

Addressing the Burden of Rotator Cuff Tears in India: Current Practices, Challenges, and Opportunities for Improved Diagnosis and Management in Healthcare and Service.

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Abstract

Background: Rotator cuff tears (RCTs) are a significant musculoskeletal issue in India, driven by lifestyle changes, an aging population, and increased physical activity. These injuries can result in pain, disability, and reduced quality of life. The complexity of diagnosing and managing RCTs in India is compounded by limited access to advanced imaging technologies, a shortage of specialized healthcare providers, and disparities in the healthcare infrastructure.

Methods and Materials: This study reviews existing literature and data from various sources, including the Indian Orthopedic Association, the Ministry of Health, and the World Health Organization. It examines the current practices for diagnosing and managing RCTs, assesses the prevalence and risk factors, and evaluates the effectiveness of various treatment modalities. Diagnostic tools like MRI, ultrasound, and arthroscopy were analyzed for their sensitivity and specificity in detecting RCTs.

Results: RCTs are prevalent in India, particularly among individuals over 50, with an estimated prevalence of 22.5%. Men are more commonly affected due to physically demanding jobs. Advanced diagnostic tools like diffusion-weighted MRI and MR Arthrography provide accurate diagnoses. Arthroscopic rotator cuff repair (RCR) shows high success rates, ranging from 70% to 90%. Early diagnosis and appropriate treatment, including physical therapy and surgical intervention, are crucial for optimal outcomes.

Conclusion: Managing RCTs in India requires a comprehensive approach involving enhanced healthcare infrastructure, increased access to advanced imaging, and specialized training for healthcare providers. Despite progress, challenges remain, such as the need for standardized treatment protocols and specialized care facilities. Addressing these issues through research collaboration and knowledge exchange can improve patient outcomes and reduce the burden of RCTs in India.

Keywords: Rotator Cuff Tears, India, Diagnosis, Management, Healthcare Disparities

INTRODUCTION

Relevance to topic: Rotator cuff injuries are a typical musculoskeletal issue with a shoulder. In India, rotator cuff injuries are likely a result of changes in lifestyle, ageing populations, and increased involvement in physical activity. Healthcare professionals can better serve the requirements of patients by having a better understanding of the prevalence.

A Physical examination is done to evaluate the shoulder joint's stability. Imaging tests such as MRI, MR Arthrography, and X-ray are performed. Diagnosing an RCT (complete or partial thickness) can determine whether the patient will be managed conservatively or need surgery. Indian communities may not benefit from the same treatment choices for rotator cuff injuries as other countries, so these studies are conducted to enhance patient outcomes and assist clinicians in choosing the best interventions for their patients.

In India, rotator cuff tears are a complicated problem that necessitates an all-encompassing approach to healthcare provision. This entails comprehending present procedures, examining epidemiological data, and recognizing obstacles, including uneven access to sophisticated imaging equipment, a scarcity of orthopaedic experts with the necessary training, and inequalities in the healthcare delivery system. Determining options for improvement such as telemedicine, training programs, and public health campaigns; assessing awareness and education among healthcare professionals, patients, and the general public; and assessing the accessibility and availability of healthcare services. Assessments are also conducted on the long-term effects of various treatment techniques, such as pain alleviation, functional recovery, and patient satisfaction.

Rotator cuff tears are a common musculoskeletal condition in India, causing pain, disability, and reduced quality of life. Initiatives like telemedicine, training programs, and public health campaigns can improve access to care, awareness, and outcomes. Analyzing the cost-effectiveness of diagnostic and treatment approaches is crucial for optimizing care delivery and reducing healthcare costs.

AIM OF THE RESEARCH

Addressing the Burden of Rotator Cuff Tears in India: Current Practices, Challenges, and Opportunities for Improved Diagnosis and Management in Healthcare Services by means of comprehensive resources based on anatomy, physiology, variables influencing surgical treatments in India, studies to determine the optimal Imaging modality for accurate diagnosis and analysis for surgical interventions.

Study on Rotator Cuff Tears in India's Healthcare

- Addresses issues like limited access to advanced imaging technologies, shortage of trained orthopedic specialists, and healthcare infrastructure disparities.
- To enhance patient outcomes, reduce disability, and improve quality of life.
- Evaluate the cost-effectiveness of diagnostic and treatment approaches to optimize care delivery and reduce healthcare costs.

OBJECTIVES OF THE STUDY

1. Comprehensive Assessment of Current Practices: Review and analyze current diagnostic and management practices for rotator cuff tears in India.
2. Identification of Challenges: Document critical barriers faced by healthcare providers, patients, and the healthcare system in diagnosing and managing rotator cuff tears.
3. Opportunities for Improvement: Identify strategies for improving diagnosis and management, including interventions, training programs, technology enhancements, and policy recommendations.
4. Development of Best Practice Guidelines: Develop evidence-based guidelines tailored to the Indian healthcare context.
5. Capacity Building: Develop educational materials, workshops, or training programs to enhance healthcare providers' knowledge and skills.
6. Improved Patient Outcomes: Facilitate earlier diagnosis, appropriate treatment plans, and better long-term management of rotator cuff tears.
7. To determine the prevalence of rotator cuff injuries among the Indian population.
8. To identify the risk factors associated with rotator cuff injuries in India.
9. To evaluate the impact of rotator cuff injuries on the quality of life and functional outcomes of affected individuals in India.
10. To evaluate the effectiveness of current treatment modalities for rotator cuff injuries in the Indian context.
11. To investigate possible preventative measures to lower the number of rotator cuff injuries in India.
12. To contribute to the existing body of knowledge on rotator cuff injuries and enhance understanding of this condition among healthcare professionals in India.

LITERATURE REVIEW

1.1 Anatomy of rotator cuff muscles

Four muscles surround the humeral head, or the ball of the shoulder joint, and their tendons make up the rotator cuff, stabilizing the shoulder joint and providing an extensive range of motion. The rotator cuff tendons are inserted into the humeral tuberosity after converging with the joint capsule and coracoid-humeral ligament. The teres minor, subscapularis, supraspinatus, and infraspinatus are the four muscles that make up the rotator cuff, called the "SITS" muscles. (Fig.1.1)

- Supraspinatus (SS): Attaches to the more prominent tubercle of the humerus after emerging from the supraspinous fossa of the scapula.

- Infraspinatus (IS): Attaches to both the humerus's more prominent tubercle and the scapula's infraspinous fossa.

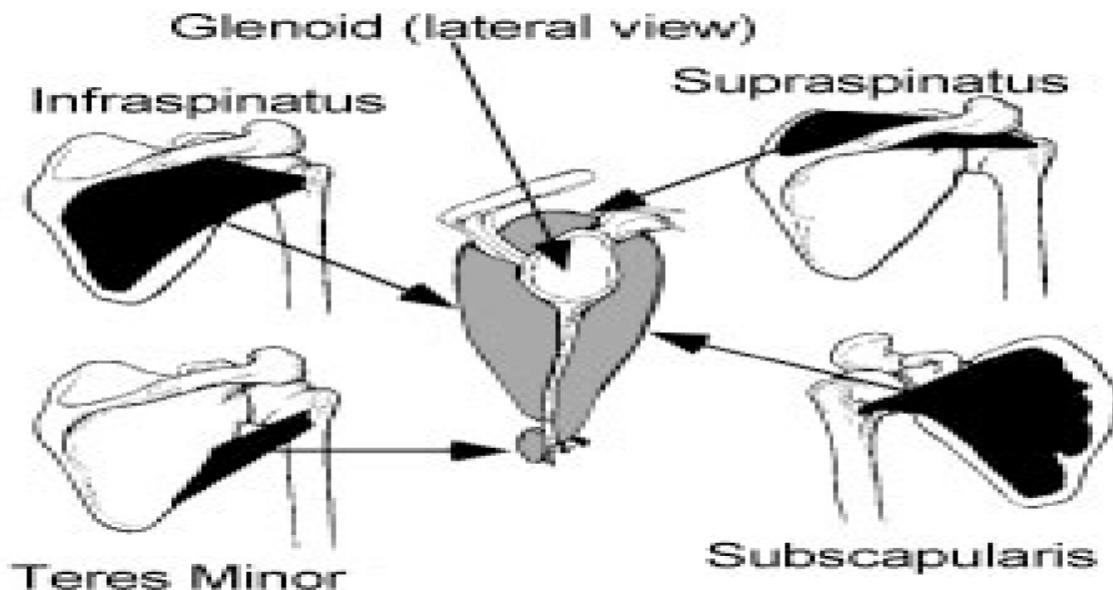
- Teres minor (TM): Derives from the scapula's lateral edge and attaches to the larger tubercle of the humerus after emerging from the lateral edge of the scapula.

- Subscapularis (SC): Attaches to the lesser tubercle of the humerus after emerging from the subscapular fossa of the scapula. The subscapularis is the most significant and strongest cuff muscle, with a tendinous upper 60% of its insertion and a muscular lower 40%. The footprint attachment of

the SC varies from 24 to 40 mm in the superoinferior direction to 16 to 20 mm in the mediolateral direction.

Figure 1.1- Rotator cuff Muscles

Image source: Research gate {Anatomy and function of rotator cuff muscles. Anterior (subscapularis) and posterior (infraspinatus, supraspinatus, teres minor) views of each of the rotator cuff muscles are illustrated, along with a lateral view of all four muscles and their anatomical relation to the glenoid fossa.}



The proximal humerus' tuberosities receive tendons from four muscles on the scapula. These muscles coordinate the glenohumeral, scapulothoracic, sternoclavicular, and acromioclavicular joints, allowing smooth arm and shoulder mobility during exercise. Rotator cuff muscles tendons surround the humeral head, aligning with the glenohumeral joint capsule. Acromioclavicular joint forms clavicle articulating with acromion. Rotator cuff tears, often located in the supraspinatus, affect the muscles' rotation, arm elevation, and shoulder joint stabilization. The bursa, a sac between the rotator cuff and acromion, becomes inflamed and uncomfortable.

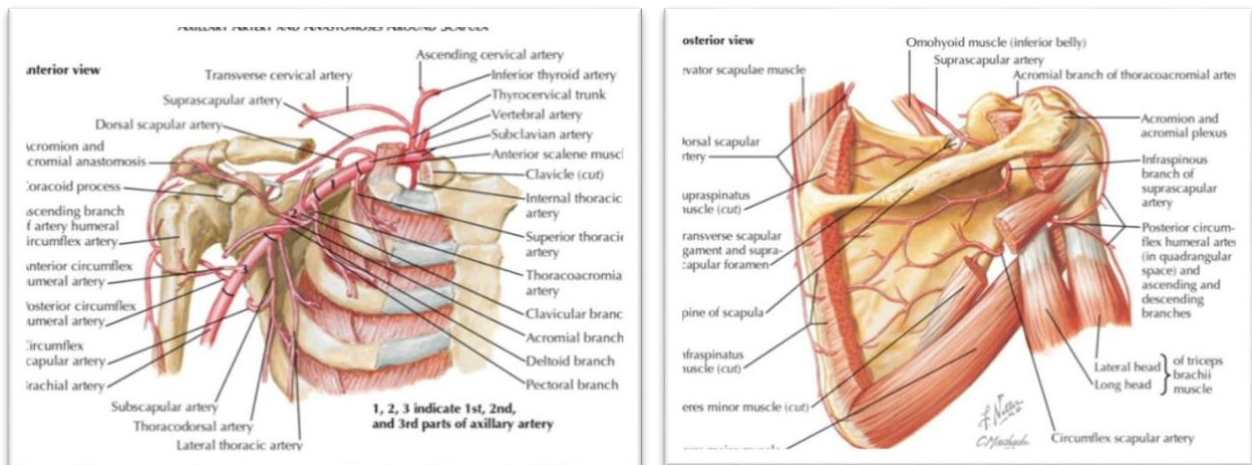
Blood supply to the rotator cuff muscles:

The thyrocervical trunk, a branch of the subclavian artery, provides blood to the rotator cuff muscles through the suprascapular artery, which emerges at the base of the neck. The muscle that supplies the supraspinatus and infraspinatus is inserted into the posterior scapular area above the suprascapular foramen.

Of the axillary arteries, the subscapular artery is the biggest branch. The axillary artery's third segment is this artery's source, which splits into the thoracodorsal artery and the circumflex scapular artery, both of which give blood to the subscapularis muscle. The posterior circumflex humeral artery emerges from the third segment of the axillary artery. It provides blood to the teres minor muscle after entering the posterior scapular area via the quadrangular gap. (Fig. 1.2).

Figure 1.2: Blood supply

Image source: Netter {Vascular supply of the rotator cuff. (From Iannotti JP, Parker RD. The Netter Collection of Medical Illustrations: Musculoskeletal System, Volume 6 Part I: Upper Limb. Philadelphia: Elsevier; 2012)}



Innervation

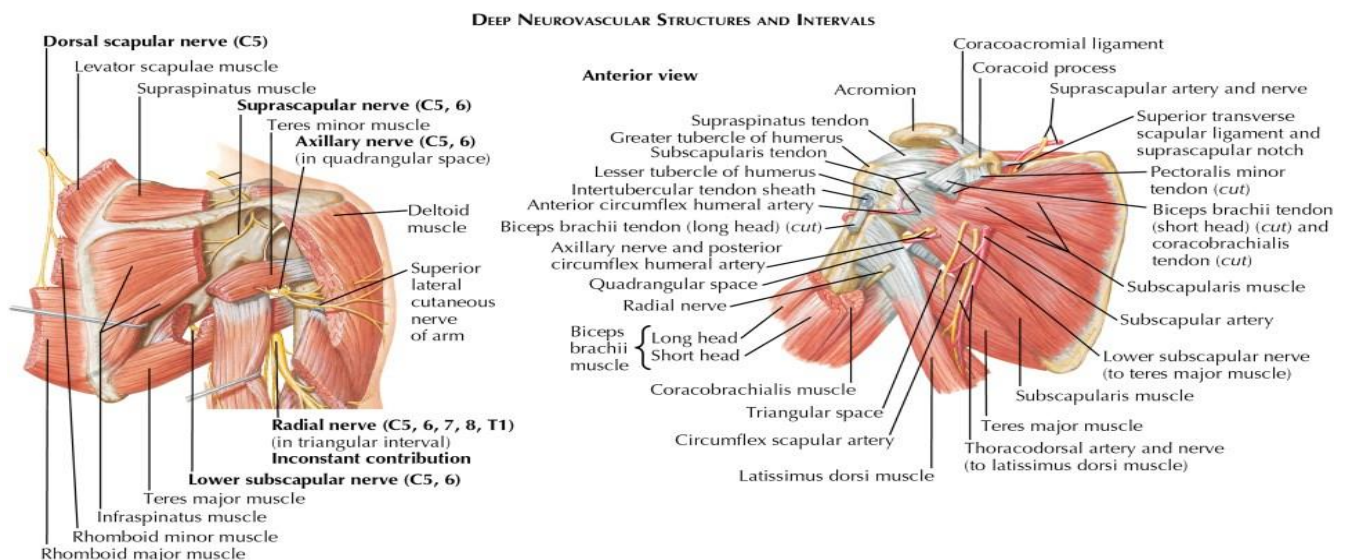
The subscapularis muscle is innervated by the subscapular nerve (upper and lower branches). Emerges from the brachial plexus's posterior chord (C5, C6, C7)

The suprascapular nerve innervates the infraspinatus and supraspinatus. Originates from the brachial plexus's superior trunk and goes via the C5 and C6 suprascapular foramen.

Teres minor is innervated by the axillary nerve, which comes from the brachial plexus's posterior chord and goes via the quadrangular gap, entering the C5 and C6 posterior scapular regions. (Fig.1.3)

Figure 1.3: Nervous supply

Image source: Netter {Innervation of the rotator cuff. (From Iannotti JP, Parker RD. The Netter Collection of Medical Illustrations: Musculoskeletal System, Volume 6 Part I: Upper Limb. Philadelphia: Elsevier; 2012.)}

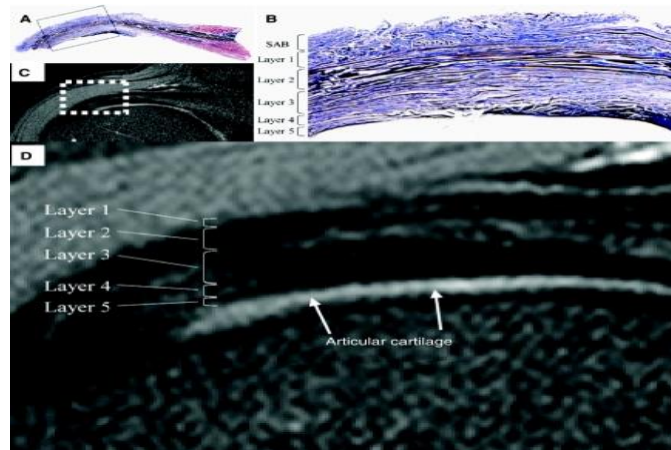


1.2 Physiology of Rotator cuff muscles

Understanding the pathogenesis of rotator cuff (RC) injuries requires understanding the histology of different RC muscles. The supraspinatus muscle, located on top of the shoulder blade, is involved in shoulder abduction due to its type I fibers, which are fatigue-resistant but less force-producing. The infraspinatus and teres minor muscles balance strength and endurance but can develop rotator cuff

tears due to degeneration from trauma or repetitive overhead exercises. The subscapularis muscle, located on the front of the shoulder blade, also contributes to internal rotation (Fig 1.4)

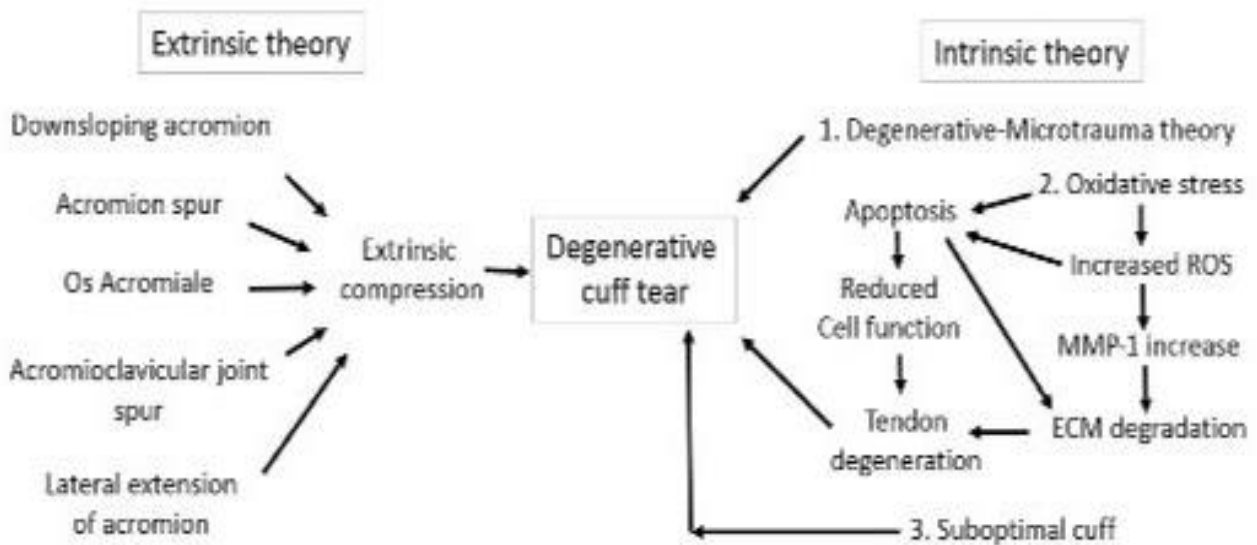
Figure 1.4; Image source: Research gate {Correlation of five-layer structure of rotator cuff between the histologic specimen and MR images. A, B: Histologic specimen of the supraspinatus tendon (Elastica-Masson stain). SAB = tissue of subacromial bursa. C, D: High-resolution MR images demonstrate the corresponding laminar structure of the supraspinatus tendon (Fat-suppressed short-TE T2-weighted images: TR/TE = 1800/50).}



Rotator Cuff Tears Extrinsic Pathway

- Anatomical differences in subacromial space, acromion form, and acromioclavicular joint morphology can affect the mechanics of rotator cuff muscles.
- Improper glenohumeral and scapular joint mechanics can strain the muscles, increasing the risk of rotator cuff injuries.
- Trauma can result in partial or complete tears of the rotator cuff tendons, especially in athletes or repetitive overhead motions.
- Systemic problems like diabetes, thyroid issues, and autoimmune diseases can degrade the tendon's collagen, hindering its repair.
- Metabolic disorders that impair tendon integrity can increase the likelihood of rotator cuff tears and degenerative alterations (fig 1.4)

Figure 1.5 - Summary of extrinsic and intrinsic pathways of rotator cuff tear



Rotator Cuff Tears Intrinsic Route

- Anomalies in shoulder mechanics and elevated stress on tendons can cause tears.
- Weakness in exterior rotators (teres minor and infraspinatus) compared to internal rotators (subscapularis) can lead to tears.
- Tendon Degeneration weakens the tendon structure due to microtrauma, diminished vascularity, and disorganized collagen.
- Degeneration can lead to thinning, elasticity loss, and increased vulnerability to tears.
- Subacromial impingement occurs when rotator cuff tendons squeeze during shoulder motions.

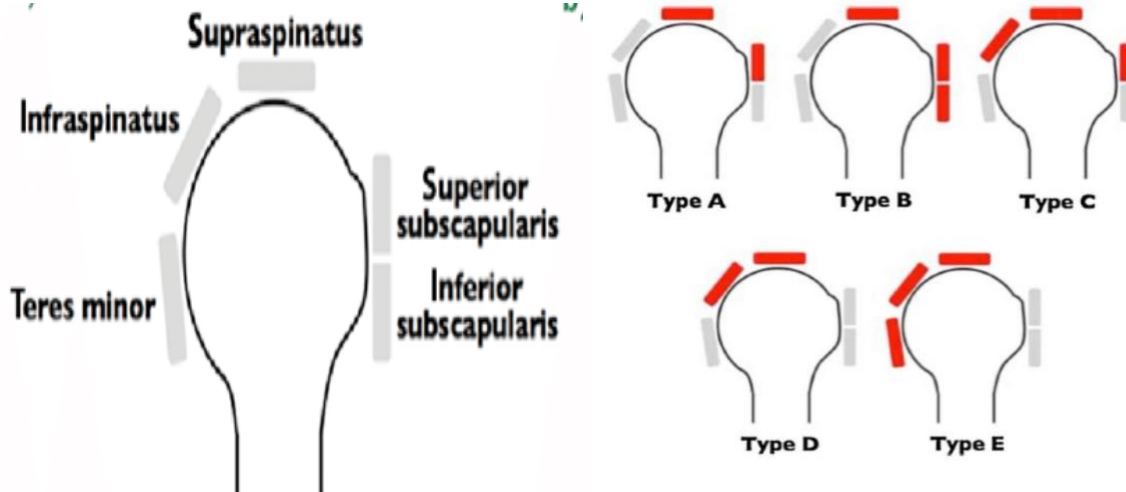
1.3 Clinical biomechanics of Rotator cuff tear

1.3.1 Biomechanics of Rotator Cuff Tears

The biomechanics and stability of the glenohumeral joint are affected by rotator cuff injuries, which frequently result in shoulder pain and disability. This leads to more significant passive external rotation and weakness in active internal rotation. Acute injuries, recurrent microtrauma, or degenerative alterations can bring on RCT. These conditions can cause aberrant muscle activation patterns, impingement, and shoulder instability. The growth of the infraspinatus tear also affects the kinematics of the humeral head, leading to superior-lateral migration during maximal internal rotation and posterior migration in the mid-range of motion. This lowers the joint compression force and is caused by an imbalance in the glenohumeral force pair. Additionally, there is an impact on the direction of the joint response forces, which results in an off-centered compression force and increased instability of the humeral head migration.

1.3.2 Classifications

A] Collin et al. further classify them into five categories:



Type A: superior subscapularis tears and supraspinatus tears

Type B: full subscapularis tears and supraspinatus

Type C: tears in the infraspinatus, superior subscapularis, and supraspinatus

Type D: supraspinatus & infraspinatus tears

Type E: supraspinatus, infraspinatus, and teres minor tear

B] Cofield created a Scheme for thickness rotator cuff injuries:

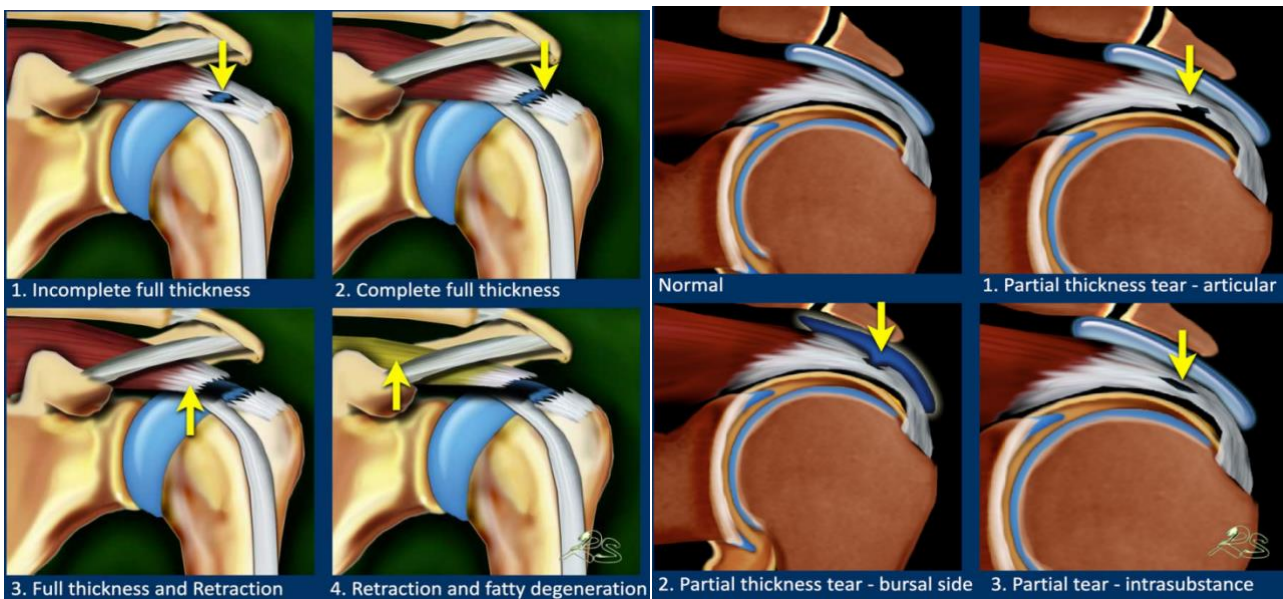
- a) Small tear: less than 1 cm
- b) Medium tear: 1–3 cm
- c) Large tear: 3–5 cm
- d) Massive tear: greater than 5 cm.

C] Symptom Based

- a. Symptomatic Tears: pain, weakness, and limited ROM
- b. Asymptomatic Tears: No clinical Symptoms but seen in Imaging

D] Full-thickness tears can be divided into:

- a. Incomplete FTT: There is a full-thickness tear, but only part of the tendon width is involved.
- b. Complete FTT: A full-thickness tear is complete when the whole tendon is ruptured.
- c. Complete FTT+ retraction: The FTT is complicated by the retraction of the muscle.
- d. Complete FTT+ retraction+ atrophy: The FTT is complicated by muscle retraction, atrophy, and fatty infiltration, resulting in a poor prognostic outcome.



E] Partial thickness tears can be divided into:

- Articular-sided tears: located at the undersurface of the tendon and connected to the glenohumeral joint.
- Bursal-sided tears: located at the bursal surface and connected to the subdeltoid bursa.
- Intrasubstance tears: located within the tendon without communication to the joint or bursa.

1.3.3 Clinical Implications & Symptoms

- Significant pain at accident moment.
- Nighttime and overhead pain.
- Positive painful arc sign.
- Shoulder stiffness.
- Muscle atrophy or thinning around the shoulder.
- Crackling or crepitus feeling when moving shoulder.
- Symptoms radiate down the arm, discomfort in the anterior shoulder, and soreness above greater tuberosity.

1.3.4 Rotator Cuff Tear Impact

- Chronic shoulder discomfort impairing quality of life and daily tasks.
- Shoulder weakness, instability, and reduced range of motion due to rupture.
- Muscular atrophy in rotator cuff muscles due to misuse or inadequate rehabilitation.
- Adhesive capsulitis, or frozen shoulder, causing pain and stiffness.
- Rotator Cuff Arthropathy, resulting from degenerative changes in the shoulder joint.
- Impaired quality of life due to discomfort, restricted function, and impairment.
- Psychological impact, including despair, anxiety, and low self-esteem.

- 2-3% of people experience problems after rotator cuff repair surgery, which can be reduced with careful surgical methods.

1.4 Factors influencing Rotator cuff tears in India

A number of factors may influence the incidence and severity of rotator cuff tears in the Indian population. Creating focused preventative and treatment plans requires an understanding of these variables.

- Biomechanical Aspects:** Shoulder joint biomechanics, which includes degenerative changes, repetitive overhead activities, and muscle imbalances, can affect rotator cuff tears. In India, rotator cuff injuries are more common in manual laborers and athletes who perform repetitive overhead work. Partial tendon tears can result in a full tear when they are caused by repeated tension and microtrauma. Age and hand dominance are other factors that raise the risk of rotator cuff injury. Tendons get weaker with age, which increases the risk of tearing injuries.
- Rotator cuff tears are linked to anatomic abnormalities in acromial shape, spurs, and joint morphology, with a study in Indian patients indicating a correlation (Singh et al., 2018).
- Genetic factors may increase rotator cuff injury risk, with Indian individuals potentially having a hereditary propensity to the disease. Further research is needed (Verma et al., 2020).
- Lifestyle variables like smoking, obesity, and physical activity levels can increase the risk of rotator cuff tears, with obesity and sedentary lifestyles being strongly linked to this disease in Indian populations (Gupta et al., 2017).

The complexity of rotator cuff tears in the Indian population highlights the significance of risk factors in diagnosing, evaluating, and treating this ailment.

SOME BASIC RISK FACTORS THAT AFFECT RCT

1. Due to the weakening and degeneration of the rotator cuff tendons with age, rotator cuff tears are more likely in those over 40.
2. Rotator cuff tendons are susceptible to tension and tears while engaging in repetitive overhead actions like throwing, lifting, or reaching.
3. A rotator cuff rupture can result after an abrupt fall, impact, or violent movement, particularly in athletes or those who engage in strenuous activities or sports.
4. Abnormal shoulder mechanics and muscular imbalances brought on by poor posture increase the likelihood of tears in the rotator cuff tendons by placing additional strain on them.
5. Hereditary variables affecting tendon strength and integrity may predispose certain persons genetically to develop RCT.
6. Smoking can reduce blood flow to the tendons and tissues, which increases the risk of damage and rips and decreases the tissues' capacity to recover.
7. Impingement is the result of the RC tendons rubbing against the shoulder joint's acromion bone, which can cause irritation, deterioration, and even rips.
8. The risk of rotator cuff tears might be elevated by weakness or imbalance in the muscles around the shoulder joint since these muscles may not be able to offer sufficient stability and support.
9. Rotator cuff tears may be more common in those who have had prior shoulder injuries, surgeries, or disorders such as shoulder instability.

CHALLENGES IN DIAGNOSING AND MANAGEMENT OF ROTATOR CUFF INJURIES IN INDIA

- **Limited Access to Advanced Imaging Technologies:** Lack of MRI or ultrasound in many healthcare facilities leads to delays in diagnosis and treatment.
- **Shortage of Specialized Healthcare Providers:** Insufficient orthopedic specialists and physiotherapists in India can result in misdiagnosis or inadequate treatment.
- **Lack of Awareness and Education:** Limited understanding of rotator cuff injuries can lead to delays in seeking medical attention.
- **Affordability of Treatment:** The cost of treatment can be prohibitive, especially for lower socioeconomic backgrounds.
- **Cultural Beliefs and Practices:** Cultural beliefs can influence patients' perceptions and treatment adherence.
- **Fragmented Healthcare System:** Challenges in coordination between primary care providers, specialists, and rehabilitation services can lead to sub-optimal outcomes.
- **Limited Rehabilitation Services:** Insufficient access to quality rehabilitation services can hinder patients' recovery and functional outcomes.

1.5 Differential diagnosis

- i. Arthrography or ultrasonography are used to distinguish between subacromial bursitis and rotator cuff tendinopathy.
- ii. Acromioclavicular injury: AC Joint Injury (ACI) is a localized pain at the shoulder's top, often caused by a blow or fall. RCI, on the other hand, is deep in the shoulder and radiates down the arm, often from overuse or sudden trauma. A limited range of motion is observed.
- iii. Glenoid labrum tear: Slap lesions and bankart lesions are common injuries involving an outstretched arm, causing pain deep in the shoulder joint and limited range of motion, especially during overhead activities or traumatic events.
- iv. Cervical pathology: Cervical Radiculopathy, a condition characterized by pain radiating from the neck down the arm, can lead to cervical spondylosis, a condition characterized by muscle weakness in specific muscle groups.
- v. Subacromial Impingement: The acromion, a bony protrusion on the shoulder blade and the humeral head, is an ailment caused by compression or press of rotator cuff tendons during shoulder motions. RCT is damage to tendons due to trauma, aging, or overuse.
- vi. Osteoarthritis (OA), Rheumatoid Arthritis (RA): Osteoarthritis is a degenerative joint condition causing discomfort, stiffness, and restricted range of motion in the shoulder joint. Rheumatoid arthritis is an inflammatory condition causing pain, swelling, and stiffness. Blood tests reveal increased auto-antibodies (such as rheumatoid factor and anti-cyclic citrullinated peptide antibodies) and inflammatory indicators (such as C-reactive protein).
- vii. Shoulder Instability: Shoulder instability is excessive shoulder joint mobility causing partial or total dislocation. Symptoms include slipping out of place, soreness, weakness, and looseness. It's often linked to specific postures or actions. Physical examinations can detect shoulder instability.

- viii. Sub-scapular nerve entrapment: Sub-scapular nerve entrapment causes deep shoulder discomfort, weakness during internal rotation, and difficulty reaching behind the back. Assessment exercises like lift-off and belly press tests can help manage the condition.
- ix. Scapulo-thoracic bursitis: Scapulo-thoracic bursitis is an inflammation of the bursa between the rib cage and the shoulder blade, causing discomfort, pain, and soreness. It can be diagnosed through scapular assistance tests or dyskinesia evaluations.
- x. Adhesive Capsulitis is characterized by shoulder stiffness and discomfort, often worsening at night and affecting women more frequently. It is more common in those aged 40-60 and may be linked to specific illnesses.
- xi. Biceps Tendonitis: Inflammation of the biceps tendon, affecting the shoulder joint. It causes shoulder discomfort, worsened by overhead tasks. Range of motion is less restricted, and tenderness is felt in the bicipital groove.
- xii. Calcific Tendonitis Shoulder: Calcific Tendonitis is a condition characterized by calcium buildup in the supraspinatus tendon, causing sudden, severe shoulder discomfort. Symptoms include extreme localized pain, limited range of motion, and potential rotator cuff rupture. Diagnosis involves X-rays and ultrasonography to examine calcium deposits.
- xiii. Parsonage Turner Syndrome, Thoracic Outlet Syndrome: PTS is an uncommon illness causing severe shoulder pain, atrophy, and weakening in the affected arm and shoulder muscles. It's characterized by brachial plexus-related nerve involvement, affecting multiple muscles. Recovery times vary, but most patients show progressive improvement in strength and mobility. Studies on nerve conduction and electromyography (EMG) can be helpful.
- xiv. Glenohumeral ligament tears or sprains: Glenohumeral ligament tears can impair the function and stability of the shoulder by causing symptoms like instability, diminished joint stability, and shoulder soreness. These tears can be brought on by trauma, prolonged stress, or rapid motion.

MATERIALS AND METHODS

2.1 Data collection

This course study is an overview of the vast knowledge of existing data on Rotator cuff injury in India. The database from the Indian Orthopedic Association (Bangalore, Mangalore, Udupi), the India Ministry of Health, the World Health Organization, PubMed, and other relevant medical records from the years 2017–2024 are examined. The reference standard, the sensitivity, specificity, and accuracy of MRI and MR Arthrography were used for the diagnosis of complete and partial thickness tears.

2.2 Data Analysis

India's Orthopaedic Procedures in 2022

- 5,675,561 orthopaedic procedures were performed in India in 2022.
- The market research study includes procedures related to orthobiologics, arthroscopy, trauma fixation, hip replacement, knee reconstruction, spinal surgery, craniomaxillofacial fixation (CMF), shoulder replacement, and joint reconstruction.

Arthroscopic Procedures in India

- In 2022, 688,221 arthroscopy procedures were carried out.
- Three main market categories for arthroscopy treatments in India are Radio-frequency systems and wand operations, implant procedures, and arthroscopic shaver procedures.

Arthroscopic Shavers and Arthroscopy Implants

- Arthroscopic Shavers remove material from tissue and bone.
- Arthroscopy Implants maintain precise alignment of minor bone fractures and apical fragments.
- Arthroscopy Radio Frequency Systems and Wands are used for soft tissue ablation and resection in arthroscopic operations.

Rotator Cuff Surgery Success Rate

- Rotator cuff surgery has a 95% success rate for small tears and over 70% for two tendon tears. [Table 1]

Table 1: List of Procedures estimation conducted in the year 2020

Procedures type	Year	No. of procedures
Indian Orthopedic	2022	5,675,561 procedures
Indian Arthroscopy	2022	688,221 procedures

2.3 Incidence & Prevalence Statistics in India

Rotator Cuff Injuries in India: A Case Studies Overview

- No precise information on the frequency and incidence of rotator cuff injuries in India.
- Shoulder discomfort is a prevalent musculoskeletal complaint in India, with rotator cuff tears being a major cause.
- Roughly 21.5% of all musculoskeletal diseases in orthopaedic outpatient clinics in India are shoulder disorders, including rotator cuff injuries.
- A retrospective research at a South Indian tertiary care hospital found rotator cuff tears most frequently cause shoulder discomfort.

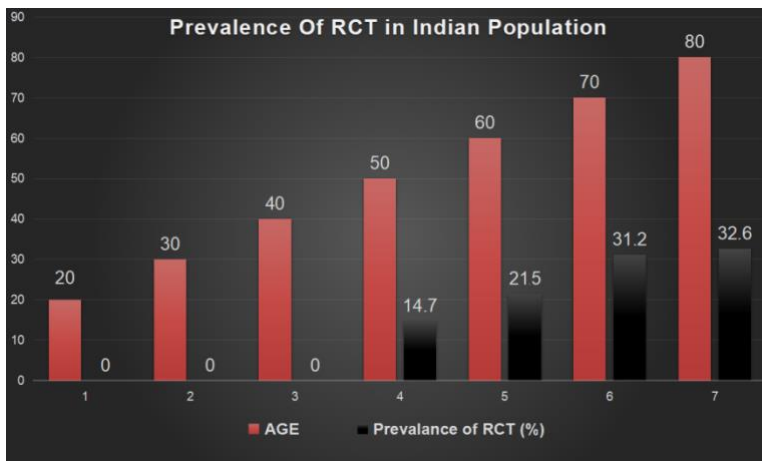


Fig 2.1 (Chart): Each decade's prevalence of rotator cuff tears. The prevalence of full-thickness rotator cuff tear in each decade was 0% in the 20s to 40s, 14.7% in the 50s, 21.5% in the 60s, 31.2% in the 70s, and 32.6% in the 80s

Source: Scholars Journal of Applied Medical Sciences, <https://saspublishers.com>.

In India, rotator cuff tears are a prevalent musculoskeletal issue, particularly among those who engage in physically demanding professions or sports. Anecdotal data and clinical experience indicate that a considerable number of rotator cuff repair procedures are performed annually by orthopaedic surgeons in major cities and metropolitan centres nationwide. Consequently, there has been a rise in the number of rotator cuff procedures carried out in India.

In order to enhance patients' quality of life and restore shoulder function, orthopaedic surgeons in India are becoming more and more aware of the significance of rotator cuff injuries and how to treat them. To treat their shoulder discomfort and dysfunction, an increasing number of patients with rotator cuff tears are choosing surgical intervention thanks to improvements in medical technology, surgical procedures, and rehabilitation programmes. Furthermore, It is noteworthy that several factors, including patient demographics, referral patterns, and the level of skill possessed by orthopaedic surgeons in various countries, may impact the frequency of rotator cuff surgery. More investigation and data gathering are required to give a more precise estimate of the prevalence of rotator cuff surgery in India.

2.4 Diagnostics Applications Used in India

The diagnosis considers subjective history, clinical examination, X-rays, MRI, ultrasound, diagnostic arthroscopy, and Isokinetic muscular performance test (IMPT).

- History includes passive coping tendencies, pain syndromes, previous injuries, activities causing pain, concurrent mental disorder, and absence of community or family encouragement.
- Clinical examination includes rotator cuff tests, strength testing, and range of motion assessments.
- MRI is used to observe soft tissue structures like rotator cuff muscles and tendons and to determine the tear's dimensions, position, and degree.
- Ultrasound is used when MRI is unavailable or contraindicated for real-time visualization of the rotator cuff.
- Diagnostic arthroscopy is a minimally invasive surgical technique to gain insight into the shoulder joint and determine if a tear is present.

- Isokinetic muscular performance test (IMPT) is used to determine the functional state of the rotator cuff muscles.

IMPROVEMENT AREAS FOR ROTATOR CUFF TEARS IN INDIA:

- **Enhance Healthcare Infrastructure:** Increase the availability of specialized orthopedic clinics and rehabilitation centers.
- **Develop regional centers of excellence** for comprehensive orthopedic care.
- **Invest in expansion and modernization** of healthcare facilities.
- **Access to Advanced Imaging Technologies:** Expand the availability of MRI and ultrasound in public and private healthcare facilities.
- **Implement telemedicine and teleradiology services** for remote interpretation of imaging studies.
- **Provide training for healthcare professionals** on using and interpreting imaging modalities for diagnosing rotator cuff tears.
- **Training for Healthcare Providers:** Offer specialized training programs, workshops, and continuing medical education courses.
- **Establish mentorship programs and collaborative networks.**
- **Encourage research collaborations and partnerships** to advance understanding and treatment of rotator cuff injuries.

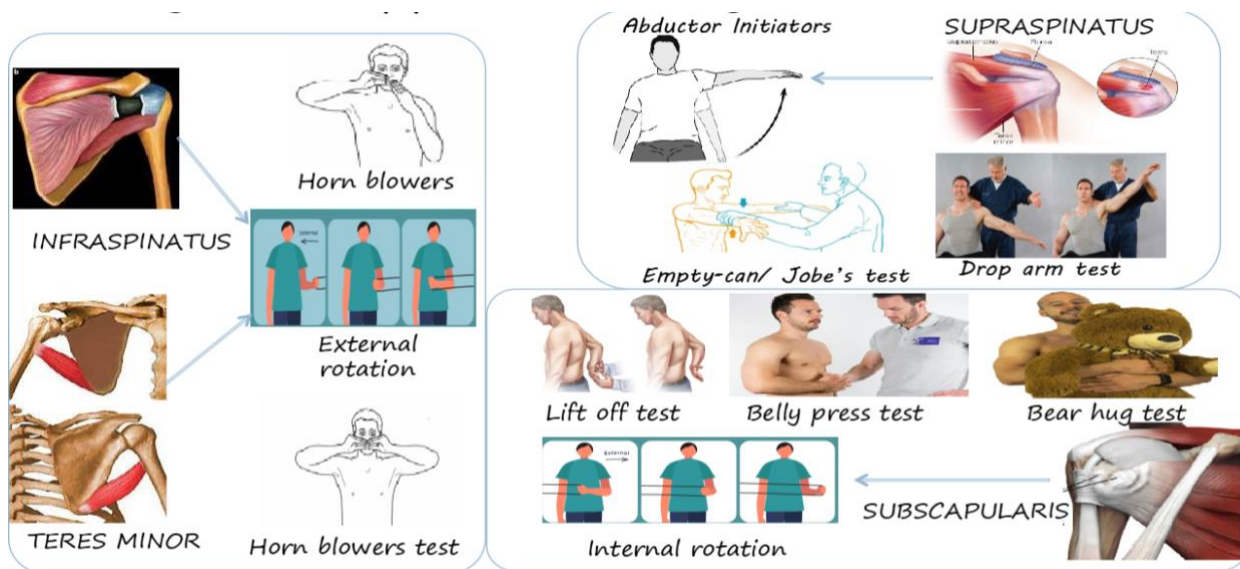
EXAMINATIONS:

The physician must assess the following ranges of motion: forward flexion, abduction, and internal/external rotation at 0° and 90°. Passive range of motion is frequently retained in cases with rotator cuff injuries, whereas active range of motion is lost.

An easily transportable handheld dynamometer may be used to assess strength. A single muscle primarily powers every movement. We assess the subscapularis muscle's internal rotation, the supraspinatus muscle's abduction, and the infraspinatus muscle's exterior rotation force. Shoulder weakness is a common presenting feature of rotator cuff injuries. If it is found that the patient effectively utilised other muscles to complete the job, the examiner has to cancel the muscle performance test.

Numerous specialised tests are mentioned for rotator cuff evaluation. A positive test results in a torn tendon in that corresponding area. A test is considered successful when a position cannot be performed or maintained.

Figure 2.3 Diagnostic approach through provocative tests



A] Tests for subscapularis:

- **Lift-off test and Passive Lift of Test:** A patient's subscapularis dysfunction is assessed through a lift-off test, where the patient's hand is placed on their back with the elbow at a right angle. The patient resists raising their hand off their back, using the examiner's aid to hold the posture against gravity. A positive test indicates tears or injuries may be the cause.
- **Belly Press:** The test measures a patient's subscapularis muscle contraction by pressing their palm on their abdomen while holding their elbow at a straight angle. The examiner instructs the patient to maintain a proper elbow angle and apply modest pressure. The test indicates a potential subscapularis RCT if the patient feels discomfort or weakness or can't hold the posture.
- **Bear Hug Test:** The Bear Embrace Test involves a patient reaching their shoulder blade, rotating their shoulder, and attempting to contact their lower spine. The examiner checks for discomfort, weakness, or restricted range of motion. A patient scoring positive on the test indicates they can embrace themselves and grasp their shoulder well.

B] Tests for Supraspinatus:

- **External rotations lag sign: 0° and 90°:** Examining the patient's capacity to rotate the shoulder at various degrees against gravity externally determines these muscles' function. Positive findings for supraspinatus or infraspinatus on the External Rotation Lag Sign RCTs imply that these muscles, which are in charge of the shoulder's external rotation, are weak or dysfunctional. The best test for infraspinatus muscle.
- **Jobe's test:** Often referred to as the Full Can or Empty Can test, involves having the patient stand or sit with their arms at their sides and elbows outstretched. With the thumbs pointing down, the patient is asked to raise their arms to a 90-degree angle in the scapular plane (shoulder abduction), mimicking the act of emptying a can by the examiner. The patient keeps their arms abducted while the examiner applies downward pressure to them, resisting the force. Weakness, soreness, or an inability to hold the posture against resistance may indicate a supraspinatus tendon tear and imply a positive test result.
- **Drop arm test:** The patient sits or stands with their elbows outstretched and their arms at their sides. The examiner passively raises the patient's arm to a 90-degree angle in the scapular plane (shoulder abduction). The examiner then instructs the patient to drop their arm back to the side carefully and gently. A positive test result indicates the patient's failure to keep the arm in place or regulate its descent, particularly when lowering it from a 90-degree angle to the side.
- **Neer test:** The patient comfortably sits or stands. With the arm completely pronated (palm facing down), the examiner grasps the patient's arm and passively lifts it forward in the scapular plane

(internal rotation position). The examiner steadies the scapula with the other hand. The thumb is then pointed downward while the arm is internally rotated. A positive Neer test result for supraspinatus tears is defined as pain or discomfort experienced during this manoeuvre.

C] Test for Teres minor and infraspinatus:

- **Hornblower's Sign:** The patient is examined while sitting or standing, with their arm held by the wrist and elbow flexed at 90 degrees. The examiner instructs the patient to maintain posture despite opposition. A positive Hornblower's sign indicates weakness in the patient's externally rotated position, potentially indicating a teres minor muscle or infraspinatus tears.

Figure 2.4: The reliability of using ultrasonography to diagnose rotator cuff injuries
 Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4686437/#B76>

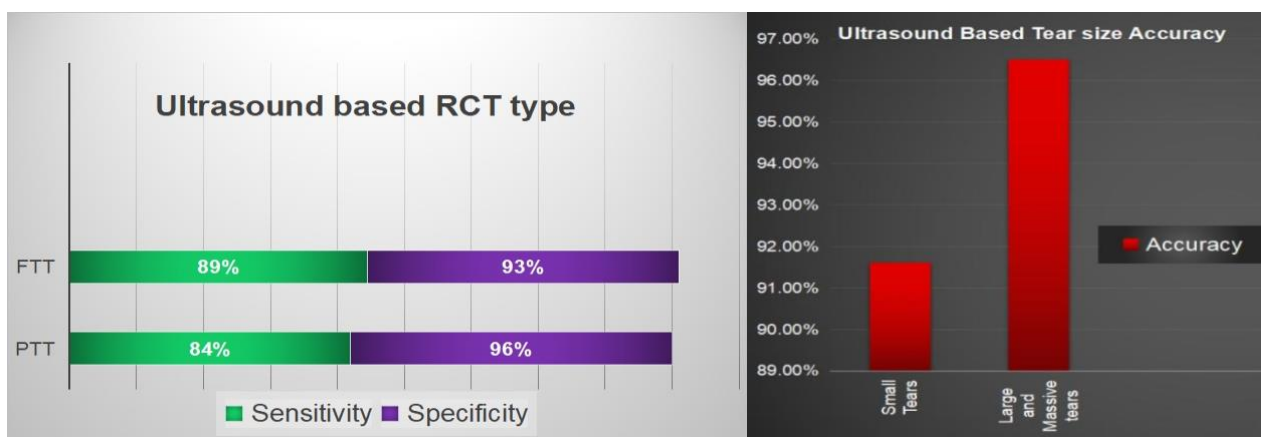
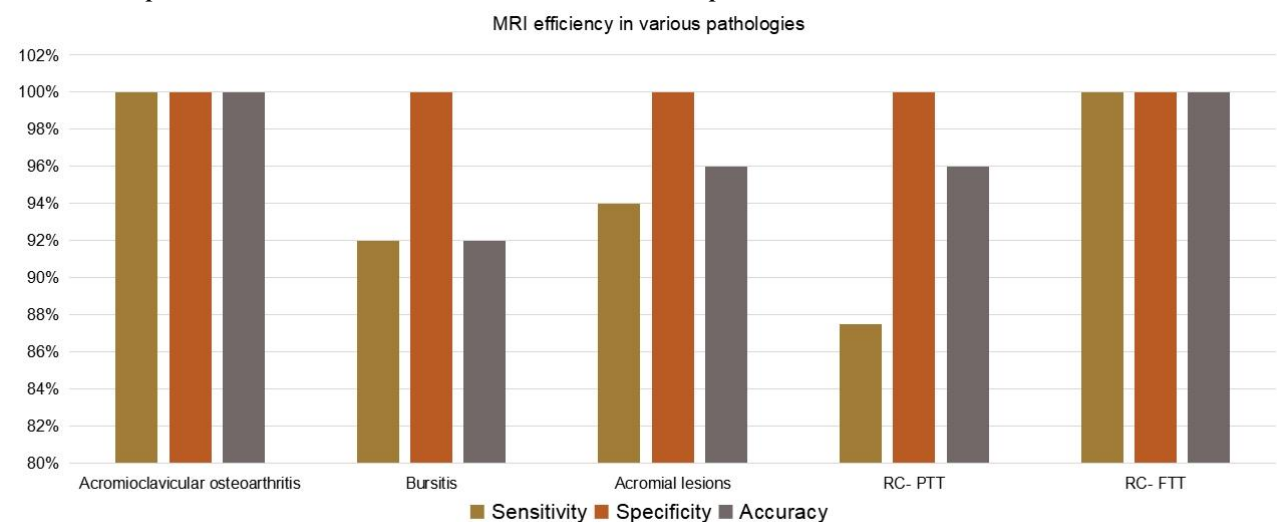

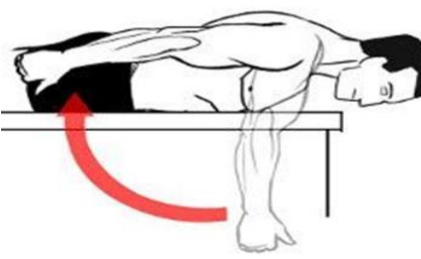

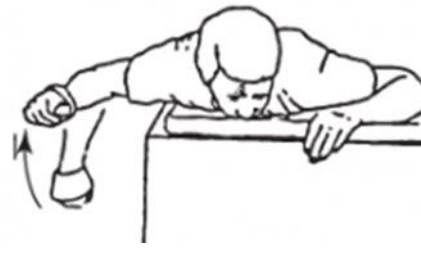


Figure 2.5: The reliability of using MRI to diagnose rotator cuff injuries
 Source: <https://www.sciencedirect.com/science/article/pii/S0378603X16302303>



Physical therapy of the shoulder:

1. OPEN CHAIN EXERCISES

EXERCISES	DESCRIPTION	FIGURES
External rotation on the side	Place a little cushion between your implicated arm and your body as you lie on your unaffected side. Raise the affected arm in external rotation while maintaining the elbow bent and fixed to the side. Return to the starting position slowly, and then do it again	
Shoulder extension	Lie on a table in a prone posture. The arm in examining is dangling straight down to the ground. Raise the arm straight back towards your hip, thumb pointing outward. Lower your arm gradually, and then do it again.	
Prone horizontal abduction	With the sore arm dangling straight to the floor, lie prone on the edge of your bed. Raise the arm to the side until it is parallel to the floor, keeping the thumb pointing upward. Lower your arm slowly and keep doing it until your shoulder muscles get a little painful or weary. As the exercise becomes simpler, move on to holding a modest weight and begin by lifting only your arm's weight.	
90/90 external rotation	On the edge of your bed, lie prone. Pull your arm out from your side until your elbow is parallel to the floor and level with your shoulder. Depending on how difficult you find the exercise, you can hold the upper arm (from shoulder to elbow) over the side of the bed or on the bed itself. Twist elbow to 90 degrees. Rotate the arm towards the back of the hand until the forearm is horizontal while maintaining a fixed shoulder and elbow. Return to the starting posture slowly and continue until the shoulder muscles become painful or fatigued. As the	

exercise becomes simpler, move on to holding a modest weight and begin by lifting only your arm's weight.

CLOSED CHAIN EXERCISES

The therapist administers rhythmic stabilization, or perturbation stresses while the patient's shoulder is elevated to 90 degrees and positioned in the scapular plane.

2.5 Management and Treatment Options in India

In India, rotator cuff tears are managed using a multi-modal strategy that combines conservative measures, surgical procedures, and rehabilitation techniques. The treatment strategy is customized based on the patient's unique needs, the degree of the tear, functional objectives, and other pertinent variables.

Conservative Management

- Avoid painful and overhead activities
- A sling to cover the shoulder and keep it immobile
- NSAIDs like acetaminophen, ibuprofen, and naproxen are advised.
- Minimal Exercises to strengthen shoulder muscles enhance the range of motion and flexibility.
- Physiotherapy
- Stem Cell Therapy involves harvesting stem cells from a higher-density location, repurposing them, and injecting them back into the injured area to promote the body's natural healing process.

Surgical Management

In India, rotator cuff tears are often recommended for surgical treatment when conservative methods fail or the tear is severe enough to require immediate attention. This is done when the tear is located in the dominant arm's shoulder and requires the most arm strength. The type of surgery depends on the tear's location, size, and form.

A partial tear may require debridement, while a complete rip in the thickest section requires sutured sides. If the tear is ripped away from insertion into the humerus, the arm bone, and the tendon are restored directly to the bone. Surgical methods like arthroscopic and open procedures are commonly used for rotator cuff repair.

To fix rotator cuff injuries, three surgical procedures are available:

- I. **Open repair:** Traditional Surgical Approach
A conventional open surgical incision is frequently necessary when dealing with large tears. An incision is made across the shoulder, separating the deltoid muscle to better view and access the torn rotator cuff.
In addition, acromioplasty is conducted, which is the excision of bone spurs from the acromion's under-surface.
- II. **Mini-Open the Repair:** Surgeons may now fully recover the rotator cuff with a minimal incision, usually 4 to 6 cm. This method also uses arthroscopy to see the tear and evaluate and treat any damage

to other joint structures. Acromioplasty, or arthroscopic excision of spurs, eliminates the need to split the deltoid muscle. After the arthroscopic part of the treatment is finished, the rotator cuff is repaired using a mini-open incision. Mini-open repairs can be handled without hospitalization. This is now one of the most popular ways to treat a rotator cuff tear.

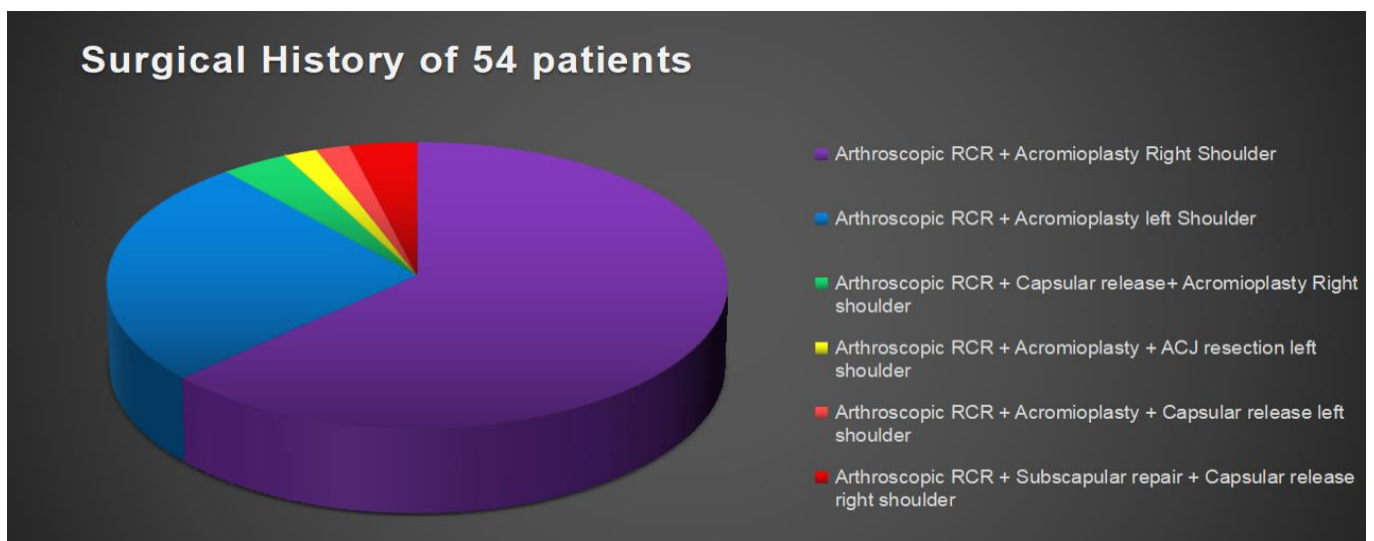
III. **The Arthroscopic Repair:** Small puncture incisions are used to implant an optical scope and tiny tools rather than a bigger incision. It involves using a small camera known as an arthroscopy, which helps to see inside the joint, assess the degree of the injury, and make necessary corrections. A video display can be used to visually control the operation. The majority of the surgical therapy is performed arthroscopically, which is less intrusive and produces fewer, smaller scars than open or mini-open surgery. The patient experiences less discomfort while recovering, and the rehabilitation may begin sooner. This is the current standard of care everywhere in the world since arthroscopy can repair almost any type of tear and promotes a speedier recovery.

More minimally invasive strategies for rotator cuff repair have been developed in surgical techniques. The patient gained benefits from each advancement towards less intrusive surgery by:

- Reducing postoperative discomfort
- Reduction of postoperative rigidity
- Reducing blood loss during surgery
- Reductions in hospital stay duration

Chart 2: Statistical Analysis of Surgical History of 54 Patients undergone Arthroscopic RCR in India

Source: <https://www.jotsrr.org/articles/clinical-and-patient-reported-outcomes-after-treatment-of-rotator-cuff-tears-a-retrospective-observational-study-12054.html>



Rehabilitation:

In India, rehabilitation is an essential component of the care of rotator cuff injuries. Its goal is to restore shoulder strength, range of motion, and function either after surgery or as a component of conservative treatment. Optimising results requires a systematic rehabilitation programme that includes patient education, supervised exercises, and a progressive progression of activities.

The following guidelines apply to both postoperative and nonoperative rotator cuff rehabilitation.

1. Reduction of stress and complete arm healing

- The upper extremities shouldn't be used for compensating movements.

- To strengthen the elbow, forearm, and wrist, it is recommended that they be utilised swiftly. Submaximal strengthening of the scapular stabilisers and mobilisation of the scapulo-thoracic joint are recommended, particularly during prolonged immobilisation. Inappropriate stressing or loading should not be applied to the damaged tissues. One method employed early in the recovery stage is the resistance exercise for scapular protraction and retraction. In order to prevent stress on the glenohumeral joint, side-lying and precise hand positioning are enlisted to oppose scapular protraction and retraction.

- Low resistance is used to start this workout. During scapular motion, the glenohumeral joint must be in a forward flexion and modest abduction.

2. Restoring normal joint arthrokinematics: Posterior capsular mobilisation and stretching procedures are frequently recommended to enhance the internal rotation range of motion.

3. Encouraging localised muscle endurance, muscular strength, and balance.

2.6 Factors That Affect the Cost of Rotator Cuff Surgery in India

The following variables impact the price of rotator cuff surgery in India:

- Rotator cuff surgery costs vary slightly throughout Indian cities based on where you receive treatment. In a manner comparable, your treatment city has an impact on hospital costs. Medical care is typically more expensive in metro areas like Mumbai and Kolkata than non-metro areas.
- Early control of rotator cuff tears is crucial, but delayed treatment can worsen the issue.
- The surgeon's expertise determines consultation and operation costs.
- Patient's age, gender, and health also influence the operation and subsequent care required.
- Diagnostic procedures like MRIs, CT scans, and X-rays help diagnose rotator cuff injuries.
- Hospitalization may be necessary overnight if complications arise.
- Anaesthesia costs and anaesthesiologist's costs depend on the surgery type and patient preferences.
- Hospital room selection affects hospital stay costs.
- Rehabilitation for at least six weeks is essential post-surgery for recovery and joint ROM restoration.
- Supportive devices like shoulder brace, painkillers, and antibiotics are required.

2.7 Outcome measures

The outcome of this study can be checked by using

- a. PENN Shoulder Score (PSS): Patients with a range of shoulder diseases can have their outcomes measured using the PSS. Three subscales comprise the 100-point questionnaire: pain, function, and satisfaction.
- b. DASH (Disabilities of Arm, Shoulder, and Hand) Score: The DASH score is a commonly used questionnaire that evaluates the functional status and outcomes of patients with upper limb musculoskeletal conditions, including those undergoing treatment for rotator cuff injuries or other shoulder-related issues. It consists of 30 questions related to the patient's ability to perform various activities, the severity of symptoms, and the impact of the condition on daily life. The score is scored on a scale from 1 to 5, with 1 indicating no difficulty or no symptom and 5 indicating extreme or severe difficulty.
- c. Single Assessment Numeric Evaluation score (SANE): The overall satisfaction and symptom improvement after a particular treatment or intervention are evaluated using the patient-reported outcome measure. When calculating the SANE score, patients are asked to assess their general health, pain, and function on a numerical scale ranging from 0 to 100. A single number evaluation that expresses the patient's perceived progress or happiness with their present situation is requested. On

the SANE scale, a higher score denotes more improvement or contentment, whereas a lower number denotes less improvement or discontent.

- d. Global Rating of Change Scale (GRCS): This examination assigns a score to the variations in shoulder symptoms. It contrasts the current symptoms with those from a year prior. There are fifteen potential scores, with the lowest being -7 and the highest being +7.
- e. Constant-Murley Score (CMS): used to assess the functional outcome and joint function of the shoulder in patients who have injuries or diseases of the shoulder. Dr. James Murley and Dr. Charles Constant created it.

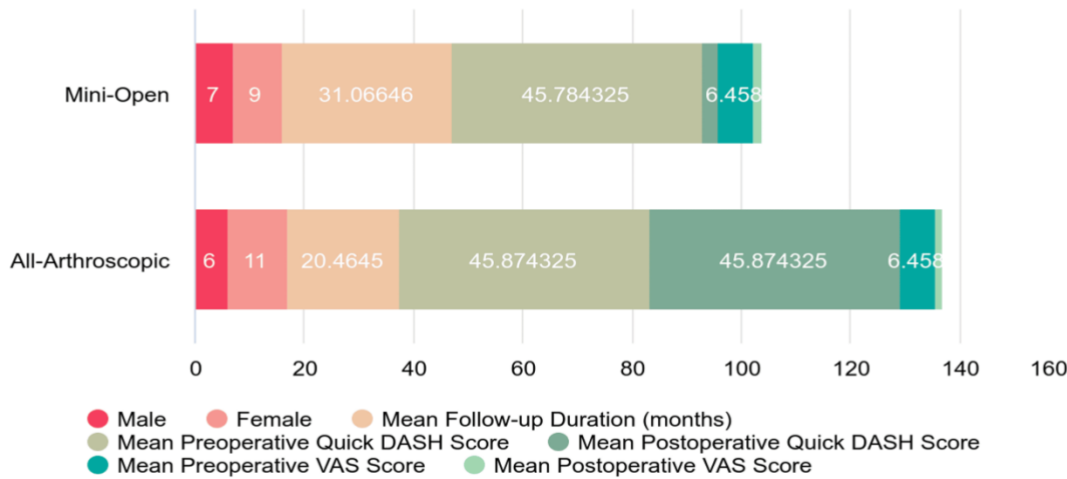
There are four parts to the Constant-Murley Score:

- Pain (15 points): On a scale of 0 to 15, patients indicate how much pain they are experiencing, with 0 denoting extreme agony and 15 denoting no pain.
- Activities of Daily Living (20 points): Evaluate how well the patient can carry out different daily living tasks. Patients are graded according to how challenging these activities are for them to complete.
- Range of Motion (40 points): Assesses the shoulder joint's flexion, abduction, internal, and external rotation ranges of motion. Every motion is graded according to the range of motion attained.
- Strength (25 points): Shoulder muscular strength, especially that of the rotator cuff muscles, is evaluated by strength testing. Patients are graded according to how well they can withstand resistance during particular motions.
- f. Rotator Cuff Quality of Life Score (RC-QOL): A disease-specific outcome measure called the RC-QOL assesses how rotator cuff disorders affect the overall quality of life. The 34 items in the questionnaire are broken down into 5 domains. These five areas consist of Physical problems and symptoms, Concerns pertaining to work, Recreation, and sports, lifestyle problems, and emotional and social problems.
- g. Functional Shoulder Elevation Test (FSET): The test evaluates the patient's ability to reach overhead and elevate their shoulder, two essential actions for both everyday living and athletics. Throughout the activities, the evaluator keeps an eye on the patient's strength, range of motion, and compensating techniques. Deficits in shoulder mobility, strength, stability, or coordination that may affect the patient's capacity to carry out daily duties or participate in sports or leisure activities might be very helpful in diagnosing them.
- h. Shoulder Pain and Disability Index (SPADI): The purpose of the SPADI is to quantify the level of pain and impairments related to shoulder pathology in individuals with musculoskeletal, neurogenic, or unclear shoulder discomfort. There are 13 items in each of the two domains: pain and disability. Activities have eight things, and pain has five. A visual analogue scale is used to rate each thing; the range is 0 for no pain or difficulty and 10 for the greatest agony conceivable or so terrible that assistance is needed.
- i. American Shoulder and Elbow Surgeons score (ASES): Patients with musculoskeletal issues might utilise the ASES to determine their functional limits and shoulder discomfort. A visual analogue scale is used to quantify the pain.
- j. Simple Shoulder Test (SST): The SST is a 12-item function scale designed to evaluate the patient's capacity to tolerate or carry out 12 activities of daily life and the degree of change in shoulder function following therapeutic treatments. The proportion of items that were responded to is presented along with the scores, which span from 0 to 100.

Figure 2.6: Analytical studies on management

Source: *cureus.com* (Authors: Dhruv Sharma, Mohit Tolani, Sohilkhan R. Pathan [et al.], Delhi India)

Comparative Analysis of Mini-Open and All-Arthroscopic Techniques for Rotator Cuff Repair



RESULTS

In India, rotator cuff tears are common, affecting an estimated 22.5% of people over 50. The largest occurrence is seen in people over 60, and the prevalence rises with age. When using Diffusion-weighted MRI, Magnetic Resonance Arthrogram, and standard MRIs, in particular, can offer precise diagnoses. These injuries can be successfully treated by the minimally invasive surgical procedure known as "arthroscopic rotator cuff repair," which has success rates as high as 70% to 90% in India. Men are more likely to sustain rotator cuff tears, which are frequently linked to strenuous manual labour or frequent overhead tasks. Treatment relies heavily on early diagnosis and adequate care, which may include physical therapy and anti-inflammatory drugs. The study highlights how crucial it is to deal with injuries to the rotator cuff in India using a thorough health science approach.

CONCLUSION

Rotator cuff tears are a common musculoskeletal issue in India, affecting physically demanding professions and sports. Orthopaedic surgeons are increasingly aware of the importance of these injuries and treating them to improve patients' quality of life. Factors such as patient demographics, referral patterns, and surgeon skill level influence the frequency of rotator cuff surgery. Further research is needed to estimate the prevalence of this condition in India.

The male ratio is greater compared to Females who are prone to RCT in India as they frequently participate in activities that strain the shoulder joint.

MR Arthrography has high sensitivity and specificity for diagnosing FTT and PTT. However, MRI provides multiplanar images with accuracy and practicality. Nonetheless, a combined clinical examination, MRI, and MR Arthrography may be able to correctly diagnose a rotator cuff injury.

Arthroscopy is considered the best surgical procedure for repairing RCT due to its minimally invasive nature, reduced risk of complications, faster recovery time, and high success rates. The ability to visualize and repair the tear with precision through small incisions allows better long-term outcomes.

In India, rotator cuff tears necessitate a multifaceted strategy that involves upgrading the country's healthcare system, expanding access to cutting-edge imaging equipment, and giving medical staff specialized training. Notwithstanding advancements in the identification and treatment of rotator cuff

injuries, issues such as a dearth of standardized methods and a shortage of specialised care facilities persist. Investing in cutting-edge imaging technology, expanding access to it, and providing specialised training programmes can help with diagnosis and management, enhancing patient outcomes and lessening the overall burden of this musculoskeletal disorder. Furthering understanding and treatment can be accomplished through research, collaboration, and knowledge exchange among healthcare professionals.

ABBREVIATION

- AC: Acromioclavicular injury
- ASES: American Shoulder and Elbow Surgeons score
- CMS: Constant-Murley Score
- CT: Computed tomography
- DASH: Disabilities of Arm, Shoulder, and Hand Score
- ECM: extracellular matrix
- FSET: Functional Shoulder Elevation Test
- GRCS: Global Rating of Change Scale
- IS: Infraspinatus
- MMP-1: matrix metalloproteinase-1
- MRI: Magnetic resonance imaging
- OA: Osteoarthritis
- PSS: PENN Shoulder Score
- PTS: Parsonage-Turner Syndrome
- RA: Rheumatoid Arthritis
- RCR: Rotator cuff repair
- RC-QOL: Rotator Cuff Quality of Life Score
- ROM: Range of motion
- ROS: reactive oxygen species.
- SAB: tissue of subacromial bursa
- SANE: Single Assessment Numeric Evaluation score
- SC: Subscapularis
- SPADI: Shoulder Pain and Disability Index
- SS: Supraspinatus
- SST: Simple Shoulder Test
- TM: Teres minor

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