Review

Physical examinations for older adults with shoulder pain: a narrative review

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Abstract

Shoulder pain is a common complaint in primary care settings. The prevalence of shoulder pain is on the rise, especially in societies with aging populations. Like other joint-related conditions, shoulder pain is predominantly caused by degenerative diseases. These degenerative changes typically affect bones, tendons, and cartilage, with common conditions including degenerative rotator cuff tears, impingement syndrome, and osteoarthritis. Diagnosing these degenerative diseases in older adults requires a thorough understanding of basic anatomy, general physical examination techniques, and specific diagnostic tests. This review aims to outline the fundamental physical examination methods for diagnosing shoulder pain in older adult patients in primary care. The shoulder's complex anatomy and its broad range of motion underscore the need for a systematic approach to evaluation. Routine inspection and palpation can identify signs such as muscle atrophy, bony protrusions, or indications of degenerative changes. Assessing range of motion, and distinguishing between active and passive deficits, is crucial for differentiating conditions like frozen

shoulder from rotator cuff tears. Targeted strength tests, such as the empty can, external rotation lag, liftoff, and belly press tests, are instrumental in isolating specific rotator cuff muscles. Additionally, impingement tests, including Neer's and Hawkins' signs, are useful for detecting subacromial impingement. A comprehensive understanding of shoulder anatomy and a systematic physical examination are vital for accurately diagnosing shoulder pain in older adults. When properly executed and interpreted in the clinical context, these maneuvers help differentiate between various conditions, ranging from degenerative changes to rotator cuff pathology.

Keywords: Aged; Physical examination; Rotator cuff injuries; Shoulder impingement syndrome; Shoulder pain

Introduction

Background

Shoulder pain is the third most common musculoskeletal complaint, following back and knee pain [1]. A systematic review revealed that the prevalence of shoulder pain in the community varies widely, with a median of 16% (ranging from 0.67% to 55.2%). In primary care settings, prevalence estimates range from 1.01% to 4.84%, with a median of 2.36%. The incidence of shoulder pain varies from 7.7 to 62 per 1,000 persons annually, with a median of 37.8 per 1,000 persons per year [2]. The prevalence of shoulder pain differs across age groups, with significant increases noted in older populations. A systematic review that focused on occupational groups found that 16 out of 21 studies reported higher prevalence estimates or odds ratios for shoulder pain in individuals over the age of 50. This trend was more evident in physically demanding occupations, where 14 out of 18 samples indicated an increased prevalence in those over 50 years old, compared to only two out of four in sedentary occupations [3].

In South Korea, data from 2011 to 2020 indicated a significant increase in shoulder lesions among individuals aged 60–69 years, underscoring the rising prevalence of shoulder pain within this demographic [4]. Kim et al. [5] recently carried out a study involving participants aged 40 years or older from a specific city. Their findings from a survey of 30 bilateral shoulders revealed that about 65% of individuals aged 60 years or older reported experiencing shoulder pain. Furthermore, the incidence of associated rotator cuff disease was significantly higher in this age group compared to those under 60 years (P=0.006).

Age is a critical demographic factor in the context of shoulder pain. Younger individuals exhibit a higher prevalence of traumatic dislocations and labral injuries, whereas older adults more frequently experience degenerative wear of the shoulder joint, along with tears in the rotator cuff tendons [6,7,8].

Objectives

The purpose of this review was to examine the basic approaches for diagnosing shoulder pain in older adult patients. It assessed the physical examination techniques used to evaluate shoulder pain.

Ethics statement

As this study is a literature review, it did not require institutional review board approval or individual consent. Supplementary video files were provided by the authors as examinee and examiner.

Anatomy

To understand shoulder disorders, it is essential to have a basic knowledge of shoulder anatomy. The shoulder is one of the most complex joints in the human body and enables a wide range of movements that are crucial for everyday activities.

The shoulder comprises three bones: the clavicle, scapula, and humeral head. Together, these bones form the glenohumeral, sternoclavicular, acromioclavicular, and scapulothoracic joints. The primary shoulder joint, the glenohumeral joint, is a ball-and-socket type located between the humeral head and the glenoid cavity. However, only 25% of the humeral head articulates with the glenoid cavity [9]. This joint is inherently unstable yet allows for a broad range of motion. Adding stability to the shoulder, the labrum—a layer of fibrocartilage—envelops the glenoid rim [10].

The shoulder is surrounded by several key muscles that not only contribute to its extensive range of motion but also provide stability to the joints. These muscles include the deltoid, trapezius, pectoralis major, latissimus dorsi, biceps, triceps, and rotator cuff. They work in concert to facilitate a wide range of movements and stabilize this highly mobile joint, thus protecting the shoulder from injury [11]. The rotator cuff muscles, comprising the supraspinatus, infraspinatus, teres minor, and subscapularis, are crucial for normal shoulder function. Injuries to these muscles or their tendons can severely impair movement and cause significant pain. These muscles are interconnected by tendons that merge to form the rotator cuff tendon. This tendon complex encircles the head of the humerus, enabling the arm to perform a wide range of movements across various planes while maintaining the stability of the shoulder joint [12]. The

supraspinatus muscle, originating from the supraspinatus fossa of the scapula, inserts into the greater tubercle of the humerus. Its primary functions are to initiate arm abduction and stabilize the humeral head within the glenoid cavity. The infraspinatus muscle arises from the infraspinous fossa of the scapula and also attaches to the greater tubercle of the humerus. Positioned just below the infraspinatus, the teres minor muscle originates from the lateral border of the scapula and inserts near the infraspinatus on the greater tubercle of the humerus. Both the infraspinatus and teres minor muscles aid in the external rotation of the arm. The subscapularis muscle, located on the anterior side of the scapula, occupies the subscapular fossa and attaches to the lesser tubercle of the humerus. This muscle facilitates the internal rotation of the arm [13].

Physical examination

The physical examination of the shoulder starts with taking the patient's history, followed by inspection, palpation, assessment of range of motion (ROM), muscle strength testing, and provocative tests for specific conditions. It is essential to obtain a detailed medical history to guide further testing and imaging. Typically, inquiries should cover the patient's age, the duration and quality of the pain, associated symptoms, and factors that aggravate or relieve the pain [14].

Shoulder pain is frequently associated with occupational factors; thus, the duration of employment, working posture, and hours worked are significant considerations. With the growing interest in leisure sports among older adults, it is crucial to gather a detailed history that includes the types of sports they engage in and whether they experience pain during these activities. Furthermore, for older patients, it is equally important to document a treatment history for concurrent conditions like diabetes, chronic kidney disease, and rheumatic diseases, which can contribute to shoulder pain [15].

Inspection

Patient inspection should be conducted with both the affected and unaffected extremities fully exposed. The examination should encompass both anterior and posterior views to detect any muscle asymmetry or abnormal bony prominences. Bilateral examination of the deltoid, supraspinatus, and infraspinatus fossae

for atrophy is essential [16]. If muscle atrophy is significant, further evaluation should be undertaken, including an assessment for shoulder pathology, to ascertain the presence of any neurological issues [17,18].

Rupture of the long head of the biceps tendon (LHBT) can occur either traumatically or spontaneously in older adults, often resulting in a noticeable bulge in the upper arm, known as the Pop eye sign [19].

Degenerative arthritis commonly affects the sternoclavicular and acromioclavicular joints in the shoulders of older adults, often resulting in bony protrusions [20,21]. Additionally, patients with massive rotator cuff tears may experience anterior protrusion of the humeral head into the shoulder joints [22]. The position of the scapula was observed from the patient's back. The differential diagnosis should consider both the static position and the dynamic motion of the scapula [23].

Palpation

Palpation, combined with visual inspection, plays a crucial role in the initial physical examination. It is essential to accurately identify the specific location of any local tenderness. This helps in predicting the disease based on its anatomical location and facilitates preparation for further evaluation.

In degenerative arthritis of the sternoclavicular and glenohumeral joints, it is essential to palpate the articular processes to assess tenderness, bony prominences, and swelling [20,21]. Rotator cuff disease is the most prevalent condition among shoulder diseases, with the supraspinatus tendon frequently affected, especially in cases of rotator cuff pathology. Precise palpation is key for diagnosing issues such as tendinitis, tears, or impingement [24]. To palpate the supraspinatus tendon, one must identify the attachment site and the greater tuberosity area. The patient's arm should be placed in slight extension (moving the arm slightly behind the body) and internal rotation (turning the hand toward the body), which moves the supraspinatus tendon anteriorly. The supraspinatus tendon and greater tuberosity can then be palpated just anterior and slightly lateral to the acromion [25]. The subscapularis tendon, part of the rotator cuff, is located on the anterior aspect of the shoulder. To palpate the subscapularis and its attachment site (the lesser tuberosity), the patient's arm should be externally rotated with the elbow flexed at 90°. This maneuver lengthens the subscapularis tendon and brings it to a more superficial position [26]. The LHBT runs through the bicipital

groove on the anterior aspect of the humerus and is commonly affected by tendinitis, instability, or rupture. The biceps groove, housing the LHBT, is situated between the greater and lesser tubercles of the humerus. To palpate the bicep groove, place the patient's arm in neutral rotation with the elbow flexed to 90°. Slightly outward rotation of the arm (turning the forearm outward) will better expose the tendon. The bicep groove can be palpated 2–3 cm inferior to the anterior border of the acromion [27].

ROM assessment

As a ball-and-socket joint, the shoulder facilitates an extensive range of motion across multiple planes [9,10]. Proper evaluation of ROM is essential for assessing function, identifying limitations, and diagnosing various conditions. Typically, ROM measurements include forward flexion, extension, abduction, external rotation, and internal rotation. These measurements can be taken while the patient is sitting, standing, or lying supine. The sitting position is particularly convenient for simultaneously conducting other muscle tests and provocative tests. However, it is crucial to stabilize the scapula to accurately measure the true ROM of the glenohumeral joint. Additionally, ROM measurements should be compared with those of the unaffected side, as the normal range varies from person to person and with age [28]. Assessment of shoulder ROM should encompass both active (unassisted) and passive (assisted by the examiner) movements. A loss of both may indicate a stiff shoulder, such as frozen shoulder or secondary stiff shoulder, whereas a loss of active ROM alone suggests shoulder weakness, potentially due to a rotator cuff tear or neurologic dysfunction. Disease-specific tests and imaging evaluations should be tailored to each specific symptom [29]. A video of the ROM assessment of shoulder joints is available in Supplement 1.

Muscle strength testing and provocative tests

Shoulder strength assessment is a crucial part of physical examinations, offering insights into muscle function that can assist in diagnosing rotator cuff disorders [22]. It is essential to understand the function of each tendon in the rotator cuff and to conduct muscle strength and provocation tests accordingly. These muscle tests should be carried out on both the affected and unaffected sides.

Supraspinatus

The supraspinatus is assessed using both the empty can test (Jobe's test) and the full can test [30]. The empty can test involved abducting the arm to 90°, internally rotating the forearm, and orienting the thumb downward. A positive result, indicating pain or weakness, is noted when the examiner exerted downward pressure on the arm. Conversely, the full can test is conducted in a similar arm position but with the forearm externally rotated and the thumb pointing upward, while the examiner applied force. The tests demonstrate the highest accuracy in detecting a torn supraspinatus tendon when muscle weakness is present, with the full can test showing 75% accuracy and the empty can test showing 70% accuracy [30]. Both tests have proven to be highly sensitive and specific, making them suitable for both screening and confirming rotator cuff tears that involve the supraspinatus. A video of the empty can test (Jobe's test), and the full can test for supraspinatus muscle strength is available in Supplement 2.

Infraspinatus and teres minor

The infraspinatus and teres minor muscles serve as external rotators of the arm. To assess external rotational strength, the patient holds their arm at their side with the elbow bent at 90°. The examiner then applies inward pressure as the patient resists by rotating the arm externally [31]. The external rotation lag sign is a diagnostic test for the shoulder, useful in identifying tears in the infraspinatus and supraspinatus tendons. This sign is considered positive if, after the examiner maximally externally rotates the arm—with the shoulder flexed at 20° and the elbow at 90°—the patient is unable to keep the arm in this position. With a specificity of 94%, a positive external rotation lag sign reliably indicates full-thickness tears of both the supraspinatus and infraspinatus tendons [32]. The Hornblower test is another clinical examination that evaluates the function and strength of the infraspinatus and teres minor muscles. During this test, the patient's arm is passively abducted and supported by the examiner with the elbow flexed at 90°. A positive result occurs if the patient cannot maintain external rotation of the arm. Given that both the infraspinatus and teres minor contribute to external rotation of the humerus, identifying weakness in these muscles can be challenging through physical examination alone [33]. A video of the external rotation lag sign and Hornblower test is available in Supplement 3.

Subscapularis

The subscapularis tendon plays a crucial role in the internal rotation of the shoulder. To assess its integrity, strength, and function, four clinical tests are conducted. Initially, the liftoff test (Gerber test) is performed. This involves the patient flexing their elbow, internally rotating their arm, and placing their hand on the lumbar spine. A positive result is indicated by the patient's inability to lift the back of their hand away from the body. Next, the belly press test (Napoleon sign) is administered. For this test, the patient places their hand on their abdomen with the arm internally rotated and the elbow flexed, keeping the wrist in a neutral position. A positive result is noted if the patient cannot maintain the elbow in a forward position or keep the wrist neutral while pressing against the abdomen. The third test conducted is the bear-hug test. The patient positions their elbow at shoulder height and places their hands on the opposite shoulder. The examiner then attempts to pull the patient's hand away from the shoulder while the patient resists. A positive result is recorded if the patient cannot maintain their hand on the shoulder. The fourth assessment is the internal rotation lag sign. In this test, the examiner positions the patient's arm behind their back in internal rotation and lifts their hand off the back. If the patient is unable to hold the position and the hand falls back, it suggests weakness or a tear in the subscapularis [34,35,36]. Videos demonstrating the liftoff test (Gerber test) and the internal rotation lag sign, which assess the strength of the subscapularis tendon, are available in Supplement 4. Additionally, a video of the belly press test (Napoleon sign) for evaluating the strength of the subscapularis tendon can be found in Supplement 5.

Impingement test

Impingement occurs when the soft tissues—specifically the subacromial bursa, supraspinatus tendon, and biceps tendon—within the subacromial space become chronically trapped between the humeral head and the acromion [37]. This condition leads to progressive degenerative changes in the hypovascular region of the rotator cuff. A thorough medical history and physical examination are crucial for diagnosing shoulder impingement syndrome. Patients typically report pain or discomfort when lifting the arm or at specific points of impingement. Special tests are integral to the physical examination process. Initially, the Hawkins test is conducted by passively internally

rotating the patient's arm, flexing the shoulder to 90 degrees forward, and flexing the elbow. The presence of acromial pain indicates subacromial impingement [38]. Next, the Neer sign test involves fixing the scapula in a depressed position and having the examiner maximally flex the patient's arm forward (passive range of motion testing). Pain localized to the anterior aspect of the shoulder suggests impingement syndrome [38]. Additionally, the Painful arc sign is identified by pain occurring as the elbow is fully extended and abducted between 60° and 120° in the scapular plane, which indicates a pathology in the subacromial space [39]. Lastly, the Jobe test, also known as the empty-can test, is positive for impingement syndrome and supraspinatus lesions [39]. Although these tests individually have low sensitivity and specificity, when used collectively, they can provide a more comprehensive assessment of shoulder impingement syndrome. A video file of the Neer sign test and Hawkins test for checking impingement of the shoulder joint is available in Supplement 6.

Osteoarthritis of the glenohumeral joint

Osteoarthritis is a degenerative disease whose prevalence increases with age. It is a significant cause of physical disability and often severely impairs the quality of life in older adults [40]. In a study of a Korean population, Cho [41] reported that approximately 5% of patients over 65 years of age had shoulder arthritis of Kellgren-Lawrence grade 2 or higher. In addition, Oh [42] reported prevalence rates of 11.3% for Samilson-Prieto grade 1, 3.4% for grade 2, and 1.3% for grade 3. In general, patients with glenohumeral joint osteoarthritis present with decreased range of motion accompanied by crepitus as their main symptom. Osteoarthritis often manifests as a secondary stiff shoulder, characterized by reduced passive and active ranges of motion. Assessment of tenderness is conducted along the joint line, and palpation is used to check for swelling and effusion along the joint surface [43].

Acromioclavicular joint disease

Acromioclavicular (AC) joint disease encompasses a range of conditions affecting the joint between the clavicle and the acromion of the scapula. These conditions include degenerative changes such as osteoarthritis and traumatic injuries like dislocation or separation. AC joint arthritis is the predominant cause of shoulder pain in middle-aged individuals, primarily due to the degeneration of cartilage and the

intraarticular disc [44]. Primary osteoarthritis of the AC joint appears to be associated with normal age-related damage and subsequent loss of protective cartilage, causing painful bone-on-bone contact [45]. Although most patients do not exhibit symptoms, some may experience pain around the AC joint during daily activities, particularly during overhead or crossbody movements [46]. The physical examination for AC joint disease starts with observing any joint asymmetry through palpation and assessing the area for tenderness. The cross-body adduction test is highly effective for diagnosing AC joint pathology. During this test, the examiner stands in front of the patient, lifts the patient's arm to 90 degrees forward, holds the elbow, and adducts the shoulder across the body. This maneuver typically provokes pain around the AC joint, indicating potential pathology [45]. Another diagnostic tool is the O'Brien active compression test, where the examiner stands behind the patient. The patient flexes their arm forward to 90 degrees with the elbow fully extended, then adducts the arm 10° to 15° with internal rotation, thumb pointing downward. The examiner applies a downward force against the patient's resistance. The test is repeated with the palms fully supinated. A positive result—pain during the first maneuver that disappears in the second—confirms the diagnosis if the pain is localized to the AC joint [47]. Tenderness on palpation of the AC joint, which seems to be the easiest and most effective method, has been recommended as a screening test for AC joint disease due to its high sensitivity (96%) [48,49].

Conclusion

The shoulder is a crucial joint that facilitates a broad spectrum of activities due to its extensive range of motion. Shoulder pain can originate from various anatomical structures, including cartilage, ligaments, tendons, and bones. A deep understanding of these structures is essential for conducting precise physical examinations of the shoulder. By performing a comprehensive physical examination and utilizing appropriate imaging studies, the underlying causes of shoulder pain can be effectively analyzed.

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Conflicts of interest

No potential conflict of interest relevant to this article was reported

Funding

This research was supported by a 2024 Research Grant from Pusan National University Yangsan Hospital

Data availability

Not applicable

Acknowledgements

Not applicable

Supplementary materials

Supplement 1. ROM assessment

Supplement 2. Supraspinatus muscle examination (full can, empty can test)

Supplement 3. Infraspinatus muscle examination (external lag sign, Hornblower sign)

Supplement 4. Subscapularis tendon examinnation (liftoff, internal lag sign)

Supplement 5. Subscapularis tendon examination(belly press test)

Supplement 6. Impingement test

References

1. Urwin M, Symmons D, Allison T, Brammah T, Busby H, Roxby M, et al. Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. Ann Rheum Dis. 1998;57(11):649–55.

2. Lucas J, van Doorn P, Hegedus E, Lewis J, van der Windt D. A systematic review of the global prevalence and incidence of shoulder pain. BMC Musculoskelet Disord. 2022;23(1):1073.

3. Hodgetts CJ, Leboeuf-Yde C, Beynon A, Walker BF. Shoulder pain prevalence by age and within occupational groups: a systematic review. Arch Physiother. 2021;11(1):24.

4. Jung J, Shon MS. Epidemiology and etiology of shoulder pain based on health statistics data from Healthcare Bigdata Hub in Korea. J Korean Med Assoc. 2022;65(11):687-698.

5. Kim DY, Hwang JT, Lee SS, Lee JH, Cho MS. Prevalence of rotator cuff diseases in adults older than 40 years in or near Chuncheon city, Korea. Clin Shoulder Elb. 2020;23(3):125-130.

6. McLaughlin HL, MacLellan DI. Recurrent anterior dislocation of the shoulder. II. A comparative study. J Trauma. 1967;7(2):191–201.

7. Lee JH, Park JW, Kim JW, et al. Factors associated with patient satisfaction after arthroscopic rotator cuff repair: do they differ by age? Clin Shoulder Elb. 2024;27(3):345-352.

8. Oh JH, Kim SH, Lee HK, et al. The prevalence of shoulder osteoarthritis in the elderly Korean population: association with risk factors and function. J Shoulder Elbow Surg. 2011;20(5):756-763.

9. Halder AM, Kuhl SG, Zobitz ME, et al. Effects of the glenoid labrum and glenohumeral abduction on stability of the shoulder joint through concavity-compression: an in vitro study. J Bone Joint Surg Am. 2001;83(7):1062-9.

10. Cooper DE, Arnoczky SP, O'Brien SJ, et al. Anatomy, histology, and vascularity of the glenoid

labrum. An anatomical study. J Bone Joint Surg Am. 1992;74(1):46-52.

11. Ludewig PM, Reynolds JF. Shoulder function: the perfect compromise between mobility and stability. J Orthop Sports Phys Ther. 2009;39(2):88-98.

12. Clark JM, Harryman DT 2nd. Tendons, ligaments, and capsule of the rotator cuff. Gross and microscopic anatomy. J Bone Joint Surg Am. 1992;74(5):713-25.

13. Kim SC, Yoo SJ, Jo JH et al. The impact of supraspinatus tear on subscapularis muscle atrophy and fatty infiltration. Clin Shoulder Elb. 2024;27(4):437-446.

14. House J, Mooradian A. Evaluation and management of shoulder pain in primary care clinics. South Med J. 2010;103(11):1129-35.

15. Kim YS, Kim JM, Kim JY, et al. Socioeconomic and other risk factors for retear after arthroscopic surgery for nontraumatic rotator cuff tear. Clin Shoulder Elb. 2024;27(1):53-60.

16. Hegedus EJ, Goode AP, Cook CE, et al. Identifying shoulder pain in older patients: the history, physical examination, and testing. J Geriatr Phys Ther. 2013;36(2):70-7.

17. Wilson L, Sundaram M, Piraino DW, et al. Isolated teres minor atrophy: manifestation of quadrilateral space syndrome or traction injury to the axillary nerve? Orthopedics. 2006;29(5):447-50.

18. Friend J, Francis S, McCulloch J, et al. Teres minor innervation in the context of isolated muscle atrophy. Surg Radiol Anat. 2010;32(3):243-9.

19. Pagnani MJ, Deng XH, Warren RF, et al. Role of the long head of the biceps brachii in glenohumeral stability: a biomechanical study in cadavera. J Shoulder Elbow Surg. 1996;5(4):255-62.

20. Rockwood CA Jr, Green DP, Bucholz RW, et al. Acromioclavicular joint disease. In: Rockwood and Green's Fractures in Adults. 4th ed. Philadelphia: Lippincott-Raven; 1996. p. 1341-409.

21. Rockwood CA Jr, Matsen FA 3rd. Osteoarthritis of the sternoclavicular joint. In: The Shoulder. 2nd

ed. Philadelphia: WB Saunders; 1998. p. 1055-66.

22. Bishay V, Gallo RA. The evaluation and treatment of rotator cuff pathology. Prim Care. 2013;40(4):889-910.

23. Kibler WB, Sciascia A, Wilkes T. Current concepts: scapular dyskinesis. Br J Sports Med. 2012;46(6):350-5.

24. Kim YS, Kim JM, Kim JY, et al. Partial-thickness rotator cuff tears: a review of current literature on evaluation and management. Clin Shoulder Elb. 2024;27(1):79-87.

25. Jacobson JA. Shoulder US: anatomy, technique, and scanning pitfalls. Radiology. 2011;260(1):6-16.

26. Lyons RP, Green A. Subscapularis tendon tears. J Am Acad Orthop Surg. 2005;13(5):353-63.

27. McDevitt AW, Cleland JA, Strickland C, et al. Accuracy of long head of the biceps tendon palpation by physical therapists: an ultrasonographic study. J Phys Ther Sci. 2020;32(11):760-7.

28. Lee SH, Yoon C, Chung SG, et al. Measurement of shoulder range of motion in patients with adhesive capsulitis using a Kinect. PLoS One. 2015;10(6):e0129398.

29. Ludewig PM, Reynolds JF. Understanding the physical examination of the shoulder: a narrative review. J Orthop Sports Phys Ther. 2011;41(6):388-405.

30. Itoi E, Kido T, Sano A, Urayama M, Sato K. Which is more useful, the "full can test" or the "empty can test," in detecting the torn supraspinatus tendon? Am J Sports Med. 1999;27(1):65-8.

31. Kim CK, Rhee KJ, Shin HD, Byun KY. Physical Examination of Rotator Cuff Tear. Clin Shoulder Elb 2008;11(1):13-18

32. Hertel R, Ballmer FT, Lombert SM, et al. The validity of the lag signs in diagnosing full-thickness tears of the rotator cuff: a preliminary investigation. J Shoulder Elbow Surg. 1996;5(4):307-13.

33. Wilson L, Sundaram M, Piraino DW, et al. Isolated teres minor atrophy: manifestation of quadrilateral space syndrome or traction injury to the axillary nerve? Orthopedics. 2006;29(5):447-

50.

34. Barth JR, Burkhart SS, De Beer JF. The bear-hug test: a new and sensitive test for diagnosing a subscapularis tear. Arthroscopy. 2006;22(10):1076-84.

35. Hertel R, Ballmer FT, Lombert SM, et al. Lag signs in the diagnosis of rotator cuff rupture. J Shoulder Elbow Surg. 1996;5(4):307-13.

36. Hegedus EJ, Goode AP, Cook CE, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests. Br J Sports Med. 2012;46(11):964-78.

37. Creech JA, Silver SA. Shoulder impingement syndrome. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.

38. Cools AM, Cambier D, Witvrouw EE. Screening the athlete's shoulder for impingement symptoms: a clinical reasoning algorithm for early detection of shoulder pathology. Br J Sports Med. 2008;42(8):628-35.

39. Garving C, Jakob S, Bauer I, Nadjar R, Brunner UH. Impingement syndrome of the shoulder. Dtsch Arztebl Int. 2017;114(45):765-76.

40. Cornoni-Huntley JC, Foley DJ, White LR, Suzman R, Berkman LF, Evans DA, et al. Epidemiology of disability in the oldest old: methodologic issues and preliminary findings. Milbank Mem Fund Q Health Soc. 1985;63(3):350-76.

41. Cho H, et al. Prevalence and risk factors of spine, shoulder, hand, hip, and knee osteoarthritis in community-dwelling Koreans older than age 65 years. Clin Orthop Relat Res. 2015;473:3307-14.

42. Oh J, et al. The prevalence of shoulder osteoarthritis in the elderly Korean population: association with risk factors and function. J Shoulder Elbow Surg. 2011;20:756-63.

43. Lee JH, Lee SH, Lee HJ, et al. Inpatients with shoulder osteoarthritis who received integrative

Korean medicine treatment: long-term follow-up of an observation study. Integr Med Res. 2020;9(3):203-10.Acromioclavicular arthritis: a review. Orthop Clin North Am. 2018;49(3):307-20.

44. Park J, Yoo JC, Lee JH, et al. Acromioclavicular arthritis: a review. Curr Rev Musculoskelet Med. 2018;11(3-4):307-20.

45. Yi JW. Isolated acromioclavicular osteoarthritis and steroid injection. Clin Shoulder Elb. 2023;26(2):107-108

46. Mazzocca AD, Arciero RA, Shea KP. Treatment of acromioclavicular joint injuries. Am J Sports Med. 2007;35(2):316-29.

47. Chronopoulos E, Kim TK, Park HB, et al. Diagnostic value of physical tests for isolated chronic acromioclavicular lesions. Am J Sports Med. 2004;32(3):655-61.

48. Hughes PC, Taylor NF, Green RA. Most clinical tests cannot accurately diagnose rotator cuff pathology: a systematic review. Aust J Physiother. 2008;54(3):159-70.

49. Walton J, Mahajan S, Paxinos A, et al. Diagnostic values of tests for acromioclavicular joint pain. J Bone Joint Surg Am. 2004;86(4):807-12.