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Prevalence Of Posterior Shoulder Tightness In Glenohumeral Internal Rotation Deficit Among Amateur Basketball Players

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ABSTRACT

Background: Glenohumeral Internal Rotation Deficit (GIRD) is common in overhead athletes and is associated with Posterior Shoulder Tightness (PST). These mobility restrictions in the shoulder are common in amateur basketball players as they are used extensively in their sport due to a lot of overhead movements. Although early identification and management are paramount, the co-prevalence of PST and GIRD in this population is largely underreported.

Objective: This study aimed to determine the prevalence of posterior shoulder tightness and its association with glenohumeral internal rotation deficit among amateur basketball players.

Methods: This was a cross-sectional observational study on 60 amateur basketball players aged 18–25 years. Glenohumeral internal rotation range of motion (IR-ROM) was measured (with a goniometer) and horizontal adduction test was used to assess posterior shoulder tightness. However, the relationship between PST and GIRD was evaluated by descriptive statistics, chi-square test, t-test, and logistic regression analysis.

Results: The study found that 43.3% of participants exhibited PST and the statistical analyses showed strong impact of PST on the likelihood of developing substantial glenohumeral internal rotation deficits ($p < 0.001$).

Conclusion: In amateur basketball players, this study demonstrates a significant relationship between posterior shoulder tightness and glenohumeral internal rotation deficit. These findings underscore the importance of early detection and targeted intervention for PST, to address and mitigate potential consequences such as GIRD in overhead athletes.

Keywords: *Posterior Shoulder Tightness, Glenohumeral Internal Rotation Deficit, Amateur Basketball Players, goniometer, horizontal adduction test.*

1. INTRODUCTION

The glenohumeral joint is the most important joint of the Shoulder girdle[1]. The glenoid fossa of the scapula and the head of humerus are bridged by a synovial ball and socket joint 2.Due to its wide range of motion, the glenohumeral joint enables athletes to perform complex and repetitive overhead manoeuvres 3.With compromise in joint stability, there is very high level of mobility predisposes the shoulder to a range overuse issues and adaptive changes.

Basketball demands high physical performance and mobility, especially in the shoulder complex, with the glenohumeral joint being important[5]. There are a lot of overhead movements required for basketball, such as shooting, passing, and rebounding, which imposes much stress on the shoulder joint[6]. Amateur basketball players are highly susceptible to shoulder mobility deficiencies due to repetitive use, especially amateur players who are not properly trained[7].

Glenohumeral Internal Rotation Deficit (GIRD), a significant reduction in the internal rotation of the shoulder joint, often in relation to the non-dominant arm, is one of the most common conditions affecting shoulder function[1]. A reduction in the internal rotation of the shoulder by greater than 20 degrees compared to the contralateral (opposite) shoulder is referred to as a glenohumeral internal rotation deficit (GIRD) [8]. Glenohumeral internal rotation deficit is often induced by microtrauma and repetitive stress during athletic activities, altering the soft tissues surrounding the glenohumeral joint[9]. Rotator cuff stiffness, humeral retroversion, posterior shoulder tightness, and improper scapular posture are some of the etiologies of GIRD[10]. One of the major contributing factors to GIRD is PST, or posterior shoulder tightness[11].

The phrase "Posterior Shoulder Tightness" (PST) refers to posterior shoulder elements like the rotator cuff muscles and the posterior capsule losing their flexibility or becoming rigid[12]. This tightness is thought to occur as a result of chronic overhead movement and is considered to be an adaptive response that prevents normal glenohumeral joint kinematics[13]. Posterior shoulder tightness alters the biomechanics of the shoulder, leading to compensatory movements that increase the risk of labral injury, impingement, and other diseases of the shoulder[14]. There is limited information available on the prevalence of posterior shoulder tightness among amateur basketball players with glenohumeral internal rotation deficit[7].

This research seeks to establish the existence of posterior shoulder tightness among participants with glenohumeral internal rotation deficit among amateur basketball players through the use of a goniometer to quantify the glenohumeral internal rotation range of motion (IR-ROM) and the horizontal adduction test to evaluate posterior shoulder tightness[12]. Identification and management of PST are important in managing and preventing GIRD among amateur basketball players performing repetitive overhead movements[1].

2. METHODOLOGY

This study is a cross-sectional observational study conducted to determine the prevalence of posterior shoulder tightness (PST) in glenohumeral internal rotation deficit (GIRD**)** among amateur basketball players. This study involved a total of 60 participants. The participants are selected with convenient sampling method. The study was conducted among amateur basketball players presented in the Mahatma Gandhi medical college and research institute, Puducherry. After receiving the consent form and demographic details from 60 participants, they were assessed by measuring their internal rotation of shoulder joint both dominant and non-dominant side using a goniometer (used to measure range of motion ROM). After fulfilling the inclusion criteria, the participants were done with horizontal adduction test to assess posterior shoulder tightness. **Inclusion criteria:** this study includes participants with age between 18–25 years**,** actively playing in local leagues, university teams, or amateur clubs for almost 2 years, Participants who are having GIRD of 20 degrees and above. **Exclusion criteria:** this study excludes participants with previous shoulder surgery, fractures, or dislocations that could affect mobility and range of motion, had absences from practice due to some injuries, and had structural deviations in the shoulder and thoracic areas, such as scoliosis and a kyphotic posture.

3. DATA COLLECTION PROCEDURES

MEASUREMENT OF GLENOHUMERAL INTERNAL ROTATION DEFICIT (GIRD):

The player will be positioned in supine lying with the shoulder abducted to 90° and elbow flexed to 90°. Using a goniometer, internal rotation (IR) range will be measured.

MEASUREMENT OF POSTERIOR SHOULDER TIGHTNESS (PST):

The horizontal adduction test will be performed.

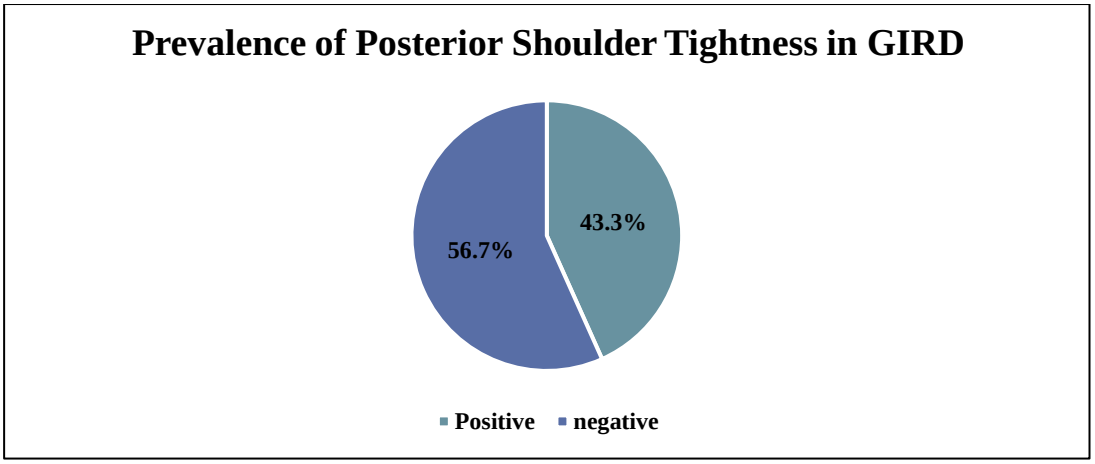
Positioning the Patient: The subject is in a seated or standing position. The examiner stands behind or beside the subject.

Test Execution: The examiner stabilizes the scapula to prevent movement.The subjects arm is passively moved into horizontal adduction (bringing the arm across the chest) while keeping the elbow flexed at 90 degree. The examiner applies gentle overpressure to the elbow to maximize horizontal adduction.

Confirmation: The Posterior Shoulder Tightness is confirmed when there is Pain or restriction in the movement presented while performing horizontal adduction test.

4. STATISTICAL ANALYSIS

Statistical analysis was carried out using SPSS software. Statistical analysis is necessary in comprehending the association between posterior shoulder tightness (PST) and glenohumeral internal rotation deficit (GIRD) among amateur basketball players. This research utilizes a number of statistical methods to examine the prevalence of the mentioned conditions and whether they are associated with each other. Descriptive Statistics – Presenting essential data characteristics like mean, standard deviation, and range for age and GIRD values. Chi-Square Test – Testing the association between posterior shoulder tightness and GIRD category to see if PST plays a significant role in the development of GIRD. T-Test – Checking differences in mean values of GIRD between PST-positive and PST-negative players for significant differences. Logistic Regression Analysis – Testing to see if age and posterior shoulder tightness are significant predictors of having GIRD.



The above pie chart shows the positive and negative percentage of posterior shoulder tightness in glenohumeral internal rotation deficit.

TABLE 01. DESCRIPTIVE STATISTICS

STATISTICS	AGE	GIRD VALUE
Mean	21.85	24.93
Standard Deviation	2.15	3.26
Minimum	18	20
Maximum	25	30

The above table shows the descriptive Statistics where the average age is 21.85 years, and the mean GIRD Value is 24.93.

TABLE 02. CHI-SQUARE TEST (ASSOCIATION BETWEEN PST AND GIRD CATEGORY)

TEST	CHI-SQUARE VALUE	P-VALUE
PST vs. GIRD Category	25.31	4.89E-07

The above table shows the chi-square test where a significant association was found between Posterior Shoulder Tightness (PST) and GIRD Category ($p < 0.001$).

TABLE 03. T-TEST (COMPARISON OF GIRD VALUES BETWEEN PST GROUPS)

GROUP	MEAN GIRD VALUE	STANDARD DEVIATION
PST Positive	27.59	1.74
PST Negative	21.89	1.31

T-STATISTIC	P-VALUE
8.33	1.75E-11

The above table shows the T-Test where the difference in GIRD values between PST-positive and PST-negative groups is

highly statistically significant ($p < 0.001$).

TABLE 04. LOGISTIC REGRESSION ANALYSIS (PREDICTING GIRD CATEGORY)

VARIABLE	COEFFICIENT (B)	STANDARD ERROR	Z-VALUE	P-VALUE
Intercept	-1.1787	0.404	-2.915	0.004
Posterior Shoulder Tightness (PST)	3.6636	0.84	4.363	0

The above table shows the logistic regression analysis, indicating that PST significantly predicts the presence of High GIRD ($p < 0.001$).

5. RESULT

This study shows that 26 participants (43.3 %) suffer from posterior shoulder tightness in glenohumeral internal rotation deficit. A total of 60 subjects that were amateur basketball players participated in this study (Sex: 48 males and 12 females; Average Age = 21.85 years, SD = 2.15, age range = 18 − 25 years). The mean GIRD value was 24.93 degrees (SD = 3.26), signifying a significant internal rotation deficit across subjects. Posterior shoulder tightness (PST) was present in a substantial number of the 60 participants. During the horizontal adduction test, presence of PST was confirmed when participants felt pain or were limited in movement. Chi-Square Test A chi-square yielded a strong and statistically significant association between PST and GIRD category ($\chi^2 = 25.31$, $p < 0.001$). Thus, these results show that PST is associated with the development of glenohumeral internal rotation deficit. T-Test a(difference between GIRD PST (+) and PST (-), showed significance. Interestingly, PST-positive participants had a mean GIRD value of 27.59 degrees (SD = 1.74), whereas PST-negative participants had a mean value of 21.89 degrees (SD = 1.31). The t-test showed a t-statistic of 8.33 and a p-value of 1.75E-11 confirm that groups are sufficient to state that PST positive players have greater deficits in the internal rotation. the logistic regression analysis additionally confirmed PST as a strong predictor of high GIRD values. The coefficient estimate for PST was 3.6636 ($p < 0.001$, SE = 0.84, z = 4.363). The strength of PST in relation to the development of sufficient deficits in glenohumeral internal rotation is highlighted through this analysis.

6. DISCUSSION

The results of this study offered in depth data on the incidence of PST and GIRD amongst amateur basketball players and their interrelationship. A significant loss of internal rotation was reported with a mean GIRD value of 24.93 degrees (SD 3.26) consistent with previous literature examining shoulder mobility deficits in overhead athletes. A powerful correlation was highlighted between PST and GIRD, (this was supported by the chi square, $\chi^2 = 25.31$, $p < 0.001$) points to the potential role of posterior shoulder tightness in the pathophysiology underlying glenohumeral internal rotation deficits.

The t-test confirms these differences, indicating a very significant difference in glenohumeral internal rotation deficits (GIRD) values between PST positive (mean = 27.59, SD = 1.74) and PST negative players (mean = 21.89, SD = 1.31), with a t = 8.33, p = 1.75E-11. The significance of this difference indicates that players with posterior shoulder tightness have a significantly higher internal rotation deficit, suggesting that PST is a contributing factor in the development of GIRD in amateur basketball players. Also, the logistic regression analysis proves that PST could be considered as a useful factor for predicting the probability of high GIRD. The β for PST ($\beta = 3.6636$, $p < 0.001$) represents a strong, statistically significant correlation, indicating that posterior shoulder tightness significantly increases the risk of GIRD.

These findings are in accordance with previous literature which lists repetitive overhead activities and adaptive changes to the soft tissues about the glenohumeral joint as major factors in shoulder mobility restrictions. Research like Wilk et al. (2020) and Borstad et al. (2011) have likewise noted a compelling association between repetitive stress and the emergence of PST and GIRD. This study supports the evidence in this area by demonstrating those associations in the population of amateur basketball players, who frequently perform high-frequency, overhead movements without structured conditioning programs. The clinical implications from this study are substantial. These GIRD-type deficiencies can be solved through direct work on PNGs through specific stretching and strengthening to address the pre-existing PST. Integrating routine assessment of PST into athletic training programs could help earlier discovery and timely management of shoulder pathologies and contribute to enhanced athletic performance.

However, there are some limitations in this study. The findings may not be generalized because of the convenience sampling method employed. Furthermore, the cross-sectional design only provides a snapshot in time and cannot establish causation. Findings may also be limited by recall bias, and longitudinal, larger sample size studies are necessary to verify these results and assess the long-term effects of PST on shoulder function.

7. CONCLUSION

This research creates a distinct and considerable relationship between posterior shoulder tightness and glenohumeral internal rotation deficit in amateur basketball players. Statistical analysis verifies that PST not only exists but also is a powerful indicator for greater GIRD. This highlights the importance of the development of early detection and intervention strategies to target posterior shoulder tightness to avoid long-term shoulder dysfunction and improve athletic performance. Future studies must investigate the efficacy of some particular rehabilitation protocols in preventing PST as well as reducing the prevalence of GIRD among overhead sports athletes.

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All authors equally contributed.

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The authors confirm that there are no conflicts of interest associated with this work.

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