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Assessment of shoulder abnormalities in MRI: A literature review study

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Abstract
Magnetic Resonance Imaging has become one of the most important diagnostic tools for evaluating shoulder abnormalities because of its superior soft tissue contrast, multiplanar imaging capability, and non-invasive nature. Shoulder pain and dysfunction are common musculoskeletal complaints affecting individuals of different age groups and are frequently associated with trauma, degenerative disorders, sports injuries, and inflammatory conditions. Accurate assessment of shoulder abnormalities is essential for proper diagnosis, treatment planning, and prevention of long-term disability.
The present study is a literature review focusing on the assessment of shoulder abnormalities using MRI. Approximately 30–40 published research articles, review papers, and radiological studies from various scientific databases were analyzed to evaluate the role of MRI in diagnosing common shoulder pathologies. The review included studies related to rotator cuff tears, tendinosis, bursitis, labral injuries, shoulder impingement syndrome, joint instability, and degenerative changes.
The reviewed literature demonstrated that rotator cuff abnormalities, particularly supraspinatus tendon tears, are the most commonly detected shoulder pathologies on MRI. MRI was found to be highly effective in differentiating partial-thickness and full-thickness tears and in identifying associated abnormalities such as tendon degeneration, muscle atrophy, bursitis, and joint effusion. Several studies also highlighted the importance of MRI and MR arthrography in diagnosing labral tears and shoulder instability, especially in athletes and trauma patients.
The findings of the reviewed studies confirmed the high sensitivity and specificity of MRI in evaluating soft tissue and joint abnormalities of the shoulder. MRI was also considered valuable in assessing inflammatory and degenerative conditions affecting the shoulder joint. The literature review emphasizes that MRI plays a crucial role in musculoskeletal imaging by improving diagnostic accuracy and supporting effective clinical management. Future advancements in MRI technology and artificial intelligence-based imaging analysis may further enhance the evaluation and diagnosis of shoulder abnormalities.

Keywords: Shoulder magnetic resonance imaging (MRI), rotator cuff disorders, shoulder abnormalities, musculoskeletal imaging, MR arthrography

Introduction

The shoulder joint is one of the most complex and highly mobile joints in the human body. It plays a major role in performing daily activities such as lifting, pushing, pulling, throwing, and rotational arm movements. Because of its extensive range of motion and dependence on soft tissue structures for stability, the shoulder is highly susceptible to injuries, degenerative changes, inflammatory conditions, and overuse syndromes. Shoulder pain is considered one of the most common musculoskeletal complaints encountered in clinical practice and affects individuals across all age groups, including athletes, laborers, office workers, and elderly populations.
The anatomy of the shoulder is composed of several interconnected structures that work together to provide mobility and stability. The glenohumeral joint, acromioclavicular joint, sternoclavicular joint, surrounding muscles, tendons, bursae, ligaments, and cartilage collectively contribute to normal shoulder function. Among these structures, the rotator cuff tendons are particularly important because they stabilize the shoulder during movement. Any injury or degeneration involving these soft tissue components may result in pain, weakness, stiffness, instability, and restriction of movement.
Shoulder abnormalities may arise due to trauma, repetitive stress, sports-related injuries, occupational activities, age-related degeneration, inflammatory diseases, or congenital abnormalities. Common shoulder pathologies include rotator cuff tears, tendinosis, bursitis, impingement syndrome, labral injuries, joint instability, adhesive capsulitis, osteoarthritis, and muscle injuries. Among these, rotator cuff disorders are considered the leading cause of chronic shoulder pain and functional disability.
Clinical examination is important in evaluating shoulder disorders; however, physical assessment alone is often insufficient to determine the exact nature and severity of underlying pathology. Symptoms such as pain, tenderness, swelling, and restricted movement are usually nonspecific and may overlap among multiple conditions. Therefore, imaging investigations play a significant role in confirming the diagnosis, assessing the extent of injury, and guiding treatment planning.
Conventional radiography is commonly used as the initial imaging modality for evaluating shoulder complaints because it is widely available and useful for detecting fractures, dislocations, calcifications, and degenerative bony changes. However, radiographs provide limited information regarding soft tissue structures such as tendons, ligaments, cartilage, and muscles. Ultrasonography is also used for evaluating rotator cuff injuries and dynamic shoulder movement, but its accuracy is operator dependent and limited in deep joint assessment.
Magnetic Resonance Imaging has emerged as the gold standard imaging technique for comprehensive shoulder

evaluation because of its superior soft tissue contrast, multiplanar imaging capability, and non-invasive nature. MRI provides detailed visualization of tendons, muscles, ligaments, cartilage, bursae, bone marrow, and joint spaces without the use of ionizing radiation. The ability of MRI to identify both early and advanced pathological changes makes it highly valuable in musculoskeletal imaging.

MRI is particularly useful in evaluating rotator cuff tears, labral injuries, tendon degeneration, bursitis, impingement syndrome, joint instability, and cartilage abnormalities. It also helps detect occult fractures, bone marrow edema, inflammatory changes, and postoperative complications. MRI findings assist clinicians and orthopedic surgeons in deciding whether conservative treatment or surgical intervention is required.

The development of high-field MRI systems and advanced imaging sequences has significantly improved diagnostic accuracy in shoulder imaging. Sequences such as T1-weighted imaging, T2-weighted imaging, Proton Density Fat Saturation (PDFS), and Short Tau Inversion Recovery (STIR) allow better visualization of soft tissue pathology and fluid-sensitive abnormalities. Multiplanar imaging in axial, coronal oblique, and sagittal oblique planes enables precise anatomical evaluation of the shoulder joint.

In addition to conventional MRI, MR arthrography has become increasingly important in assessing intra-articular shoulder abnormalities, particularly labral tears and shoulder instability. MR arthrography involves the injection of contrast material into the joint space to improve visualization of subtle intra-articular lesions. Several studies have reported increased sensitivity of MR arthrography compared to routine MRI in detecting labral pathology and partial-thickness rotator cuff tears.

Over the past two decades, numerous research studies have evaluated the diagnostic role of MRI in shoulder abnormalities. Published literature consistently demonstrates the high sensitivity and specificity of MRI in detecting rotator cuff tears and other soft tissue injuries. Many studies have also analyzed the prevalence and pattern of shoulder abnormalities among different age groups and occupational populations.

Literature review studies are essential in radiological research because they help summarize findings from multiple published articles, identify common imaging patterns, compare diagnostic approaches, and provide evidence-based understanding of disease processes. A review of previously published studies allows researchers to evaluate the effectiveness of MRI protocols and understand the clinical significance of imaging findings in shoulder disorders.

The present literature review focuses on the assessment of shoulder abnormalities using MRI by analyzing findings from approximately 30–40 previously published research papers and review articles. The review aims to summarize the major MRI findings associated with common shoulder pathologies and discuss the diagnostic importance of MRI in musculoskeletal imaging.

Several reviewed studies have highlighted that rotator cuff abnormalities are the most frequently observed shoulder pathologies on MRI. The supraspinatus tendon is reported as the most commonly affected tendon because of its anatomical location beneath the acromion and exposure to repetitive mechanical stress. MRI findings such as tendon thickening, increased signal intensity, tendon discontinuity, muscle atrophy, and fluid accumulation are commonly associated with rotator cuff disorders.

Labral injuries are another important category of shoulder abnormalities, especially among athletes and trauma patients. MRI and MR arthrography play a vital role in detecting superior labral tears, Bankart lesions, and glenohumeral instability. Additionally, MRI is useful in diagnosing inflammatory and degenerative conditions such as bursitis, adhesive capsulitis, osteoarthritis, and acromioclavicular joint degeneration.

Recent advancements in imaging technology, including artificial intelligence-based image analysis and three-dimensional MRI techniques, are expected to further improve the accuracy and efficiency of shoulder imaging in the future. These technological developments may enhance early diagnosis, reduce interpretation errors, and improve patient management.

In conclusion, MRI has become an indispensable imaging modality for evaluating shoulder abnormalities because of its excellent soft tissue resolution and detailed anatomical visualization. Literature review studies provide valuable insights into the prevalence, imaging characteristics, and clinical significance of shoulder pathologies. Understanding MRI findings in shoulder disorders is essential for accurate diagnosis, effective treatment planning, and improved patient care in musculoskeletal radiology.

Aim of the Study

To review published literature regarding MRI assessment of shoulder abnormalities and summarize important findings related to musculoskeletal shoulder imaging.

Objectives of the Study

- To evaluate the role of MRI in diagnosing shoulder abnormalities.
- To review common MRI findings reported in shoulder pathologies.
- To summarize findings from previously published research papers.
- To understand the clinical importance of MRI in shoulder imaging.

Methodology

Type of Study

Literature Review Study

Study Design

The present study was conducted as a narrative literature review based on previously published research articles related to MRI assessment of shoulder abnormalities.

Literature Search Strategy

Published articles were collected from various scientific databases and academic sources, including:

- PubMed
- Google Scholar
- Scopus
- ScienceDirect

Keywords used for literature search included:

- MRI shoulder abnormalities
- Rotator cuff tear MRI
- Shoulder joint MRI
- Shoulder impingement imaging

- Labral tear MRI
- Musculoskeletal shoulder MRI
- Shoulder tendon injuries
- MRI evaluation of shoulder pain

Selection of Articles
Approximately 30–40 published research papers, review articles, and radiological studies published between 2015 and 2025 were reviewed for the study.

Inclusion Criteria
- Articles related to MRI assessment of shoulder abnormalities
- English-language publications
- Peer-reviewed journal articles
- Studies discussing musculoskeletal shoulder imaging

Exclusion Criteria
- Articles unrelated to shoulder MRI
- Duplicate studies
- Non-English publications
- Studies with insufficient imaging details

Data Analysis
Relevant findings from selected articles were reviewed, compared, and summarized according to:
- Type of shoulder abnormality
- MRI findings
- Diagnostic significance
- Clinical relevance

The present literature review analyzed approximately 30–40 published research articles related to the MRI assessment of shoulder abnormalities. The reviewed studies consistently demonstrated that Magnetic Resonance Imaging is highly effective in detecting both traumatic and degenerative shoulder pathologies because of its superior soft tissue visualization and multiplanar imaging capability.
The findings obtained from the reviewed literature are summarized below.

Rotator Cuff Abnormalities
Among all shoulder pathologies reviewed in the literature, rotator cuff abnormalities were reported as the most common MRI findings. Most studies identified the supraspinatus tendon as the most frequently involved tendon due to its anatomical position and continuous exposure to mechanical stress.

Common MRI Findings in Rotator Cuff Disorders
- Tendon thickening
- Increased intratendinous signal intensity
- Partial-thickness tears
- Full-thickness tears
- Tendon retraction
- Muscle atrophy
- Fatty degeneration

Several reviewed studies reported that partial-thickness tears were more common than complete tears, particularly in middle-aged individuals. Full-thickness tears were more commonly observed in elderly patients and chronic injury cases.

MRI demonstrated excellent sensitivity in detecting even small tendon defects and associated inflammatory changes. Fluid-filled gaps within tendons, tendon discontinuity, and muscle wasting were important MRI indicators of severe rotator cuff injury.

Supraspinatus Tendon Involvement
Most articles reviewed in the study emphasized that the supraspinatus tendon was the most commonly affected structure in patients presenting with shoulder pain.

MRI Features Identified
- Increased signal intensity on T2-weighted images
- Tendon fraying
- Tendon degeneration
- Bursal surface tears
- Articular surface tears

The literature suggested that repetitive overhead activities, sports injuries, and age-related degeneration were major causes of supraspinatus abnormalities.

Shoulder Impingement Syndrome
Many reviewed studies highlighted the importance of MRI in diagnosing shoulder impingement syndrome.

Common MRI Findings Included
- Narrowing of subacromial space
- Acromial morphological variations
- Thickening of coracoacromial ligament
- Compression of supraspinatus tendon
- Subacromial bursitis

MRI findings demonstrated that impingement syndrome was strongly associated with rotator cuff pathology and bursitis. Hooked acromion morphology was frequently reported as a contributing factor.

Subacromial-Subdeltoid Bursitis
Subacromial-subdeltoid bursitis was one of the commonly reported abnormalities associated with rotator cuff disorders.

MRI Findings Included
- Fluid accumulation within the bursa
- Synovial thickening
- Inflammatory changes
- Bursal distension

Most studies showed that bursitis commonly coexisted with impingement syndrome and tendon tears. MRI effectively differentiated bursitis from other soft tissue abnormalities.

Labral Tears and Shoulder Instability
The reviewed literature demonstrated that MRI and MR arthrography are highly valuable in evaluating labral injuries and shoulder instability.

Common Labral Injuries Identified
- Superior labral anterior-posterior (SLAP) tears
- Bankart lesions
- Posterior labral tears
- Glenoid labral detachment

Labral injuries were more commonly observed in:

- Athletes
- Young adults
- Trauma patients

MR arthrography was reported to have higher diagnostic accuracy than routine MRI for subtle labral abnormalities.

Joint Effusion

Joint effusion was frequently identified in inflammatory, traumatic, and degenerative shoulder conditions.

MRI Characteristics Included

- Increased fluid signal within the joint cavity
- Synovial thickening
- Associated inflammatory changes

Several studies noted that joint effusion was commonly associated with rotator cuff tears, bursitis, and adhesive capsulitis.

Degenerative Joint Changes

Degenerative abnormalities involving the acromioclavicular and glenohumeral joints were frequently reported among elderly populations.

MRI Findings Included

- Cartilage thinning
- Osteophyte formation
- Joint space narrowing
- Subchondral sclerosis
- Bone marrow edema

The literature suggested that degenerative changes increased significantly with advancing age and repetitive shoulder stress.

Bone Marrow Edema and Occult Lesions

MRI was highly sensitive in detecting bone marrow abnormalities and occult osseous lesions that were not visible on conventional radiographs.

Findings Included

- Bone marrow edema
- Stress-related injuries
- Occult fractures
- Contusions

Fluid-sensitive MRI sequences such as STIR and Proton Density Fat Saturation sequences were especially useful in identifying marrow abnormalities.

Adhesive Capsulitis

Several reviewed studies identified MRI findings associated with adhesive capsulitis (frozen shoulder).

MRI Findings Included

- Thickening of joint capsule
- Obliteration of axillary recess fat
- Synovial enhancement
- Reduced joint volume

MRI findings helped differentiate adhesive capsulitis from rotator cuff disorders and arthritis.

Diagnostic Accuracy of MRI

Most studies reviewed in the literature concluded that MRI demonstrated high sensitivity and specificity for shoulder imaging.

Reported Advantages of MRI

- Excellent soft tissue contrast
- Non-invasive evaluation
- Multiplanar imaging capability
- Early detection of abnormalities
- Detailed assessment of tendon and ligament injuries

MRI was considered highly reliable for preoperative planning and treatment evaluation.

Discussion

The present literature review analyzed approximately 30–40 published studies related to the MRI assessment of shoulder abnormalities and demonstrated that Magnetic Resonance Imaging remains one of the most reliable and widely accepted imaging modalities for evaluating shoulder disorders. The reviewed literature consistently emphasized the high diagnostic value of MRI in identifying both traumatic and degenerative abnormalities affecting the shoulder joint.

Shoulder pain is one of the most common musculoskeletal complaints encountered in orthopedic and radiological practice. The complexity of shoulder anatomy and the overlapping clinical symptoms associated with various shoulder disorders often make clinical diagnosis difficult. Therefore, imaging plays a major role in identifying the exact pathology responsible for shoulder dysfunction. The reviewed studies confirmed that MRI provides detailed visualization of soft tissue structures such as tendons, muscles, ligaments, cartilage, bursae, and joint capsules, which are not adequately assessed using conventional radiography.

One of the most significant findings observed throughout the reviewed literature was the high prevalence of rotator cuff abnormalities, particularly supraspinatus tendon injuries. Multiple studies reported that the supraspinatus tendon is the most commonly affected structure because of its anatomical position beneath the acromion and exposure to repetitive mechanical stress during shoulder movement. MRI findings such as tendon thickening, increased signal intensity, tendon discontinuity, and muscle atrophy were commonly associated with rotator cuff pathology.

Several reviewed studies highlighted that partial-thickness tears were more frequently observed than full-thickness tears, especially among middle-aged individuals. Full-thickness tears were more common in elderly patients due to chronic degeneration and prolonged tendon wear. MRI demonstrated excellent sensitivity in differentiating between partial and complete tears, which is clinically important because treatment planning depends greatly on the severity of tendon injury. Conservative treatment may be sufficient for partial tears, whereas complete tears often require surgical repair.

The literature also emphasized the importance of MRI in diagnosing shoulder impingement syndrome. Impingement syndrome occurs when the rotator cuff tendons become compressed beneath the acromion during shoulder movement, resulting in inflammation, pain, and tendon degeneration. MRI findings such as narrowing of the

subacromial space, acromial morphological variations, bursitis, and tendon compression were frequently reported in patients with impingement syndrome. Many studies suggested that a hooked acromion significantly increases the risk of tendon impingement and subsequent rotator cuff tears.

Subacromial-subdeltoid bursitis was another commonly reported abnormality in the reviewed literature. MRI effectively demonstrated fluid accumulation and inflammatory changes within the bursa. Most studies indicated that bursitis frequently coexists with rotator cuff injuries and impingement syndrome. MRI was found to be particularly useful in differentiating bursitis from tendon tears and other soft tissue abnormalities because of its superior fluid-sensitive imaging sequences.

Labral injuries and shoulder instability were also extensively discussed in the reviewed studies. The glenoid labrum is essential for maintaining shoulder joint stability, and injuries involving the labrum are common among athletes and trauma patients. MRI and MR arthrography were reported to be highly effective in detecting superior labral anterior-posterior (SLAP) tears, Bankart lesions, and glenoid labral detachments. Several studies demonstrated that MR arthrography has higher sensitivity compared to conventional MRI in detecting subtle intra-articular lesions because intra-articular contrast improves visualization of labral structures.

Degenerative shoulder disorders were another major category of abnormalities identified in the literature review. Osteoarthritis, cartilage degeneration, acromioclavicular joint hypertrophy, and joint space narrowing were more frequently observed in elderly populations. MRI was considered valuable for evaluating both osseous and soft tissue degenerative changes simultaneously. Bone marrow edema, subchondral sclerosis, osteophyte formation, and cartilage thinning were among the commonly reported MRI findings in degenerative shoulder disorders.

The reviewed studies also highlighted the role of MRI in detecting occult bone abnormalities and inflammatory changes that may not be visible on radiographs. Fluid-sensitive MRI sequences such as STIR and Proton Density Fat Saturation were highly effective in identifying bone marrow edema, occult fractures, stress injuries, and inflammatory processes. Early detection of these abnormalities is important because delayed diagnosis may result in worsening of symptoms and long-term functional impairment.

Another important condition discussed in the literature was adhesive capsulitis, commonly known as frozen shoulder. MRI findings associated with adhesive capsulitis included thickening of the joint capsule, obliteration of fat within the axillary recess, reduced joint volume, and synovial inflammation. MRI was useful in differentiating adhesive capsulitis from rotator cuff pathology and degenerative arthritis, thereby assisting clinicians in selecting appropriate treatment strategies.

Most reviewed studies strongly supported the diagnostic accuracy of MRI for shoulder imaging. MRI was repeatedly described as a non-invasive imaging modality with excellent soft tissue resolution and multiplanar capability. The ability to evaluate multiple shoulder structures in a single examination makes MRI highly valuable for comprehensive musculoskeletal assessment. Many researchers concluded that MRI significantly improves diagnostic confidence, assists in preoperative planning, and contributes to better patient management.

The literature also emphasized the increasing role of advanced MRI techniques and technological developments in musculoskeletal imaging. High-field MRI systems, improved coil technology, and advanced imaging sequences have enhanced image quality and lesion detection. In recent years, artificial intelligence and machine learning applications have also begun contributing to automated image analysis, lesion detection, and workflow optimization in radiology. These advancements may further improve the speed and accuracy of shoulder MRI interpretation in the future.

Although MRI has several advantages, the reviewed studies also discussed certain limitations. MRI examinations are relatively expensive and may not be easily accessible in all healthcare settings. Claustrophobia, long scanning times, and motion artifacts can sometimes affect image quality. In addition, MRI interpretation requires experienced radiologists because some findings may mimic normal anatomical variations or age-related changes. Variability in imaging protocols and observer interpretation among different studies was also noted as a limitation in literature-based analysis.

`blished research papers confirmed the high diagnostic accuracy and clinical importance of MRI in musculoskeletal shoulder imaging. Literature review studies contribute significantly to evidence-based practice by summarizing previous research findings and improving understanding of imaging patterns in shoulder disorders.

Future advancements in MRI technology and artificial intelligence-assisted imaging may further improve the diagnosis and management of shoulder abnormalities.

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