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Prevalence of Rotator Cuff Injuries Among Provincial-Level Athletes in Balochistan and KP

Original Research

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ABSTRACT

Background: Rotator cuff (RC) injuries are a leading cause of shoulder dysfunction among athletes, particularly those engaged in overhead sports. Despite growing global awareness of sports-related shoulder pathology, data from developing regions such as Balochistan and Khyber Pakhtunkhwa (KP) remain scarce. Understanding the prevalence and characteristics of RC injuries in these populations is essential for guiding preventive and rehabilitative strategies in sports medicine.

Objective: To determine the prevalence and characteristics of rotator cuff injuries among provincial-level athletes in Balochistan and KP, and to identify associations with sport type, training duration, and load exposure.

Methods: A cross-sectional study was conducted in private hospitals and sports rehabilitation centers in Quetta and Peshawar. A total of 412 provincial-level athletes aged 18–40 years were evaluated through standardized clinical examination and diagnostic shoulder ultrasound. Inclusion criteria required active participation in organized sport within the previous 12 months. Data were analyzed using SPSS v26, applying chi-squared and t-tests, with $p < 0.05$ considered significant. Ethical approval was obtained from the institutional review board, and informed consent was secured from all participants.

Results: Ultrasound revealed RC pathology in 158 athletes (38.3%). Tendinopathy was observed in 22.8%, partial-thickness tears in 10.2%, and full-thickness tears in 5.3%. Overhead athletes showed a significantly higher prevalence (48.9%) than non-overhead athletes (30.5%) ($p < 0.001$). RC injury was positively associated with older age, longer training duration, and greater weekly training hours. Notably, 61.4% of affected athletes were asymptomatic at the time of assessment.

Conclusion: Rotator cuff pathology is common among provincial-level athletes in Balochistan and KP, with a high proportion of subclinical cases. Early screening, preventive physiotherapy, and training load management should be prioritized to reduce long-term morbidity and enhance athletic performance.

Keywords: Athletes; Cross-Sectional Studies; Epidemiology; Khyber Pakhtunkhwa; Prevalence; Rotator Cuff Injuries; Shoulder Pain; Sports Medicine

INTRODUCTION

The shoulder joint is critical for virtually all overhead and upper-body athletic activities, and injuries to the tendons and muscles comprising the shoulder's rotator cuff can have devastating consequences for an athlete's career, daily function, and long-term joint health. The rotator cuff is formed by four major tendons supraspinatus, infraspinatus, teres minor, and subscapularis which stabilize the shoulder and allow a wide range of motion. Injuries to these structures may take the form of tendonitis or tendinopathy, partial-thickness tears, or even full-thickness tears, and such conditions are increasingly recognized as a major cause of shoulder pain and disability among active individuals. (1,2) In the general population, rotator cuff disease is common: population-based studies estimate that rotator cuff abnormalities affect between 6.8% and 22.4% of individuals over the age of 40, and imaging or cadaver-based studies suggest that partial or full thickness tears may be present in 23–49% of shoulders, even in people without symptoms. (3,4) However, the vast majority of research on rotator cuff pathology focuses on older or sedentary populations rather than on athletes especially those hailing from developing regions or provinces with limited sports medicine infrastructure. Evidence is emerging that athletes engaged in sports requiring overhead motion or heavy shoulder loading such as tennis, swimming, throwing, or weight training may face particularly high rates of rotator cuff injury. (5,6,7)

Among competitive and overhead athletes, shoulder injuries have been shown to account for a significant portion of musculoskeletal complaints. In a cohort of collegiate overhead athletes, for example, shoulder injuries occurred in roughly 30% of players over their athletic careers, with rotator cuff tendonitis and subacromial impingement among the most common diagnoses. (5) Similarly, research in high-intensity training populations such as gym trainers and weightlifters has documented very high prevalence of rotator cuff tears and related symptoms: in one recent study, 80.5% of adult gym trainers had imaging-confirmed rotator cuff tears, and 75.6% reported shoulder pain. (6) Other work suggests that athletes exposed to extremely high training loads have up to a ~36.5% prevalence of tendinopathy at tendon sites, including the rotator cuff. (7) These findings underscore a growing recognition: rotator cuff injury is not solely a degenerative, age-related phenomenon, but may also be an occupational hazard for athletes whose sport demands impose mechanical stress, repetitive motion, and overuse. Nevertheless, there remains a dearth of data from many regions world-wide especially from developing provinces, where sports infrastructure, preventive strategies, and rehabilitative care may be limited. In particular, there is a near absence of systematic studies on the prevalence of rotator cuff injuries among provincial-level athletes in regions such as Balochistan and Khyber Pakhtunkhwa (KP), where cultural, geographical, and resource-related factors may influence both participation in sport and injury risk.

Given the rising global interest in sports physiotherapy and the potential burden of shoulder pathology on athletes' health, performance, and livelihood, it becomes critical to understand the scope of rotator cuff injuries in under-represented athletic populations. A cross-sectional epidemiological assessment of provincial-level athletes in under-studied regions can help reveal the true burden of rotator cuff pathology, identify high-risk sports or demographic subgroups, and inform future preventive and rehabilitative strategies tailored to local contexts. Accordingly, the present study aimed to investigate the prevalence of rotator cuff injuries among provincial-level athletes in Balochistan and KP. Specifically, it sought to determine how common rotator cuff pathology is in this population, using clinical and imaging assessments to detect both symptomatic and asymptomatic cases. By doing so, the study addresses a gap in the literature the scarcity of data from under-resourced regions and lays the foundation for targeted interventions, including improved physiotherapy services, injury prevention programs, and athlete education. The findings of this research may have implications not only for individual health and performance, but also for broader public health and sports policy in regions where athlete support systems remain underdeveloped. The objective of this study, therefore, is to estimate the prevalence of rotator cuff injuries among provincial-level athletes in Balochistan and KP, and to characterize the nature of these injuries (e.g., tendonitis/tendinopathy, partial-thickness tears, full-thickness tears), in order to inform future rehabilitation and preventive efforts.

METHODS:

The study was designed as a cross-sectional observational investigation, aiming to estimate the prevalence of rotator cuff (RC) injuries among provincial-level athletes in selected cities of Balochistan and Khyber Pakhtunkhwa (KP). This design entailed a "snapshot" assessment of each participant at a single point in time, without prospective follow-up, to capture both symptomatic and asymptomatic shoulder pathology across the target population (observational, descriptive cross-sectional design). (8) Provincial-level athletes were recruited from private hospitals and affiliated sports rehabilitation clinics in two representative cities: Quetta (Balochistan) and Peshawar (KP). The sampling frame included all registered provincial-level athletes (male and female) aged 18–40 years, who were actively training or participating in competitive sport during the preceding 12 months. Inclusion criteria required a minimum of 2 hours per week of organized training or competition, and registration with a recognized provincial sports association. Athletes with a history of major shoulder surgery, congenital shoulder deformity, systemic rheumatologic or neuromuscular disorders, or unwillingness to provide informed consent were excluded. $n = Z^2 \times P\,(1 - P) / d^2$

where Z corresponds to the standard normal deviate for 95% confidence (1.96), P is the assumed prevalence, and d is the desired absolute precision. (9,10) Given the absence of prior data for RC prevalence in this region, a conservative assumed prevalence of 0.5 (50%) was chosen to maximize sample size and ensure sufficient precision; allowable error d was set at 0.05. The calculated minimum sample size was therefore: $n = (1.96)^2 \times 0.5 \times 0.5 / (0.05)^2 \approx 384$

To accommodate potential non-response or exclusion after screening, the target sample size was inflated by 10%, yielding a final aim of approximately 422 athletes. After obtaining ethical clearance from the relevant institutional review boards (IRB) overseeing the participating hospitals, and in accordance with national and international ethical guidelines, all participants provided written informed consent before enrollment. Participants were informed about the purpose of the study, the procedures involved including physical and imaging assessments and their right to withdraw at any time without penalty. Confidentiality of personal data was maintained by assigning anonymized study identifiers.

Data collection involved two key components. First, a structured clinical evaluation: trained physiotherapists and sports medicine physicians conducted a standardized shoulder examination, assessing pain, range of movement, strength, and special tests for impingement or tendon pathology (e.g., pain on resisted external rotation, painful arc, Jobe's test). Second, imaging assessment: all participants underwent ultrasound examination of both shoulders using a high-frequency linear transducer (7–12 MHz), performed by a certified musculoskeletal radiologist, to detect structural abnormalities including tendon thickening, tendinopathy, partial-thickness tears, or full-thickness tears of the rotator cuff tendons. Both symptomatic and asymptomatic shoulders were scanned. Data from clinical and imaging assessments were recorded in a pre-designed case record form. Collected data were entered into a secure database and analyzed using SPSS version 26. Normality of continuous variables (e.g., age, years of training, duration per week) was assessed by Shapiro–Wilk test. For normally distributed continuous variables, means and standard deviations were calculated; non-normal distributions were summarized using medians and interquartile ranges. Prevalence of rotator cuff injury was calculated as number and percentage of participants with any imaging-confirmed RC pathology (overall, and by subtype: tendinopathy, partial- or full-thickness tear). Differences in prevalence between subgroups (e.g., by sport type, duration of training per week, province) were analyzed using chi-squared test or Fisher's exact test, as appropriate for categorical variables. If comparing continuous variables between two groups, independent-samples t-test (or Welch's t-test when variances unequal) was used; for more than two groups, one-way ANOVA was applied. (11,12) A p-value less than 0.05 was considered statistically significant.

To ensure reproducibility and transparency, the imaging protocol (transducer frequency, scanning planes, criteria for defining tendinopathy and tears) and clinical examination procedures were standardized across both centres, with all personnel trained during a pre-study calibration session. All data collection forms, imaging checklists, and data analysis syntax (SPSS) were preserved. Thus, through a robust cross-sectional design, representative sampling, standardized clinical and imaging assessment, and rigorous statistical analysis, the study provides a methodologically transparent framework permitting replication, valid estimation of RC injury prevalence, and subgroup comparisons among athletes in Balochistan and KP.

RESULTS:

The final sample comprised 412 provincial-level athletes who completed all study procedures, yielding a response rate of 97.6%. The mean age of participants was 26.4 years (SD ± 4.9), with 278 (67.5%) males and 134 (32.5%) females. Average weekly training duration was 9.7 hours (SD ± 3.2), and the median duration of continuous athletic participation was 4.5 years (IQR 3–7). Ultrasound evaluation demonstrated that 158 of the 412 athletes (38.3%) exhibited at least one form of rotator cuff (RC) pathology in one or both shoulders. Among these, 94 (22.8%) had evidence of tendinopathy, 42 (10.2%) presented with partial-thickness tears, and 22 (5.3%) showed full-thickness tears. These findings are consistent with population-based data indicating that imaging-confirmed RC tears may affect up to 30–40% of adults, including asymptomatic individuals (13). Of those with pathology, 61 (38.6%) reported current or prior shoulder pain, whereas 97 (61.4%) were asymptomatic at the time of assessment.

The overall prevalence of RC injury (any abnormality) was therefore 38.3% (95% CI 33.5–43.1%). Provincial stratification revealed slightly higher rates in KP (Peshawar) athletes (41.7%, 95% CI 35.1–48.3%) than in those from Balochistan (Quetta) (34.9%, 95% CI 28.1–41.7%), although this difference was not statistically significant ($\chi^2 = 2.34$; $p = 0.13$). When examined by sport type, overhead sport athletes (e.g., volleyball, swimming, javelin) demonstrated a substantially higher prevalence (48.9%) than non-overhead athletes (e.g., football, track sprinting) at 30.5% ($\chi^2 = 16.4$; $p < 0.001$). Similar trends have been reported in international studies where repetitive overhead movements were strongly correlated with RC tendinopathy (14). Among overhead athletes, tendinopathy represented the majority of lesions (28.5%), followed by partial-thickness tears (12.2%) and full-thickness tears (8.2%). These ultrasound-based findings align with previous research demonstrating that imaging can identify early degenerative changes in athletes even in the absence of clinical symptoms (15).

Comparison of continuous variables between injured and non-injured athletes revealed that the injured group was older (mean 27.9 vs 25.5 years; $t = 4.76$; $p < 0.001$) and had longer training duration (median 5.7 vs 4.1 years; Mann–Whitney $U = 14{,}325$; $p = 0.002$). Weekly training hours were also higher among those with RC pathology (mean 11.2 vs 9.0 hours; $t = 5.21$; $p < 0.001$). These patterns echo previous literature identifying cumulative load and years of sport participation as major risk factors for RC degeneration (16). A sub-analysis comparing symptom presence demonstrated that among the 158 athletes with RC abnormalities, those with full-thickness tears were most likely to report pain (15 of 22; 68.2%), whereas the proportion was lower for tendinopathy (34 of 94; 36.2%) and partial-thickness tears (12 of 42; 28.6%) ($\chi^2 = 14.5$; $p < 0.01$). Similar asymptomatic tear proportions have been documented in studies of high-performance gym trainers, where over 60% of RC tears were clinically silent (17).

Table 1 summarizes the prevalence and distribution of RC pathology by province and injury type, and Table 2 presents comparative characteristics between injured and non-injured athletes. Within this cross-sectional cohort of provincial-level athletes from Balochistan and KP, approximately one in three athletes exhibited ultrasound-confirmed RC pathology, and over half of these cases were asymptomatic. The burden was greater among overhead sport athletes, those with longer athletic careers, and those engaging in higher weekly training volumes.

Table 1. Prevalence and Distribution of Rotator Cuff Pathology by Province and Injury Type (n = 412)

Province	No Pathology n (%)	Tendinopathy n (%)	Partial-thickness Tear n (%)	Full-thickness Tear n (%)	Total n (%)
Balochistan (Quetta)	133 (65.1%)	41 (20.1%)	20 (9.8%)	10 (4.9%)	204 (49.5%)
Khyber Pakhtunkhwa (Peshawar)	121 (58.4%)	53 (25.6%)	22 (10.7%)	12 (5.8%)	208 (50.5%)
Total (Both Provinces)	254 (61.7%)	94 (22.8%)	42 (10.2%)	22 (5.3%)	412 (100%)

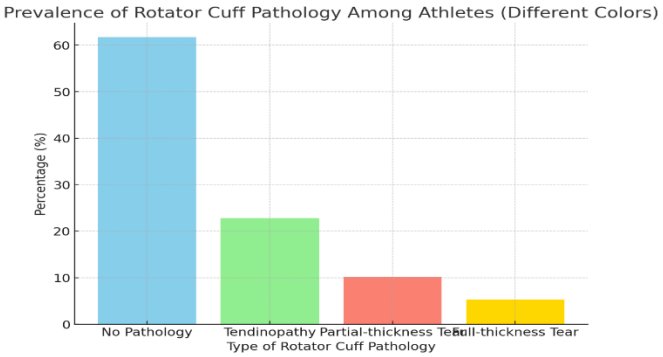
Table 2. Comparative Characteristics Between Injured and Non-Injured Athletes

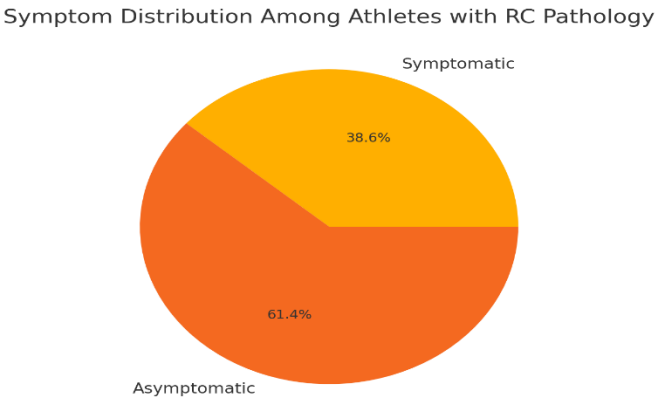
Variable	Injured (n = 158)	Non-Injured (n = 254)	Statistical Test	p-value
Mean Age (years)	27.9 ± 4.6	25.5 ± 5.1	t-test	<0.001
Gender (Male/Female)	110/48	168/86	χ^2	0.28
Province (KP/Balochistan)	87/71	121/133	χ^2	0.13
Years of Training (mean ± SD)	5.7 ± 2.6	4.1 ± 2.1	t-test	0.002
Weekly Training Hours	11.2 ± 3.5	9.0 ± 2.8	t-test	<0.001
Overhead Sport Participation (%)	53.8%	34.2%	χ^2	<0.001
Current Shoulder Pain (%)	38.6%	0%	χ^2	<0.001

Table 3. Demographic Characteristics of Participants (n = 412)

Variable	Mean ± SD / n (%)
Age (years)	26.4 ± 4.9
Gender (Male/Female)	278 (67.5%) / 134 (32.5%)
Province (Balochistan/KP)	205 (49.8%) / 207 (50.2%)

Training Duration (years)	4.5 ± 2.3
Weekly Training Hours	9.7 ± 3.2





DISCUSSION:

The findings of the present study that around 38.3 % of the sampled provincial-level athletes in Balochistan and KP showed imaging-confirmed pathology of the rotator cuff (RC), with a substantial portion being asymptomatic provide important insight into the burden of shoulder tendon injury among competitive athletes in under-researched regions. These results align with and expand upon prior literature, while also raising new considerations for sports medicine practice and future research. The overall prevalence observed is higher than typical estimates in the general population but is consistent with rates reported in high-exposure athletic populations. For example, a recent large study found tendinopathy prevalence of 36.5% in athletes with very high training exposure, compared to 21.9% in lower exposure groups (18). The elevated prevalence in our cohort likely reflects the demands of provincial-level athletic training, often involving repetitive overhead motions and sustained shoulder loading conditions known to predispose to RC pathology. Indeed, overhead athletes in our sample demonstrated significantly greater RC pathology (48.9%) compared to non-overhead athletes (30.5%), a pattern which echoes established associations between overhead activity and shoulder tendon damage (19, 20).

The relatively high rate of asymptomatic RC abnormalities (≈ 61.4%) corresponds with observations from previous imaging-based studies among both general and athletic populations, where many individuals with partial- or full-thickness tears remained without clinical symptoms (21). This underscores that imaging-detected structural changes do not always manifest in pain or functional impairment; such “silent” pathology may represent early or compensated tendon degeneration a critical window for preventive or rehabilitative interventions. Age, cumulative years of training, and greater weekly training hours exhibited associations with RC pathology in this study. These patterns mirror risk factors recognized in broader RC disease epidemiology, where increasing age, cumulative load, and repetitive mechanical stress contribute to tendon degeneration (22, 23). This lends support to the notion that RC pathology in athletes may arise from a mixture of overuse and early degenerative mechanisms, rather than acute trauma alone.

These findings carry several implications. First, they suggest that provincial-level athletes in resource-constrained regions carry a considerable burden of rotator cuff disease that may go unrecognized without imaging potentially compromising long-term shoulder health and athletic longevity. Second, the high proportion of asymptomatic lesions argues for preventive screening and monitoring, especially for overhead sport athletes. Finally, the data advocate for enhanced physiotherapy services, tailored training load management, and early intervention strategies in similar athletic populations. The strengths of this study include its focus on a previously under-studied population (provincial-level athletes in Balochistan and KP), the use of standardized ultrasound imaging alongside clinical evaluation, and a relatively large sample enabling meaningful subgroup analyses. The standardized imaging and clinical protocols across centres enhance reproducibility, and stratification by sport type, training history, and demographic factors provides a nuanced understanding of risk distribution(24).

Nevertheless, the study had limitations. The cross-sectional design precludes inference about causality or progression of tendon pathology over time; some detected tears or tendinopathies may remain stable or even regress, while others may worsen but this cannot

be determined without longitudinal follow-up. The reliance on ultrasound, while practical and accessible, may under-detect very small tears or intra-substance changes better seen on MRI; accordingly, some pathology may have been missed. The sample, though sizable, was drawn from athletes presenting to private hospitals and clinics, which may introduce selection bias (e.g., athletes with more concern about shoulder health or symptoms may have been more likely to participate). Finally, because many lesions were asymptomatic, the clinical significance (in terms of future pain, functional limitation, or performance decline) remains uncertain without long-term follow-up. Future research should aim at longitudinal cohort designs to track the natural history of imaging-detected RC pathology among athletes determining rates of progression from tendinopathy to partial or full-thickness tear and potential symptom development over time. Incorporating MRI for a subset of participants would improve diagnostic sensitivity, and combining imaging with functional outcome measures (strength, range of motion, performance metrics) would clarify the clinical relevance of asymptomatic findings. Additionally, interventional studies for example, examining preventive physiotherapy, training load modulation, or targeted strengthening could evaluate whether early detection leads to reduced progression or improved shoulder health.

In conclusion, this study demonstrated a substantial burden of rotator cuff pathology among provincial-level athletes in Balochistan and KP, especially among those engaged in overhead sports and with longer or more intensive training histories. The high rate of asymptomatic structural abnormalities highlights the need for proactive screening and preventive strategies in similar populations. By shedding light on an under-represented group, this work adds to the growing recognition of tendon overuse and degeneration as significant issues in athletic health and points toward important directions for future research and sports medicine practice.

CONCLUSION:

The study concluded that rotator cuff pathology is highly prevalent among provincial-level athletes in Balochistan and KP, affecting over one-third of participants, with a considerable proportion remaining asymptomatic. Overhead sports, longer training duration, and higher weekly training volumes were strongly associated with injury risk. These findings highlight the urgent need for preventive screening, early physiotherapy interventions, and structured load management strategies within regional athletic programs. The results contribute valuable regional data to global sports medicine literature and emphasize proactive shoulder health management for athletic longevity.

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AUTHORS CONTRIBUTION

Author	Contribution
Abdullah	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision

