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Unravelling The Complexity of Posterior Internal Impingement: AComprehensive Case Study Investigation

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ABSTRACT

The individual in question is a 25-year-old male enrolled as a student at Delhi University. There is no history of falls. He visited our clinic seeking physiotherapy assistance. Upon assessment, the patient complained of pain and restricted range of motion in his right shoulder joint, particularly during movements involving reaching overhead and behind the back (cross-body movements). He experiences dull, discomfort and deep pain within the shoulder joint or at the back of the shoulder, along with tenderness along the joint line and pain during the throwing. Physical examination further revealed limitations in shoulder flexion, abduction, and predominantly internal rotation, with slightly reduced external rotation. Additionally, weakness was noted in the external rotators (infraspinatus, teres minor) and rotator cuff muscles (supraspinatus), along with tightness in the posterior capsule and internal rotators (subscapularis, pectoralis major, and latissimus dorsi). We offered a six -week rehabilitation program at our clinic. Our physiotherapy treatment adopted a comprehensive strategy to address the condition, incorporating physical activity treatment, hands-on therapy, electrical therapy, advice on ergonomic practices, and strategies for patients to manage their own care.

KEYWORDS: Internal impingement, Posterior impingement, Rotator cuff, Sleeper stretch

INTRODUCTION

The shoulder complex comprises four joints that operate with precise coordination and synchronization. Alterations in arm position entail movements of the clavicle, scapula, and humerus. These movements arise from the collective action of the sternoclavicular, acromioclavicular, and glenohumeral joints, as well as the scapulothoracic gliding mechanism. (Bechtol, 1980); (Inman, Saunders, & Abbott, 1944); (Warwick & Williams, 1973)

The acromioclavicular joint

This articulation constitutes a synovial plane joint, connecting a small, convex oval facet located at the lateral end of the clavicle with a concave area situated on the anterior aspect of the medial border of the acromion process of the scapula (Moore, 1980); (Warwick & Williams, 1973).

Joint capsule

The acromioclavicular (AC) joint possessesa slender capsule coated with synovial tissue. This capsule is fragile and gains reinforcement from capsular ligaments both below and above, which are further strengthened by connectionsfrom the deltoid and trapezius muscles (Neumann, 2009).

Ligaments

- Coracoclavicular Ligament (Levangie & Norkin, 2011) –
- The conoid ligament the trapezoid ligament
- The acromioclavicular ligament

Muscles

- Pectoralis Major (Clavicular Head) Sternocleidomastoid
- Deltoid Trapezius

The sternoclavicular joint

This joint functions as a synovial articulation. While its structure resembles that of a plane joint, its functionality is more akin to a ball-and-socket joint. Approximately half of the prominent, rounded medial (internal) end of the clavicle extends beyond the shallow sternal socket (DePalma, 1973). The innermost portion of the clavicle is connected to the sternum andthe first rib, including its costal cartilage. Ligaments provide reinforcement to the fibrous capsule in front, behind, above, and below (Beam, 1967); (Warwick & Williams, 1973).

Joint capsule

The SC Joint capsule is strong enough however, it relies heavily on the ligaments for structural support.

Ligaments

a. Anterior Sternoclavicular Ligament
b. Posterior Sternoclavicular Ligament
c. Costoclavicular Ligament
d. Interclavicular Ligament (Dutton, 2008); (Levangie & Norkin, 2005).
e. Coracohumeral ligament
f. Transverse humeral ligament (Dutton, 2012); (Levangie & Norkin, 2011).

Muscles

a. Deltoid
b. Pectoralis Major (Clavicular Head) Trapezius
c. SternocleidomastoidSubclavius muscle
d. Scalene muscles

The glenohumeral joint

This joint is characterized by a synovial structure featuring a multiaxial ball-and-socketdesign. While the meeting points of the humeral head and the glenoid fossa of the scapula exhibit complementary curvature, they are oval in shape and do not constitute complete spheres (Warwick & Williams, 1973).

The surfaces do not align perfectly, and the joint is in a state of loose packing. Complete congruence and the tightest fit occur when thehumerus is abducted and rotated outward (Warwick & Williams, 1973).

The glenoid labrum is a fibrocartilaginous rim that encircles the periphery of the glenoid fossa. Various theories suggest that the labrum serves to deepen the joint cavity, shield the bone edges, and aid in joint lubrication (Bateman, 1971); (Moore, 1980); (Warwick & Williams, 1973). The labrum adjusts itself to rotate the humeral head thereby providing flexibility to the borders of the glenoid fossa.

Joint capsule

The front part of the capsule gain reinforcement from the superior, middle, and inferior glenohumeral ligaments, which create a Z-shaped pattern on the capsule. Additionally, the rotator cuff muscles reinforce the joint capsule from above, behind, and in front. Ligaments

A. Superior glenohumeral ligament
B. Middle glenohumeral ligament
C. Inferior glenohumeral ligament

Muscles

a. Deltoid (Anterior Portion)
b. Triceps Brachii
c. Teres Major
d. Deltoid (Posterior Portion)
e. Latissimus Dorsi

The scapulothoracic joint

Scapulothoracic gliding mechanism is not an actual joint; rather, it involves the movement of the concave front surface of the scapula along the convex posterolateral surface of the thoracic cage (Warwick & Williams, 1973); Kelley, D. L. (1971). The capsule envelops the joint and is connected medially to the rim of the glenoid fossa, extending past the labrum. The capsule is relatively thin and alone does not offer significant stability to the joint. The long head tendon of the biceps brachii muscle travels from the supraglenoid tubercle, passing over the head of the humerus and residing within the capsule. The intertubercular groove is where it exits the joint. Encased by a synovial sheath, this setup aids the tendon's movement within the joint. Vulnerability to injury occurs where the tendon arches over the humeral head, transitioning from the bony cortex to the articular cartilagesurface (Bateman, 1971).

The Rotator Cuff

This complex consists of the musculotendinous attachment of the supraspinatus muscle above, the subscapularis muscle in front, and the teres minor and infraspinatus muscles behind. Their tendonsblend intricately with the fibrous capsule, offering active support to the joint and functioning as dynamic ligaments. Rotator cuff lesions can develop due to repetitive activitiesover time or sudden overload, resulting in spontaneous injury (Frankel & Nordin, 1980).

Muscles

Supraspinatus
Infraspinatus
Teres Minor
Subscapularis

Internal impingement of the shoulder occurs when the greater tuberosity of the humeral head excessively contacts the posterosuperior aspect of the glenoid during arm abduction and external rotation. This leads to compression of the rotator cuff and labrum. The painful throwing shoulder doesn't have a single underlying pathophysiological process. Internal impingement syndrome is believed to be more complex and multifaceted. Alongside the posterosuperior labrum and rotator cuff, injury to various other shoulder structures has been linked to pathological internal impingement (Jobe, 1995). It has been proposed that up to five anatomical structures are susceptible: the posterior superior labrum, the rotator cuff tendon (articular surface), the greater tuberosity, the inferior glenohumeral ligament (IGHL) complex, and the posterior superior glenoid. Internal impingement manifests as posterior shoulder pain when the athlete places the humerus in extreme external rotation and abduction, such as during the cocking phase of pitching or throwing. Posterior internal impingement (PII) of the glenohumeral joint is a prevalent cause of pain in the shoulder complex among overhead athletes. Impingement in this context occurs between the supraspinatus and/or infraspinatus and the glenoid rim. The pathological contact between the posterior glenoid and the posterior tendons of the rotator cuff, which face the articular surface ofthe glenohumeral joint, is referred to as posterior internal impingement (Manske et al., 2013).

TYPES OF INTERNAL IMPINGEMENT

There are two types of internal impingement

- Anterosuperior
- Posterosuperior

ETIOLOGY

Impingement has been characterized as a cluster of symptoms rather than a precise diagnosis (Cools et al., 2008). Glenohumeral instability (Meister, 2000), rotator cuff or biceps pathology (Heyworth & Williams, 2009), scapular dyskinesis (Burkhart et al., 2003); (Kibler, McMullen, & Sciascia, 1998); (Kamkar et al., 1993). SLAP lesions and glenohumeral internal rotation deficit (GIRD) have been associated with impingement symptoms Two pathological mechanisms in the possible aetiology of internal impingement have beendescribed

1. Excessive humeral translations, compromising glenohumeral congruence,
2. Scapular dyskinesis, decreasing the quality of functional scapular stability (Heyworth & Williams, 2009); (Myers et al., 2007); (Myers et al., 2006).

Anterior GH instability - Jobe et al. proposed that repetitive stretching of the anterior glenohumeral (GH) capsule resulting

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in anterior instability or laxity of the shoulder complex may lead to this form of impingement among throwing athletes. This laxity permits greater anterior translation of the humeral head (Heyworth & Williams, 2009).

Tight posterior GH capsule - It is suggested that tightness in the posterior capsule and the muscle-tendon unit of the posterior rotator cuff restricts internal rotation of the joint (Burkhart et al., 2003). Tightness in the posterior capsule results in Glenohumeral Internal Rotation Deficit (GIRD) (Myers et al., 2007); (Myers et al., 2006). Burkhart et al. (2003) defined GIRD as a loss of internal rotation of >20° compared with the contralateral side.

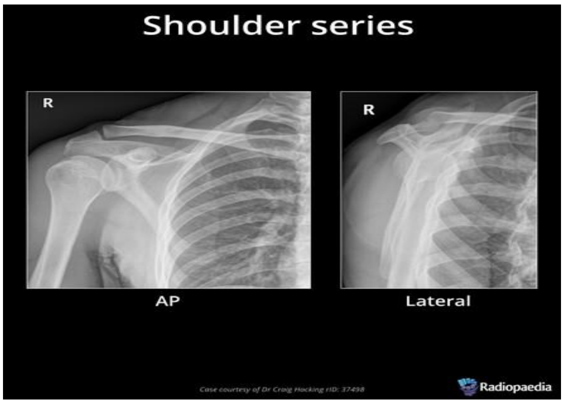
Muscle imbalance and/or improper neuromuscular control of the shoulder complex- Jobe et al. also found that improper positioning of the arm in relation to the glenoid bone during throwing actions can contribute to the impingement of rotator cuff tendons between the glenolabral complex and the humeral head (Heyworth & Williams, 2009). Research indicates that fatigue or weakness in the muscles responsible for retracting the scapula can result in reduced force generation in all four rotator cuff muscles. This, in turn, can cause abnormal positioning of the glenohumeral joint (Tyler et al., 2009); (Mihata et al., 2009).

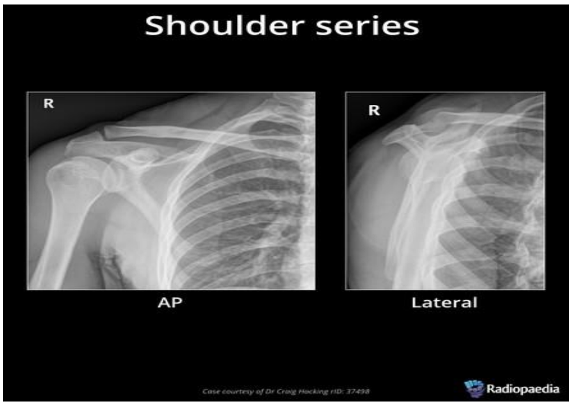
HISTORY

The individual under review is a 25-year-old male student at Delhi University. He has no history of falls or traumatic incidents. However, during assessment, he reported experiencing pain in his right shoulder when reaching overhead and behind his back, along with activity limitations. Additionally, he mentioned experiencing pain during the late cocking phase of the throwing. Physical examination revealed restricted shoulder movement in flexion, abduction, and predominantly internal rotation, with slightly decreased external rotation. Furthermore, weakness was observed in the external rotators (infraspinatus, teres minor) and the rotator cuff muscles (supraspinatus), coupled with tightness in the posterior capsule and internal rotators (subscapularis, pectoralis major, and latissimus dorsi).

INVESTIGATIONS

An X-ray imaging was conducted encompassing both the antero-posterior and lateral perspectives of the right shoulder joint. It shows narrowing of joint space. There were no subsequent fractures, dislocations, or degenerative changes in the bones and joints.





OUTCOME MEASURE

The intensity of the pain was assessed utilizing the Visual Analog Scale, while the range of motion of the elbow was determined employing a universal goniometer. Certain special tests which were performed and came out to be positive to rule out the diagnosis were as follows –

- Jobe's relocation sign (Jobe et al., 1989)
  The patient is placed in a supine position, with the elbow flexed at 90 degrees and abducted to 90 degrees. An external rotation force is applied to the shoulder by the therapist. If the patient reports any feelings of apprehension, the Apprehension Test is deemed positive. Subsequently, the therapist may administer a posteriorly

directed force to the shoulder. If the patient experiences reduced apprehension or pain in

this position, the Jobe Relocation Test is regarded as positive (Dutton, 2008).

Jobe's relocation test

- Kim's impingement test

The patient will sit with his arm abducted to 90 degrees. The examiner supports the elbow and lateral aspect of the upper arm, applying a significant axial loading force. while the arm is raised diagonally upward at a 45-degree angle, downward and backward pressure is exerted on the upper arm. A sudden onset of posterior shoulder pain, irrespective of any accompanying posterior clunk of the humeral head, indicates a positive test result.

Kim's impingement test

Acute recovery phase – (0-2 weeks)

- Cryotherapy over posterior structures of the shoulder for 10 – 12 mins
- Ultrasound therapy with intensity of 0.8 watt/cm², frequency – 1MHz and time duration of 6 minutes over the posterior structures of the shoulder
- Soft tissue mobilizations/techniques as tolerated (Brotzman & Wilk, 2003).
- Range of motion restoration exercises to restore normal range of motion in the shoulder joint while avoiding exacerbating impingement.

Intermediate recovery phase – (2-4 weeks)

- Grade IV posterior glides of the glenohumeral joint in the scapular plane as described by Maitland (Maitland, 1991) and in maximum glenohumeral internal rotation in 90° shoulder abduction (Hsu et al., 2000).
- Active-assisted cross-chest adduction with manual stabilization of the scapula (Bang & Deyle, 2000). Cross- arm stretching exercises the cross-arm stretch can be performed in either a seated or supine position by the patient or by force imparted by a therapist (Manske et al., 2013).
- "Sleeper stretch" which allows posterior capsular stretching (Corpus et al., 2024) - 3 sets of 30 seconds

"Sleeper stretch" exercises in patients were found to have significant increases in both internal rotation and total rotation, as well as a 38% decrease in the prevalence of shoulder problems (Burkhart et al., 2003).

Rotator cuff and scapular strengthening exercises-

i. Rhythmic stabilization exercises are performed for the rotator cuff muscles in a supine position with the shoulder in approximately 20-30 degrees of scapular plane abduction and progressed to 90 degrees of elevation or more (still in the scapular plane) as the patient tolerates (Manske et al., 2013).

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Jobe's clinical classification of internal impingement (Jobe, 1997).

Stage	Presentation/symptoms
1. Early	Shoulder stiffness and need for prolonged warm-up, no pain with ADL's
2. Intermediate	Pain localized to posterior shoulder in the late cocking phase, no pain with ADL's
3. Advanced	Similar symptoms stage II, but refractory to a period for adequate rest and rehabilitation
ADL's – Activity of daily living	

ii. Rhythmic stabilization exercises are performed for the rotator cuff muscles in a supine position with the shoulder in approximately 20-30 degrees of scapular plane abduction and progressed to 90 degrees of elevation or more (still in the scapular plane) as the patient tolerates (Manske et al., 2013).

iii. Progressive exercises were performed with isometrics in greater ranges of either flexion or abduction or doing them in an upright position with the extremity in a closed chain position via hand placement on a wall (Davies & Dick off-Hoffman, 1993).

iv. The prone full can, or horizontal abduction (100 degrees of elevation) with external rotation exercise facilitates high supraspinatus electromyographic activity (Blackburn et al., 1990).

v. Push up plus done with feet elevated to enhance cuff and scapular muscle recruitment (Uhl et al.,2003).

vi. Prone on elbows strengthening exercise for early scapular strengthening.

vii. Prone Blackburn exercises performed in 100 degrees of abduction and external rotation (thumb up) (Blackburn et al., 1990).

viii. Core strengthening exercises (Corpus et al., 2024).

Advanced strengthening phase – (4-6 weeks)

- Scapular strengthening exercises using dumbbell and therabands
- Rotator cuff strengthening exercises using dumbbell and therabands
- LE & core- progress strengthening
- UE- push up progression
- Progress closed chain UE activities, balance, PNF (Brotzman & Wilk, 2003).

Return to activity (6-12 weeks)

- Proper throwing mechanics (Corpus et al., 2024).
- The home exercise program included the sleeper stretch, cross-chest adduction, external rotation, and scapular strengthening exercises (Tyler et al., 2010).
  - Flexibility exercises
  - Flexion
  - External rotation
  - Self – scapular stretches
  - Isotonic exercises
  - Supraspinatus
  - Prone extension
  - Prone horizontal abduction
  - Internal and external rotation
  - Neutral or 90/90 position
  - D2 proprioceptive neuromuscular facilitation (PNF) pattern (Brotzman & Wilk, 2003).

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Fig.1 and 2Ultrasound therapy with intensity of 0.8 watt/cm², frequency – 1MHz and Cross arm stretch done by therapist

"Sleeper stretch" which allows posterior capsular stretching (Corpus et al., 2024)- 3 sets of 30 seconds

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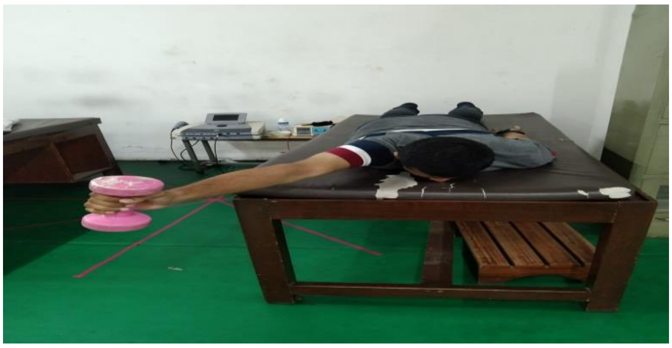

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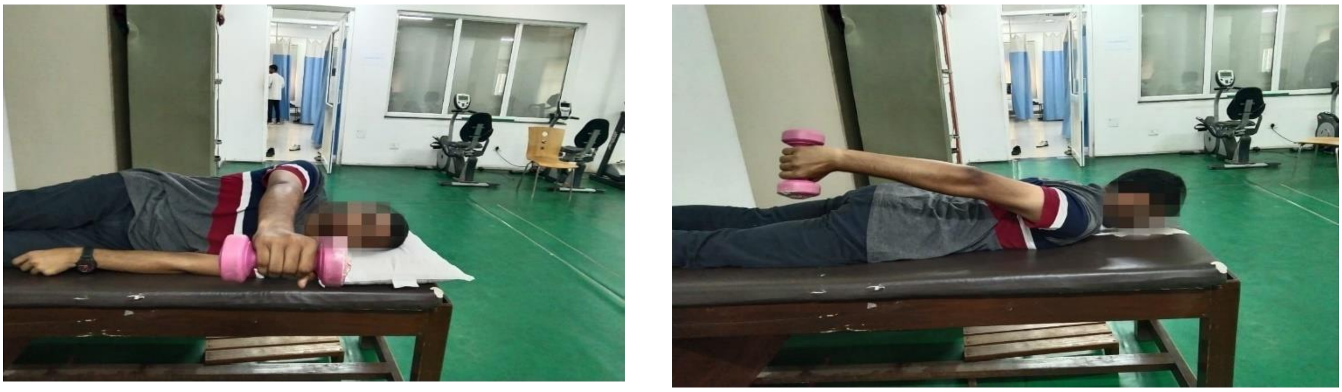

Fig.1.Cross- arm stretching exercises for posterior capsules stretching, 2. Wall push-ups to strengthen scapular muscles, 3. Push up progression: Push up plus done with feet elevated to enhance cuff and scapular muscle recruitment[47] 4.Ecentric strengthening of External rotators using TheraBand, 5. Shoulder external rotators strengthening exercise with dumbbell, 6. Scapular retractors strengthening exercises with dumbbell

Following the treatment, a clear decrease in discomfort and enhancement in mobility were evident.

OUTCOME MEASURES	PRE-INTERVENTION		POST INTERVENTION	
1. VAS	8 (During overhead activity and reaching behind the back)		0	
2. ROM(SHOULDER)	AROM	PROM	AROM	PROM
FLEXION	160º	165º	180º	180º
ABDUCTION	160º	165 º	175º	180º
INTERNAL ROTATION	45º	50º	65º	90º
EXTERNAL ROTATION	75º (with pain)	80º (with pain)	85º	90º

OUTCOME MEASURES	PRE-INTERVENTION	POST INTERVENTION
1. **MMT (SHOULDER)**	**GRADES**	**GRADES**
FLEXORS	**4**	**5**
EXTENSORS	**4**	**4+**
ABDUCTORS	**4-**	**4+**
ADDUCTORS	**4**	**5**
INTERNAL ROTATORS	**3+**	**4+**
EXTERNAL ROTATORS	**3+**	**4+**

DISCUSSION

In this case study, we encountered a 25-year-old male student presenting with symptoms indicative of internal impingement syndrome in his right shoulder. His history and clinical examination revealed pain and restricted range of motion, predominantly affecting movements such as overhead reaching and behind-the- back activities,

The assessment highlighted limitations in shoulder flexion, abduction, and internal rotation, along with weakness in the external rotators and rotator cuff muscles, and tightness in the posterior capsule and internal rotators. Positive findings from special tests such as Jobe's relocation test and Kim's impingement test corroborated the diagnosis of internal impingement.

Radiographic imaging ruled out fractures or degenerative changes but indicated joint space narrowing, consistent with impingement-related changes. The treatment plan involved a comprehensive six-week rehabilitation program focusing on cryotherapy, ultrasound therapy, soft tissue mobilization, and a structured exercise regimen aimed at restoring range of motion, improving strength, and enhancing scapular stability.

Throughout the rehabilitation phases—acute recovery, intermediate recovery, advanced strengthening, and return to activity—the patient showed significant improvement. Outcome measures demonstrated a marked reduction in pain intensity, improved range of motion, and enhanced muscle strength, as assessed by the Visual Analog Scale, goniometric measurements and manual muscle testing.

The SPADI score improved from 27.69% to 1.5% over the course of six-week physical therapy sessions. The patient reported full return to usual activity, with only mild or occasional symptoms associated with lifting and reaching overhead.

The Maitland (Maitland, 1991) mobilization techniques - Grade IV posterior glides of the glenohumeral joint in the scapular plane and in maximum glenohumeral internal rotation in 90° shoulder abduction (Hsu etal., 2000); active-assisted exercises of cross-chest adduction with manual stabilization of the scapula scapula (Bang & Deyle, 2000) supports our treatment.

Sleeper stretches which allows posterior capsular stretching (Corpus et al., 2024) - 3 sets of 30 seconds, these exercises in patients were found to have significant increases in both internal rotation and external rotation; Cross- arm stretching exercises that are performed in either a seated or supine position by the patient or by force imparted by a therapist (Manske et al., 2013) also supports our treatment.

CONCLUSION

In conclusion, the successful outcome of this case underscores the efficacy of a tailored physiotherapy approach in managing internal impingement syndrome. By addressing underlying biomechanical deficits, improving muscular balance, and restoring functional mobility, the rehabilitation program facilitated a return to pain-free activities. Long-term management will involve continued adherence to strengthening exercises, maintenance of proper throwing mechanics and ongoing monitoring to prevent recurrence and promote optimal shoulder health. We can use this therapeutic regime including cryotherapy for 10-12 mins, ultrasound therapy for 6 mins, soft tissue mobilization and Maitland mobilization (grade-4) techniques as tolerated as well as therapeutic exercises mentioned above in clinical practice.

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