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ANTHROPOLOGY OF ACROMION TYPE IN PATIENT WITH CHRONIC SHOULDER PAIN: A RETROSPECTIVE STUDY

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ABSTRACT

Background: Shoulder pain is one of the most prevalent musculoskeletal disorders, with a reported prevalence of 18–26%. A comprehensive clinical history allows development of diagnostic algorithms by correlating symptom patterns with specific pathologies. Radiographic evaluation remains the first-line investigation for chronic shoulder pain. This study aimed to determine the prevalence of acromion types and their association with shoulder pathology at Prof. Soeharso Orthopaedic Hospital from January 2022 to December 2025.
Materials and Methods: This retrospective study included 260 patients diagnosed with chronic shoulder pain who attended Prof. Soeharso Orthopaedic Hospital, Surakarta, between January 2022 and December 2025. Acromion morphology was classified according to Bigliani et al. into type I (flat), type II (curved), and type III (hooked) using supraspinatus outlet view radiographs. Acromion types were correlated with shoulder pathology, affected side, and age group.
Results: Of the 260 patients reviewed, 132 were diagnosed with impingement shoulder syndrome and 128 with rotator cuff tears. The mean age was 39.6 years for the impingement group and 58.6 years for the rotator cuff tear group. Right shoulder involvement was more common than left. Type II acromion was the most prevalent (64.7%), followed by type I (23.5%) and type III (11.8%).
Conclusion: Type II acromion is the most frequently observed morphology in patients with shoulder pathology, particularly impingement syndrome and rotator cuff tears. Acromion morphology did not demonstrate significant variation with age.
Keywords: Chronic shoulder pain, acromial morphology, anthropology, incidence

Introduction

The shoulder, one of the most mobile and complex joints of the human body, consists of four articulations. Multiple tendons and ligaments surround these joints to provide stability. This flexibility comes at a cost of decreased stability that makes the joints and the supporting myotendinous structures prone to injury and degeneration, often resulting in severe, persistent pain. Shoulder pain is defined as chronic when it has been present for longer than six months. Shoulder pain is one of the most prevalent musculoskeletal pain syndromes with a prevalence of 18%–26%. The incidence of chronic shoulder pain increases with age, with the prevalence peaking in those over 70 years of age.[1]

Patient with chronic shoulder pain commonly report pain during daily activities that require arm movements such as reaching to grasp objects or carry weights, which affects daily life and is often a reason for care seeking. These symptoms are commonly diagnosed as subacromial pain and clinicians often base their clinical judgements on reports of pain with movement, either looking at patterns of movement and similarities among the painful movements and activities or by doing provocative movements in an attempt to investigate the underlying mechanical causes of pain.[2]

Shoulder problems can be divided into six major diagnostic categories including tendinitis, rotator cuff tears, adhesive capsulitis, glenohumeral osteoarthritis, glenohumeral instability, and acromioclavicular joint pathology. Symptomatology of the shoulder can be broadly divided into pain, weakness, stiffness, and instability. However, each of these symptoms is not specifically related to a separate pathology, instead, a symptom can be present in different pathologies. With a comprehensive history, still, a diagnostic algorithm can be made by carefully digging out the proportion of a symptom in different pathologies.[3]

The morphology of acromion has been considered the main cause of sub-acromion disease as in tendinitis and cuff-rotator tears. In 1986, the morphology of acromion was first described by Bigliani based on radiography into Type I- Flat, Type II-Curved, Type III-Hooked. Rotator cuff pathology has been long associated with anatomic variants of the acromion. Neer stated that most rotator cuff pathology is caused by a mechanical conflict between the undersurface of the acromion and the rotator cuff insertion. Therefore, surgeons have traditionally performed an acromioplasty at the time of rotator cuff repair. This is today's commonly used classification and a strong correlation was found between hooked acromions and rotator cuff disease.[4]

To further narrow down the differential diagnosis, relevant investigations are done to come up with a definitive diagnosis. Radiographs are usually considered first-line investigations for chronic shoulder pain. With a background history of trauma, radiographs may show evidence of bony injuries. Radiographs may show findings of acromial morphology for the patient with chronic shoulder pain, osteoarthritis of the glenohumeral and acromioclavicular joints. Secondary signs of massive rotator cuff tear may be seen which include superior migration of the humeral head and sclerosis of the undersurface of the acromion.[3]

Anatomy

The glenohumeral joint consists of an articulation between the scapula and humerus (Figure 1). The humeral head lies within the glenoid fossa, a cavity that is lined by the glenoid labrum. The shallow nature of the glenoid fossa lends the glenohumeral joint an increased range of motion while providing little stability. The osseous structures are surrounded by the glenohumeral capsule, a fibrous network attached medially to the margin of the glenoid cavity and laterally to the anatomic neck of the humerus. Thickenings within the glenohumeral capsule comprise the superior, middle, and inferior glenohumeral ligaments (IGHLs), which are critical static stabilizers of the joint. The rotator cuff muscles surround

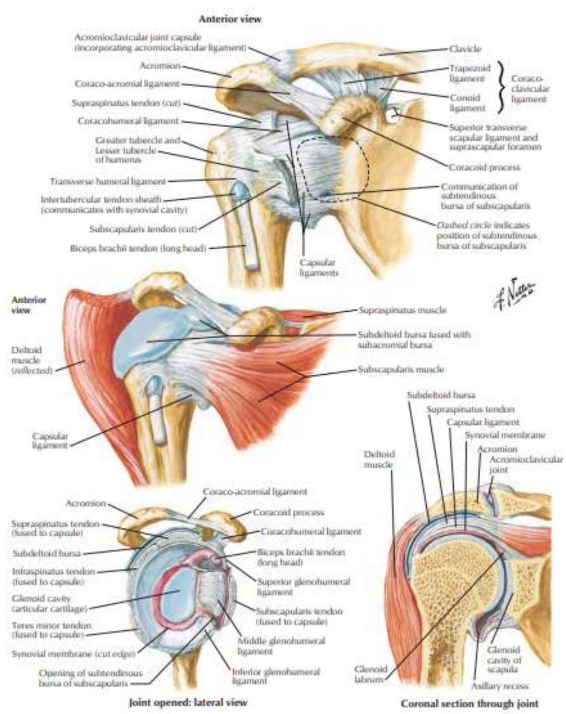

***Figure 1**. Anatomy of Shoulder.* [5]

the glenohumeral capsule and create balanced force couples that play a central role as dynamic stabilizers of the humeral head during range of motion.[5]

Classification

Bigliani Classification

In 1986 Bigliani et al. presented their work on the morphology of acromion and its relationship to rotator cuff tears. The acromion types were specified based on radiographic control and more specifically on the angled outlet Y view of the shoulder (Fig. 2). Each acromion type is correlated with a percentage representing the risk for rotator cuff tears. They described three types of acromion: Type I (flat: 17%, angle of anterior slope: ~ 13°, and full thickness rotator cuff tears: 3%), Type II (curved: 43%, angle of anterior slope: ~ 30°, and full thickness rotator cuff tears: 24%), and Type III (hooked: 39%, angle of anterior slope: ~ 27°, and full thickness rotator cuff tears: 70%).[9]

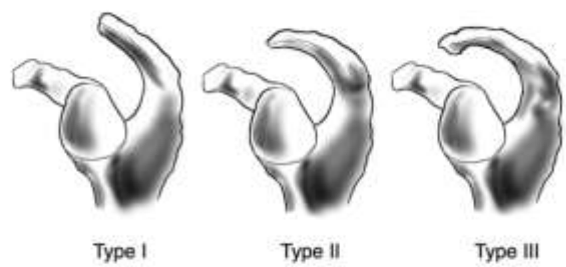

Figure 2. *The three types of acromion morphology according to the Bigliani classification: type I flat acromion; type II curved acromion; type III hooked acromion.*[9]

The acromial angle classification categorizes acromial shape as one of three types (Fig. 3) determined by two lines connecting the highest point both with the most anterior and the most posterior point of the acromial undersurface. This classification assigns the acromion to Type 1, if the acromial angle is <12°, to type 2 from 13° to 27°, and to type 3 over 27°.[10]

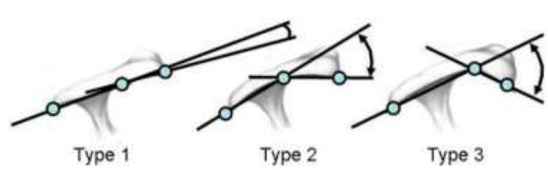

Figure 3. *Acromial angle classification (modified from Bigliani 1986).*[10]

Table. 1 *Seddon and Sunderland Classification of Nerve Injury*

Seddon	**Sunderland**	**Description**	**MRI**	**Ultrasound**
Neuropraxia	I	Conduction block	T2 hyperintensity	Decreased nerve echogenicity/hypoechoic
Axonotmesis	II	Discontinuity of the axon with Wallerian degeneration	T2 hyperintensity with increased size Hyperintensity in muscles due to denervation	Decreased echogenicity & increased caliber of the nerve
	III	Scarring of the endoneurium	Endoneurium can not be delineated with current MR technique T2 hiperintensity with Increased size. Hyperintensity in muscles due to denervation.	Focal decreasea in echogenicity with increase in calibre with change in echotexture of the affected muscles.
	IV	Neuroma in Continuity with Formation of a scar Which blocks Nerve regeneratiom	T1 hypointense, T2 hyperintense focal enlargement with loss of fascicular pattern	Hypoechoic fusiform lesion in continuity with the nerve with loss of fascicular architecture with altered echogenocity

			Hyperintensity in muscle due to denervation.	of denervated muscles
Neurotemesis	V	Rupture of the nerve	End Nuroma Formation at proximal end with denervation	Hypoechoic neuroma with proximal end with local soft tissue oedema and denervation changes in denervation muscle.
	Mackinnon And Dellon type VI	Mixed Injury	Variable findings with nerve heterogenecity and muscle denervation changes	Hypoechoic enlarged with mixed findings of scarring, discontinuity or neuroma formation.

Diagnosis

The physical examination of chronic shoulder pain begins with history taking, inspection, palpation, assessment of ROM, muscle strength tests, and physical examination tests to obtain important diagnostic clues. First, it is important to take a detailed history, which can guide further necessary exams to identify the pathology of any shoulder problem.[11]

History taking is important to rule out extrinsic etiology of shoulder pain, which is usually represented by pain that is difficult to localize and not affected by passive and active ROM. A history of trauma is likely to be related with fractures or dislocations. Typical questions to assess the characteristics of shoulder pain should include the duration, quality, associated symptoms, radiation, and aggravating and alleviating factors. It is also important to be aware of the patient's age when assessing the shoulder problem; traumatic injuries are frequently observed in young adults whereas rotator cuff diseases and adhesive capsulitis are common in the elderly.[11]

The next important step is inspection, which involves looking at the entire shoulder with proper exposure. The patient should be inspected both anteriorly and posteriorly. The examiner should look for asymmetry between the affected and unaffected sides of the shoulder. Presence of atrophy, deformity, ecchymosis, swelling, wounds, scarring, and redness of the skin should be noted. In cases of massive rotator cuff tears, the humeral head can be seen as a bulge anteriorly within the shoulder. Any abnormalities seen on the affected side should be compared with the contralateral side.[11]

Palpation is another important step. Finding areas of focal tenderness is important; for instance, tenderness in certain areas may represent acromioclavicular osteoarthritis, tendinitis, or rotator cuff disorders. Pain induced by deep palpation of the lateral deltoid inferior to the acromial process may reflect the presence of supraspinatus tendinitis or rotator cuff tear.[11]

Assessment of shoulder ROM should include both active (unaided) and passive (with assistance from the examiner) movements. Loss of both may indicate adhesive capsulitis, whereas loss of only active ROM reflects shoulder impingement. The ROM includes forward flexion from 150° to 180°, extension from 40° to 60°, abduction from 150° to 180°, and external rotation from 60° to 90°. Internal rotation is assessed by the vertebral level that hand can reach.[11]

Imaging

Imaging modalities, including radiography, ultrasound (US), and magnetic resonance imaging (MRI), are often used for the evaluation of shoulder pathologies and facilitation of better diagnosis.[11]
Radiography provides important information regarding osseous structures and secondary signs of soft tissue pathology around the shoulder joint. In combination with symptoms and physical examination tests, radiographs can guide further imaging such as US and MRI. Standard radiographs of the shoulder (true AP, axillary lateral, and scapular Y) are helpful adjuncts to the initial evaluation, as they provide information about overall bony anatomy, calcific tendinitis, glenohumeral joint osteoarthritis, or chronic signs of impingement, such as subacromial spurring or abnormalities at the greater tuberosity. If symptoms still persist after 6 weeks of conservative therapy (ex: steroid injection and physical therapy), advanced imaging techniques may be utilized.[11-12]

US enables visualization of soft tissues (e.g., tendons and muscles) and detection of fluids (e.g., in effusion and bursitis). The real-time capability of US also enables US-guided injections. Ultrasound is able to evaluate the shoulder in motion, assess the contralateral shoulder in the same visit, is easy to perform, low-cost, and emits no radiation. Ultrasound has high sensitivity for tendinopathy, although it is more useful in diagnosing complete tears or determining tear extent. A major downfall with ultrasound, however, is difficulty in seeing the entire rotator cuff. Ultrasound is also highly user dependent.[11-12]

MRI is superior to US in visualizing osseous structures, the bone marrow, and the overlying cartilage. Both US and MRI are reported as highly accurate in the diagnosis of rotator tears. Although these modalities are considered as the gold standard for the evaluation of shoulder problems, they are frequently overused. It is also important for physicians to consider the costs of ordering imaging tests because a higher diagnostic accuracy, though beneficial, is not always needed.[11]

Management

Conservative management, injection therapies and operative management are employed in the treatment of chronic shoulder pain. Conservative management for shoulder pain include rest, ice, physiotherapy and oral medications, but these treatments are often unable to provide long-term analgesic benefit. Non-operative invasive interventions used to treat chronic shoulder pain include nerve blocks, intra-articular and soft tissue (e.g. bursa or trigger point) injections. These interventions provide an inconsistent and highly variable duration of pain relief. The nerve supply around the shoulder is complex, with the nerves innervating the joint also contributing motor branches to the muscles around it. Operative management is often offered if other options fail, although surgery does not always provide pain relief. Many patients may not be suitable candidates for surgery due to advanced age and associated co-morbidities.[1]

Material and Methods

This research was performed a retrospective descriptive of prospectively collected data for patients with a diagnosis of chronic shoulder pain at Prof. Dr. R. Soeharso Orthopaedic Hospital Surakarta in January 2022 – December 2025. Data collection was conducted by collecting medical records of patients with a diagnosis of Chronic Shoulder Pain at Prof. Soeharso Orthopaedic Hospital, Surakarta from January 2022 – December 2025. Patients included in the criteria were aged > 20 years, patients with a diagnosis of chronic shoulder pain at Prof. Dr. R. Soeharso Orthopaedic Hospital Surakarta in January 2022 – December 2025. Meanwhile, exclusion criteria were patients with traumatic shoulder pathology, patients who previous operated shoulder surgery, and patients who tumor involving shoulder joint.

Patients who had chronic shoulder pain between January 2022 – December 2025 and their dataset was examined for completeness and accuracy were included. The research data obtained will be analyzed descriptively in the form of input data consisting of included age, gender,and affected side, radiographic imaging of acromial morphology and categorized in the classification of Bigliani. Acromion types were classified according to Bigliani et al type I acromion has flat undersurface, type II acromion has curved undersurface, type III acromion has hooked undersurface on Supraspinatous outlet view radiographs. Types of Acromion were co-related with affected side and age group. After that, the results of the data analysis will be presented in the form of tables and narratives.

Result

A total of 260 patients were treated operatively at Prof Dr. R. Soeharso Orthopedic Hospital Surakarta During the period of January 2022 – December 2025.

Characteristics	***Quantity (n)***	**Percentage (%)**
Aged		
20-50	208	80%
>50	52	20%
Gender		
Male	142	54,5%
Female	118	45,5%
Affected Side		
Right	137	52,7%
left	123	47,3%
Dominant Hand		
Left	175	67,3%
Right	85	32,7%
Diagnosis		
Impingement syndrome	170	65,4%
RC tear	90	34,6%
Acromion Type		
Type 1	94	36%
Type 2	140	54%
Type 3	26	10%

Table 2. *Patient with Chronic Shoulder Pain Characteristics Data at RSO Surakarta*

In the period of November 2022 – December 2025, from 260 patients there were 52 patients with humeral shaft fracture accompanied by radial nerve palsy were treated operatively at Prof Dr. Soeharso Orthopedic Hospital Surakarta.

DISCUSSION

Demographics

The radial nerve is the most frequently injured major nerve in the upper extremity. The reported incidence of radial nerve palsy ranges from 1.8% to 22% in all humeral shaft fracture cases, with an average prevalence of 11.8% according to a meta-analysis of 4517 fractures reported in 21 studies.[3]

The number of patients with humeral shaft fracture was treated operatively from January 2022 – December 2025 as many as 55 patients with 30 (54.5%) men and 25 (45.5%) women. There were 52 (20%) patients who had radial nerve lesions were 24 (45.5%) women and 28 (54.5%) men who underwent ORIF and exploration.

Fracture Type

This study was reporting according to *AO* classification type of humeral shaft fracture, exploration in 55 patients were obtained as many as 29 patients (52.7%) with simple fracture type (11 patients with spiral type/ A1, 12 patients with oblique type/A2, and 6 patients with transverse type/A3), 18 patients (32.7%) wedge fracture type (11 patients with spiral wedge type/ B1, 3 patients with bending wedge/ B2, and 4 patients with fragmented wedge/ B3), and 8 patients (14.6%) with complex fracture type (5 patients with segmental/ C2, and 3 patients with irregular/ C3).

Patients with humeral shaft fracture accompanied by radial nerve palsy and performed ORIF and exploration in 52 patients were obtained as many as 19 patients (36.3%) with simple fracture type (3 patients with spiral type/A1, and 1 patient with oblique type/A2), 28 patients (54.6%) wedge fracture type (3 patients with spiral wedge type/ B1, 1 patient with bending wedge/B2, and 2 patients with fragmented wedge/B3), and 5 patient (9.1%) with complex fracture type (segmental type/C2).

Mechanism of Injury

Regarding the mechanism of injury among 260 patients, 175 patients (67.3%) were due to a low-energy mechanism of injury. The most common was a fall from the standing position with hands as support. The mechanism of injury due to high energy trauma was in 85 patients (32.7%), and all of them were motor vehicle accidents. The high energy injuries were common in the group of patients aged 20-30 years, while low energy injuries were common in the group of patients aged 41-50 years.

This study indicated 52 patients with humeral shaft fracture were accompanied by radial nerve palsy, 24 (45.5%) patients were in the high energy injury and 28 (54.5%) patients were in the low energy injury.

Radial nerve palsy with high energy injuries, including avulsion, entrapment, and transections with or without nerve defects of radial nerves. High energy injuries often lead to more severe bone and soft tissue injuries, which may explain the higher rate of nerve lesions and a lower rate of spontaneous recovery from radial nerve palsy. Venouziou et al. reported similar results, in which all patients with low energy injury had an intact or entrapped radial nerve and recovered completely.[10]

Timing for the onset of recovery and total recovery from nerve damage

Eleven patients humeral shaft fracture accompanied by radial nerve lesion had already recovered, with average onset recovery time was 10.7 weeks and from 9 patients were observed had totally recovered with average 60.8 weeks. Two patients had not all experienced a recovery phase and are still under observation, they were fragmented wedge and segmental in fracture type. The mechanism of injury for both patients was due to high-energy injury (motor vehicle accidents). High energy injuries often lead to more severe bone and soft tissue injuries, which may explain the higher rate of nerve palsies and a lower rate of spontaneous recovery from radial nerve palsy.

Shao et al. reported that the meantime to the onset of recovery was 7.3 weeks (2 weeks to 6.6 months), and the meantime to complete recovery was 6.1 months (3.4–12 months). In contrast, Venouziou et al. reported in their series that in patients with low-energy injury, the initial time to recover was 3.2 weeks (1–8 weeks) and the average time to full recovery was 12 weeks (3–22 weeks), whereas in patients following high-energy injury, the time of initial recovery was 14 weeks (7–23 weeks) and the meantime to full recovery was 26 weeks (11–35 weeks). However, this finding cannot be supported with our results, since we did not find a significant influence of the trauma mechanism on time to onset or time to full recovery. Another study reported that there was no significant difference in time to onset of nerve recovery or time to full recovery between high- and low-energy injury, between fracture types, and fracture locations along the shaft or type of treatment.[10]

Conclusion

Humeral shaft fractures are common fractures of the diaphysis of the humerus. These fractures presenting associated with low-energy and high-energy injury mechanisms, but the majority of fractures are associated with low-energy injury. They may be accompanied by radial nerve palsy, and in this study, among 55 patients with humeral shaft fractures, 11 patients (20%) were accompanied by radial nerve palsy. Almost all of the palsies had already recovered especially when the mechanism of injury was due to low-energy injury. Most of the fracture types occur on simple and wedge fracture types.

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Conflict of Interest

The authors declare no conflict of interest.

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