informed consent, demographic data, clinical history, and risk factors were recorded. MRI of the affected shoulder was performed using standard protocols. Images were analyzed by two experienced radiologists to assess tendon tears, tendon degeneration, muscle atrophy, and fatty infiltration. Data were analyzed using SPSS version 21.*

Results: *The study included 80 participants, with a majority being male (63.7%) and middle- aged (51–60 years, 42.5%). Most participants were diabetic (63.7%) and experienced right-shoulder pain (65.0%), with pain duration commonly lasting four months (25.0%). MRI findings were abnormal in 65.0% of participants, with 65.0% showing rotator cufftears, predominantly partial tears, and Grades II and IV being most frequent. Associated findings were present in 53.8%, highlighting the overall high prevalence of shoulder pathology in the study population.*

Conclusion: *The study concludes that diabetes significantly increases the prevalence and severity of rotator cuff pathology. Early screening using MRI, along with targeted preventive and therapeutic strategies, is essential to reduce functional impairment and improve shoulder outcomes in diabetic patients.*

Introduction

Shoulder pain represents one of the most common musculoskeletal complaints in clinical practice, with rotator cuff pathology being a predominant etiology. The rotator cuff, a confluence of four tendons (supraspinatus, infraspinatus, teres minor, and subscapularis), is critical for glenohumeral stability and movement. Concurrently, Diabetes

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Mellitus (DM) has reached epidemic proportions globally and is recognized not only as a metabolic disorder but as a systemic disease with profound musculoskeletal consequences. A growing body of evidence suggests a significant association between diabetes and an increased prevalence, severity, and rate of progression of rotator cuff disorders. This research synopsis aims to investigate this association through a comparative Magnetic Resonance Imaging (MRI) evaluation of the rotator cuff in diabetic versus non-diabetic patients presenting with shoulder pain. MRI, as the gold standard for soft-tissue imaging of the shoulder, provides unparalleled detail of tendon integrity, morphology, and associated pathological changes, making it an ideal tool for this comparative analysis (1).

The rotator cuff is a group of four muscles and their tendons that surround the shoulder joint, providing stability and enabling a wide range of rotational movements. Rotator cuff pathology encompasses a spectrum of conditions, including tendinosis (degenerative change), partial-thickness tears, full-thickness tears, and associated conditions like subacromial impingement and bursitis. Diabetes Mellitus is a chronic metabolic disorder characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both Shoulder pain affects approximately 7-26% of the general population at any given time, with rotator cuff tears being a leading cause, showing an age-related increase. The prevalence of full-thickness rotator cuff tears rises from under 10% in those under 50 to over 50% in individuals over 80. Diabetes mellitus affects over 537 million adults globally, with projections indicating a continued rise. Critically, the prevalence of shoulder pain and rotator cuff disease in diabetic patients is markedly higher, with studies indicating that diabetics are 2-3 times more likely to develop rotator cuff tears compared to their non-diabetic counterparts (2).

For rotator cuff disease, general risk factors include advancing age, repetitive overhead activities, occupational stressors, smoking, and genetic predisposition. In diabetic patients, specific additional risk factors exacerbate this risk Longer disease duration and poorer glycemic control (elevated HbA1c) correlate strongly with increased severity of tendon pathology. The presence of retinopathy, nephropathy, or neuropathy is often associated with more severe musculoskeletal manifestations. Frequently comorbid with type 2 DM, these conditions contribute to systemic inflammation and mechanical load (3).

The pathogenesis of rotator cuff tears in the general population is multifactorial, involving intrinsic degeneration (age-related hypovascularity, mechanical stress) and extrinsic factors (subacromial impingement). In diabetes, this process is accelerated and intensified through several interconnected mechanisms of Chronic hyperglycaemia promotes the non-enzymatic glycation of collagen fibers. Accumulation of AGEs within tendon tissue leads to cross-linking, resulting in increased tendon stiffness, loss of elasticity, and reduced tensile strength, making the tendon more susceptible to tearing. Diabetic microvascular disease compromises the already tenuous blood supply to the rotator cuff tendons (particularly the "critical zone" of the supraspinatus), leading to chronic hypoxia, impaired nutrient delivery, and reduced capacity for repair. Diabetes is a pro-inflammatory state. Elevated levels of cytokines (e.g., TNF-α, IL-6) can promote tendon matrix degradation and inhibit the function of tenocytes, the cells responsible for tendon maintenance and repair. Diabetic neuropathy may alter shoulder biomechanics and proprioception, leading to abnormal joint forces and contributing to degenerative changes (4).

Diagnosis relies on a combination of clinical assessment (history, physical examination including specific provocative tests like the Neer and Hawkins tests) and imaging. While ultrasound is a valuable dynamic and accessible tool, Magnetic Resonance Imaging (MRI) is the definitive non-invasive investigation for suspected rotator cuff pathology. It provides excellent soft-tissue contrast, allowing for detailed assessment of: Precise delineation of partial-thickness vs. full-thickness tears, including tear size, retraction, and morphology. Evaluation of muscle atrophy and fatty infiltration (Goutallier classification), which are critical prognostic factors for surgical outcomes and are suggested to be more severe in diabetics. Identification of associated

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findings like subacromial bursitis, labral tears, and osteoarthritis (5).

Management is tailored to the severity of the tear, patient symptoms, and functional demands. Options range from conservative treatment (physical therapy, activity modification, corticosteroid injections, and glycemic control optimization in diabetics) to surgical intervention (arthroscopic or open repair). Evidence indicates that diabetic patients often have poorer functional outcomes post-surgery, higher re-tear rates, and increased complication rates (e.g., infection, stiffness), highlighting the need for careful patient selection and preoperative optimization (6).

Despite established clinical observations of a link between diabetes and shoulder disorders, there is a need for detailed, imaging-based comparative studies that objectively quantify the differences in rotator cuff pathology. Existing literature often relies on clinical diagnoses or ultrasound. A dedicated comparative MRI study can provide higher-level evidence by Quantifying if full-thickness tears, tear size, and retraction are more common in diabetics. Assessing if diabetic patients exhibit more advanced stages of muscle atrophy and fatty infiltration, which significantly impact treatment options and prognosis. Identifying if there are specific morphological patterns of tearing associated with diabetic tendonopathy. The findings can guide clinicians in having a higher index of suspicion for severe rotator cuff pathology in diabetic patients with shoulder pain, potentially leading to earlier imaging, more tailored counseling, and optimized management strategies that account for the underlying diabetic pathophysiology. Therefore, this study aims to compare the MRI findings of the rotator cuff in diabetic and non-diabetic patients presenting with shoulder pain to elucidate the distinct imaging characteristics and severity of tendon pathology in the diabetic population.

Material and method

This study employed a comparative cross-sectional analytical design conducted over four months at MRI-equipped diagnostic centers in Lahore. A calculated sample size of 52 participants was selected using a non-probability consecutive sampling technique. Inclusion criteria comprised adults aged 30-70 years, of any gender, with shoulder pain lasting over one month and a confirmed diagnosis of diabetes. The comparative non-diabetic group consisted of age- and gender-matched patients with shoulder pain but no diabetes. Exclusion criteria included prior shoulder surgery, trauma, inflammatory arthritis, malignancy, systemic infection, pregnancy, or long-term corticosteroid use.

RESULTS

Table 1: Demographic and Clinical Characteristics of the Study Cohort (n=80)

This table summarizes the baseline demographic and clinical profiles of the participants. The cohort predominantly consisted of middle-aged (51–60 years) males. A significant majority (63.7%) were diabetic patients, and right shoulder pain was more commonly reported. Most participants reported a pain duration of 3 to 6 months.

Characteristic	Category	Frequency (n)	Percent (%)
Age Group	Young Adults (≤50)	28	35.0
	Middle-aged (51–60)	34	42.5
	Older Adults (>60)	18	22.5
Gender	Female	29	36.3
	Male	51	63.7
Diabetes Status	Non-Diabetic	29	36.3
	Diabetic	51	63.7
Pain Duration	2-4 Months	50	62.5
	5-7 Months	30	37.5
Shoulder Involvement	Left Shoulder	28	35.0

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	Right Shoulder	52	65.0

Table 2: Prevalence of MRI Findings and Rotator Cuff Tears

This table presents the primary outcome of MRI evaluation. Abnormal MRI findings were common, present in 65% of participants. A rotator cuff tear was identified in the same proportion (65%), confirming it as the principal pathology. Among those with a tear, partial-thickness tears were more than twice as common as full-thickness tears.

MRI Finding	Category	Frequency (n)	Percent (%)
Overall MRI Result	Normal	28	35.0
	Abnormal	52	65.0
Rotator Cuff Tear	Absent	28	35.0
	Present	52	65.0
Tear Type	Partial Tear	52	65.0*
	Full-Thickness Tear	28	35.0*
*Percentages are calculated from the 52 participants with a tear present.			

Table 3: Severity of Rotator Cuff Tears According to Grading

This table details the severity distribution of rotator cuff tears using a grading system. While 35% of the cohort had no tear (Grade 0), the remaining 65% exhibited a spectrum of severity. The findings show a notable prevalence of higher-grade pathology, with Grades II and IV together accounting for 45.1% of all participants.

Tear Grade	Description	Frequency (n)	Percent (%)
Grade 0	No Tear	28	35.0
Grade I	Mild / Partial Tear	16	20.0
Grade II	Moderate / High-Grade Partial Tear	19	23.8
Grade IV	Full-Thickness Tear	17	21.3

Table 4: Association Between Diabetes and Rotator Cuff Pathology

This cross-tabulation compares key pathological findings between diabetic and non-diabetic participants. Diabetic patients exhibited a markedly higher prevalence of abnormal MRI findings and rotator cuff tears. The presence of associated findings (e.g., tendinosis, bursitis, muscle atrophy) was also more frequent in the diabetic group.

Pathological Finding	Diabetic Patients (n=51)	Non-Diabetic Patients (n=29)
Abnormal MRI Finding	40 (78.4%)	12 (41.4%)
Rotator Cuff Tear Present	40 (78.4%)	12 (41.4%)
Associated Findings Present	32 (62.7%)	11 (37.9%)

DISCUSSION

This study aimed to evaluate and compare the MRI findings of rotator cuff pathology in diabetic and non-diabetic patients presenting with shoulder pain. The results confirm a significant association between Diabetes Mellitus and a higher burden of structural shoulder disease, offering critical imaging-based evidence to support clinical

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observations. The most salient finding is the substantially higher prevalence of abnormal MRI results and rotator cuff tears in diabetic patients (78.4%) compared to non-diabetics (41.4%). This more than twofold increase aligns with and quantifies previous epidemiological studies, such as those by Chung et al. (2013), who reported diabetics were at a significantly increased risk for rotator cuff tears. This correlation is not merely a function of age, as our cohort's mean age was similar across groups, pointing to diabetes-specific pathophysiology.

The predominance of partial-thickness tears in our overall sample and within the diabetic subgroup is noteworthy. While full-thickness tears are often the focus of surgical intervention, the high rate of partial tears underscores the role of progressive tendon degeneration, a process accelerated in diabetes by mechanisms like advanced glycation end-product (AGE) accumulation and microangiopathy, as described by De Oliveira et al. (2016). AGEs lead to collagen cross-linking, reducing tendon elasticity and predisposing it to fraying and partial failure under load. Furthermore, the severity grading revealed a concerning pattern, with a combined 45.1% of all participants having Grade II (high-grade partial) or Grade IV (full-thickness) tears. This distribution of moderate-to-severe pathology in a pain-predisposed cohort highlights the clinical significance of these findings. The higher prevalence of associated findings (e.g., tendinosis, bursitis) in diabetics (62.7% vs. 37.9%) further illustrates the diffuse, inflammatory, and degenerative milieu of the diabetic shoulder, consistent with the chronic low-grade inflammatory state characteristic of diabetes.

Our finding of a male predominance and right-sided prevalence reflects common demographic and functional trends in shoulder pathology studies. However, the key differentiator remains diabetic status. The poorer vascular supply and impaired healing microenvironment in diabetic patients, as highlighted in microangiopathy research, likely explain not only the higher incidence but also the documented poorer surgical outcomes and higher retear rates post-repair in this population, as noted by Clement et al. (2013).

In conclusion, this MRI-based study provides robust imaging evidence that diabetic patients with shoulder pain present with a significantly greater prevalence and severity of rotator cuff pathology compared to their non-diabetic counterparts. The findings emphasize that shoulder pain in a diabetic patient should prompt a high index of suspicion for substantial rotator cuff disease. This warrants a more proactive diagnostic approach, potentially involving earlier imaging referral to guide tailored management strategies that address both the mechanical pathology and the underlying metabolic disorder.

CONCLUSION

This study concludes that diabetic patients with shoulder pain present with a significantly higher prevalence and severity of rotator cuff pathology on MRI compared to non-diabetic patients. The findings strongly suggest that diabetes mellitus is a major independent risk factor for structural rotator cuff degeneration. Therefore, shoulder pain in diabetic individuals warrants a low threshold for advanced imaging to accurately diagnose often substantial underlying tendon disease and guide appropriate management.

LIMITATIONS

The single-center, cross-sectional design cannot establish a causal relationship between diabetes and tear development.

The reliance on existing MRI reports without centralized, blinded re-evaluation may introduce interpretation bias.

Key variables like specific diabetes duration, HbA1c levels, and medication history were not controlled for, limiting the analysis of dose-response relationships.

RECOMMENDATIONS

Future longitudinal studies are needed to establish the temporal relationship between diabetes control and rotator cuff disease progression.

Research should correlate specific MRI findings (e.g., tear grade, muscle atrophy) with glycemic control metrics (HbA1c) and functional outcomes.

Clinical guidelines should consider advocating for earlier MRI evaluation in diabetic patients with

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persistent shoulder pain to enable timely intervention.

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