JSES Reviews, Reports, and Techniques 2 (2022) 149–154

Contents lists available at ScienceDirect

JSES Reviews, Reports, and Techniques

journal homepage: www.jsesreviewsreportstech.org

Utility of lateral scapular radiographs in initial evaluation of nontraumatic shoulder conditions

Samuel D. Gieg, MPH, Christopher Schaefer, MD, Matthew J. Smith, MD, Richard Ma, MD, Sally D. Heil, BS, H. Mike Kim, MD*

Missouri Orthopaedic Institute, University of Missouri, Columbia, MO, USA

ARTICLE INFO

Keywords:
Lateral scapular view
Clinical utility
Shoulder
Nontraumatic shoulder conditions
Survey

Level of evidence: Level III; Diagnostic Study

Background: Lateral scapular radiographs have been routinely included in the initial radiographic examination of both traumatic and nontraumatic shoulder conditions. With the advance of modern imaging modalities, the clinical utility of the lateral scapular view has become questionable. The purpose of the study was to assess the utilization of the lateral scapular view among the members of the American Shoulder and Elbow Surgeons (ASES) and to determine the clinical utility of the lateral scapular view in the initial evaluation of nontraumatic shoulder conditions.

Methods: The study consisted of two parts. The first part involved an online survey of ASES members, which asked them 3 questions regarding their preference for radiographic evaluation of new patients with nontraumatic shoulder pain. The second part involved a clinical vignette–based survey, where 4 shoulder surgeons at our institution were given 50 clinical vignettes and asked to independently answer 4 questions regarding the most probable diagnosis, abnormal radiographic findings, further imaging studies, and treatment plan for each case. The survey was repeated twice; the first was given without a lateral scapular view, and the second given 4 weeks later with a lateral scapular view included. We obtained diagnostic accuracy and percent agreement of each surgeon over two surveys and intraobserver and interobserver reliability on each variable.

Results: Of a total of 235 ASES members who responded to the online survey, 193 (82.1%) indicated their routine use of a lateral scapular view. The most common reason for obtaining the view was better characterization of acromion morphology (75.4%). The clinical vignette–based survey showed substantial intrarater reliability ($\kappa > 0.6$) of the 4 surgeons between the two surveys for the most probable diagnosis, abnormal x-ray findings, and further imaging studies, while the intrarater reliability for treatment plan was moderate ($\kappa = 0.548$). The mean diagnostic accuracy of the 4 surgeons was almost equal (74% vs. 75%) between the surveys. Overall, each surgeon's percent agreement across the 2 surveys was over 70%. None of the 4 surgeons recommended a lateral scapular view for further imaging during the first survey; each wanted either advanced imaging (computed tomography, magnetic resonance imaging) or none.

Discussion: The addition of a lateral scapular radiograph in the presence of other orthogonal views does not appear to improve surgeons' diagnostic accuracy or affect their decision-making on the treatment plan in nontraumatic shoulder conditions. The clinical utility of the lateral scapular view may need to be reassessed in this setting.

Traditional evaluation of nontraumatic shoulder conditions involves obtaining a series of 4 radiographic views of the glenohumeral joint: anteroposterior (AP), Grashey, axillary, and lateral scapular view (e.g., scapular Y-view, supraspinatus outlet view).[2,7,12] These 4 views were originally used for evaluation of traumatic shoulder conditions and have been referred as the "trauma series".[8,16] The lateral scapular view has historically been useful in diagnosing various glenohumeral injuries, including anterior and posterior glenohumeral dislocation and proximal humerus fracture.[15,18,21] Proponents of the lateral scapular view argue that this method of evaluation allows for good visualization of acromion morphology and is better for the patient, as it is easily obtained and less painful than other views.[2,3,13,18] However, the

This study was approved by the University of Missouri Institutional Review Board (IRB#2025121).

*Corresponding author: H. Mike Kim, MD, Department of Orthopaedic Surgery, Missouri Orthopaedic Institute, University of Missouri, 1100 Virginia Avenue, Columbia, MO, 65212, USA.

E-mail address: kimhm@health.missouri.edu (H.M. Kim).

https://doi.org/10.1016/j.xrrt.2022.01.001

clinical utility of this view has become questionable in modern orthopedic practice as more advanced diagnostic imaging studies are readily available. Studies have especially called the effectiveness and practicality of the lateral scapular view into question. Arguments have been made that a lateral scapular radiograph can be difficult to obtain in certain patient populations and that it can be difficult to interpret due to overlying anatomical structures.[4,10,21,23] Multiple studies assessing the utility of the lateral scapular view in an acute trauma setting concluded that this projection does not provide additional information that cannot be obtained with other radiographic views.[12,17,20] In fact, subsequent radiographic analysis suggests that replacing the lateral scapular view with a modified trauma axial view, or a combination of either AP and axillary views or AP and apical oblique views, may identify additional injuries that would have otherwise been overlooked.[12,17,20] While the trauma literature appears to recommend against the use of the lateral scapular view, there is a paucity of literature regarding the utility of this view in nontraumatic shoulder conditions. It is important to try to limit radiographic views to the ones that provide useful information for the suspected diagnosis as radiographs not only involve radiation to the patient but also incur costs in healthcare systems.

The purpose of this study was (1) to assess the utilization of the lateral scapular view among the members of the American Shoulder and Elbow Surgeons (ASES) for nontraumatic shoulder conditions and (2) to determine if including the lateral scapular view in the initial radiographic examination makes meaningful contribution to establishing accurate diagnosis and treatment plan for new patients with a nontraumatic shoulder condition. We hypothesized that the lateral scapular view is routinely obtained by the majority of surgeons and that including a lateral scapular view has little effect on surgeons' diagnostic accuracy and decision-making in treatment plan. To this end, we conducted an online survey of members of the ASES and administered a clinical vignette–based questionnaire on surgeons in our institution.

Table I
Three questions asked in online survey of ASES members and the responses.

Survey questions	Total responses
What are your routine x-rays for new clinic patients who present with nontraumatic shoulder pain? (select all that apply)	
Anteroposterior (AP) view	114 (48.51%)
Grashey AP view	203 (86.38%)
Axillary view	225 (95.74%)
Lateral scapular view	194 (82.55%)
Other	34 (14.47%)
• Bernageau view: 3	
• Variants of Grashey view: 3	
• Grashey views in external and internal rotation: 9	
• Internal rotation view: 2	
• Zanca view: 14	
• Resisted abduction view: 2	
• Rarely get any radiographs in this setting: 1	
Do you routinely obtain a lateral scapular view (e.g., scapular Y-view, supraspinatus outlet view) for evaluation of new patients presenting with nontraumatic shoulder pain? (select one)	
Yes	193 (82.13%)
No	42 (17.87%)
If yes, what is your primary reason for obtaining this view? (select all that apply)	
Better characterization of acromion morphology	150 (75.38%)
Better appreciation of the humeral head position relative to the glenoid	76 (38.19%)
Better evaluation of scapular morphology	56 (28.14%)
Better evaluation of supraspinatus outlet	84 (42.21%)
Following conventional teaching	29 (14.57%)
Following institutional protocol	26 (13.07%)
Other	22 (11.06%)
• Can be helpful for localizing calcific tendinitis: 10	
• Don't think this view is necessary: 3	
• Screening for subscapular osteochondroma in rare cases: 1	
• Better evaluation of AC joint: 1	
• Miscellaneous: 7	

AC, acromioclavicular.

Materials and methods

Online survey of American Shoulder and Elbow Surgeons members

An online survey of ASES members was conducted via a commercial survey platform (SurveyMonkey®). An email survey invitation was sent to the members of the ASES in June 2020, and the survey was open for 6 weeks. The respondents answered 3 questions regarding their use of lateral scapular view x-rays in their practice (Table I). The 3 questions were as follows: 1) What are your routine x-rays for new clinic patients who present with nontraumatic shoulder pain? 2) Do you routinely obtain a lateral scapular view (e.g., scapular Y-view, supraspinatus outlet view) for evaluation of new patients presenting with nontraumatic shoulder pain? and 3) If yes, what is your primary reason for obtaining this view?

Clinical vignette–based surgeon survey

A separate survey was performed at our institution using clinical vignettes. After obtaining approval from our institutional board review, we reviewed a list of patients who had visited our shoulder and elbow clinic from January 2020 to July 2020 and identified 50 patients eligible for the study. The inclusion criteria were patients who presented as a new patient with shoulder pain that had not been caused by major trauma, had no prior injury or surgery to that shoulder, had no known preexisting deformities in that shoulder, underwent 4-view x-rays (i.e., AP, Grashey, axillary, and scapular Y-view) of the affected shoulder at our institution, and had a final diagnosis that was confirmed with advanced imaging, laboratory testing, or surgery by the treating surgeon. Fifty clinical vignettes were then created using Microsoft PowerPoint based on the 50 selected patient cases. Each clinical vignette included patient age and sex, chief complaints, history of present illness, physical examination findings, past medical and surgical history, and a series of radiographs of the affected shoulder. Each vignette was 5- to 8-slide long. No personal identifiable information was included in the vignettes. We developed a questionnaire, which was administered to 4 orthopedic surgeons in our institution: two shoulder and elbow fellowship-trained surgeons and two sports medicine fellowship-trained surgeons. All 4 surgeons were actively involved in treating shoulder conditions. The questionnaire asked the surgeons 4 questions regarding their most probable diagnosis, abnormal radiographic findings they could see in the given radiographs, further imaging studies, and treatment plan for each vignette (Fig. 1). An initial survey was sent to the surgeons at the beginning of the study period. This survey included the aforementioned questionnaire, the 50 clinical vignettes with AP, Grashey, and axillary radiographs with no scapular Y-view. A follow-up survey was sent to the same surgeons 4 weeks after the initial survey. This survey was conducted in the same way as the first survey, but with the addition of a scapular Y-view in each clinical vignette. The 4 surgeons were blinded to the true diagnoses and completed the questionnaire independently. The 50 cases were selected in such a way that the types and proportions of nontraumatic shoulder conditions seen in our shoulder and elbow clinic could be well represented. They consisted of 19 cases of a full-thickness rotator cuff tear, 7 glenohumeral osteoarthritis, 7 cuff tear

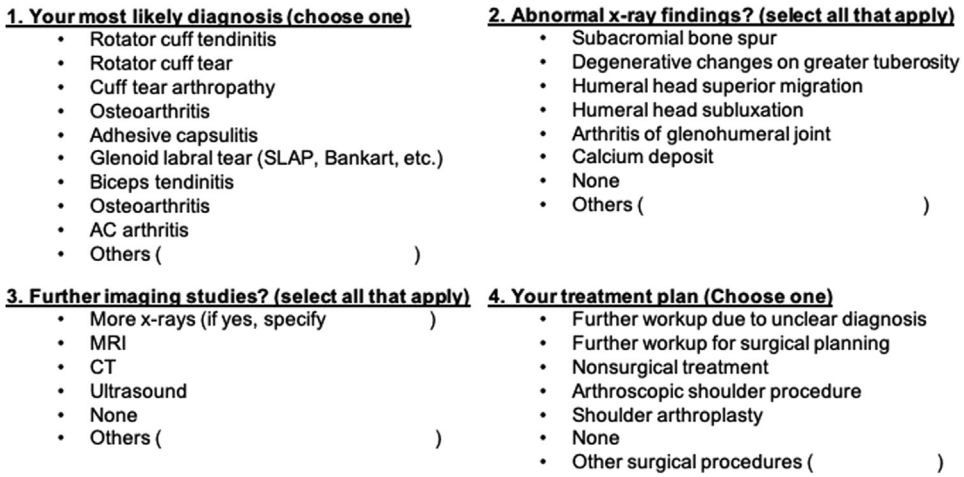

Figure 1 The 4 questions asked in the clinical vignette–based survey. *CT*, computed tomography; *MRI*, magnetic resonance imaging; *SLAP*, superior labrum anterior and posterior lesion; *AC*, acromioclavicular.

arthropathy, 7 rotator cuff tendinitis vs. a partial-thickness rotator cuff tear, 5 labral tear, 3 instability, 1 calcific tendinitis, and 1 septic shoulder arthritis.

Data analysis

Data obtained from the online survey of ASES members were compiled and reported in descriptive statistics. Percentages of individual responses were calculated to provide additional evidence for or against the use of the lateral scapular view. Regarding the clinical vignette–based surgeon survey, the diagnosis and treatment data obtained from the initial surgeon questionnaire were compared to those of the second survey completed 4 weeks later to investigate if adding a lateral scapular view influenced the surgeons' evaluation of each case. Percent agreement for diagnosis, x-ray findings, further studies, and treatment plan across the 2 surveys was calculated for each surgeon. Additionally, Spearman's rank correlation and Cohen's kappa were calculated to assess intraobserver reliability across the 2 surveys. Interobserver reliability between the 4 surgeons at each survey was assessed using Fleiss' multirater kappa. The statistical significance was set at $P<.05$.

Results

Online survey of American Shoulder and Elbow Surgeons members

A total of 235 ASES members responded to the SurveyMonkey questionnaire (Table I). Of these respondents, 193 (82.1%) reported routinely ordering a lateral scapular view x-ray in the evaluation of new patients with nontraumatic shoulder pain. The most commonly obtained view was an axillary view (95.7%) followed by a Grashey view (86.4%). A regular AP view was routinely obtained by only 48.5% of the surgeons. Of the 235 total survey responses, 199 respondents provided their reasons for obtaining a lateral scapular view. The 3 most commonly cited reasons were better characterization of acromion morphology (75.4%), better evaluation of the supraspinatus outlet (42.2%), and better appreciation of the humeral head position relative to the glenoid (38.2%).

Clinical vignette–based surgeon survey

The intrarater reliability of the 4 surgeons between the 2 surveys was substantial for (1) most probable diagnosis ($\kappa = 0.702$), (2) abnormal x-ray findings ($\kappa = 0.645$), and (3) further imaging studies ($\kappa = 0.620$) (Table II). The intrarater reliability for treatment plan was moderate ($\kappa = 0.548$), with the reliability of surgeon 1 being substantially low ($\kappa = 0.296$). If this surgeon's reliability is removed, the average kappa increases to 0.631, which is in the "substantial agreement" category. When compared to the gold standard diagnoses confirmed with advanced imaging studies, laboratory findings, or surgery, the surgeons diagnosed correctly in 74% and 75% of cases in the first and second surveys, respectively (Table III), indicating that the addition of a lateral scapular view did not substantially improve the diagnostic accuracy of the surgeons. Overall, each surgeon's percent agreement across the 2 surveys was over 70% (Table IV). The surgeons kept the same diagnosis in 77% of cases across the two surveys. During their second survey, surgeon 2 and surgeon 4 added no x-ray findings that were related to the morphology of the acromion or scapular spine that could be detected in a lateral scapular view (e.g., curved or hooked acromion, subacromial bone spur, humeral head subluxation, calcific tendinitis, or abnormal scapular morphology). Surgeon 3 identified one new finding of a subacromial bone spur only in one case during the second survey. Surgeon 1 added a new finding of subacromial bone spur in 7 cases and humeral head subluxation in 5 cases during the second survey. Except for the results of surgeon 1, the data suggest that adding a lateral scapular view did not substantially increase the rate of detecting abnormal x-ray findings that potentially could be seen in that view. As for further imaging study recommendation, none of the surgeons recommended more x-rays during the first survey. They all recommended either none or advanced imaging studies (e.g., computed tomography [CT] or magnetic resonance imaging [MRI]).

Discussion

The present study sought to assess the frequency with which surgeons utilize a lateral scapular radiograph in the initial evaluation of patients with nontraumatic shoulder pain and to analyze the benefit of a lateral scapular radiograph for establishing diagnosis and treatment plan in this patient population. We found that many surgeons routinely obtain a lateral scapular radiograph when evaluating patients with nontraumatic shoulder pain as 82% of the ASES member respondents indicated in the online survey. However, the analysis of data collected from our clinical vignette–based survey suggested that the addition of a lateral scapular radiograph

Table II
Each surgeon's intrarater reliability between two surveys.

Intrarater reliability over two surveys shown in Spearman's rank correlation coefficient rho (*P* value)				
	Diagnosis	X-ray findings	Further studies	Treatment plan
Surgeon 1	0.736 (<0.001)	0.441 (<0.001)	0.632 (<0.001)	0.392 (0.005)
Surgeon 2	0.832 (<0.001)	0.823 (<0.001)	0.706 (<0.001)	0.820 (<0.001)
Surgeon 3	0.487 (<0.001)	0.727 (<0.001)	0.580 (<0.001)	0.700 (<0.001)
Surgeon 4	0.620 (<0.001)	0.531 (<0.001)	0.628 (<0.001)	0.675 (<0.001)
Average	0.669	0.631	0.637	0.647
Intrarater reliability shown in *Cohen's kappa (approximate significance)				
	Diagnosis	X-ray findings	Further studies	Treatment plan
Surgeon 1	0.604 (<0.001)	0.473 (<0.001)	0.631 (<0.001)	0.296 (0.001)
Surgeon 2	0.849 (<0.001)	0.805 (<0.001)	0.676 (<0.001)	0.648 (<0.001)
Surgeon 3	0.623 (<0.001)	0.648 (<0.001)	0.545 (<0.001)	0.534 (<0.001)
Surgeon 4	0.731 (<0.001)	0.652 (<0.001)	0.627 (<0.001)	0.712 (<0.001)
Average	0.702	0.645	0.620	0.548

*Cohen's kappa interpretation [Cohen J. A coefficient of agreement for nominal scales. Educ Psychol Meas. 1960; 20:37–46].
- 0.01-0.20: none to slight agreement.
- 0.21-0.40: fair.
- 0.41-0.60: moderate.
- 0.61-0.80: substantial.
- 0.81-1.00: almost perfect.

Table III
Each surgeon's accuracy for diagnoses of 50 cases (percent accuracy compared to the diagnoses confirmed with advanced imaging or surgery).

Surgeon	Survey #1 (%)	Survey #2 (%)
Surgeon 1	60	64
Surgeon 2	82	84
Surgeon 3	76	78
Surgeon 4	78	74
Average	74	75

Table IV
Each surgeon's agreement between two surveys (%).

Surgeon	Diagnosis	X-ray findings	Further studies	Treatment plan
Surgeon 1	70	55	86	54
Surgeon 2	90	84	90	88
Surgeon 3	72	71	68	64
Surgeon 4	78	72	86	84
Average	77.5	70.5	82.5	72.5

had little influence on surgeons' diagnosis and treatment plan in this patient population.

One of the classic advantages of the lateral scapular radiograph is that this view allows for improved visualization of certain morphology and pathology, specifically with regard to the acromion.[3,5,13] This benefit was echoed in our survey of ASES members, with 75.4% of respondents stating that their primary reason for obtaining a lateral scapular radiograph was because it provides better characterization of acromion morphology. Contrary to this perceived benefit of the lateral scapular view among ASES member surgeons, the 4 surgeons at our institution did not recommend a lateral scapular radiograph for further workup when they were given only AP, Grashey, and axillary views during the initial clinical vignette survey. All 4 surgeons recommended either advanced imaging studies (i.e., MRI, CT) or no additional imaging at all. This finding may suggest that the surgeons were able to make an appropriate diagnosis and treatment plan without a lateral scapular radiograph and wanted an MRI or CT rather than a lateral scapular radiograph when they felt further imaging studies were needed. This finding also suggests that improved visualization of the acromion through a lateral scapular radiograph was not necessary for surgeons to diagnose nontraumatic shoulder conditions and decide on the treatment plan. Studies have shown that sagittal MRI views are equal or even superior to lateral scapular radiographs in evaluation of acromial morphology.[14,24] The literature is not consistent about the diagnostic value of acromial morphology. Studies have shown only poor to moderate agreement between surgeons on radiographic classification for acromial morphology.[5,9,11] Additionally, studies have raised questions about the traditional notion that certain acromial shapes are related to specific shoulder conditions such as rotator cuff tear, frozen shoulder, and calcific tendinitis.[1,6,19,22] In summary, acromial morphology that can be appreciated in a lateral scapular radiograph may not add a substantial diagnostic or therapeutic value when other standard radiographs and clinical information (e.g., history and physical examination) are available. MRI and CT scans usually outperform a lateral scapular radiograph if truly an accurate assessment of the acromial morphology is required.

In our clinical vignette–based survey, the surgeons kept the same diagnoses over the 2 surveys in 77% of the cases. Alternatively stated, surgeons changed their initial diagnoses during their second survey in 23% of cases. We performed an additional analysis to evaluate the nature of these changes and investigated whether the surgeons had changed their diagnoses because they were able to see a lateral scapular radiograph. We found that none of the changes could be directly related to the introduction of a lateral scapular radiograph. For example, one of the most common diagnosis changes was changing from rotator cuff tendinitis to a rotator cuff tear or vice versa. It is highly unlikely that a lateral scapular view would add meaningful information that would change the surgeon's diagnosis from tendinitis to a tear or vice versa. A similar reasoning can be applied to other diagnoses as none of the diagnoses given to the surgeons could be directly derived from a lateral scapular view. We admit that this finding may reflect a limitation of our study design as the study hypothesis could not be directly tested with this design. But, at the same time, this lack of diagnoses that can be directly derived from a lateral scapular view may speak to the low relevance of this view in our daily practice.

In our study, the treatment plan question of the clinical vignette–based survey showed lower interobserver and intraobserver reliability than other questions. Although the reason for this low reliability is not clear, it might have been that the survey question was constructed in a way that can potentially generate multiple answers. An additional analysis showed that surgeons often could not decide how to answer between "further workup due to unclear diagnosis" and "further workup for surgical planning" when they were asked about their treatment plan. We admit that the respondents could have gone in either way in some cases. For instance, a surgeon might have strongly suspected that a patient had a rotator cuff tear based on physical examination and x-rays and requested an MRI for further imaging. The surgeon might have proceeded in this manner because he either wanted to confirm his diagnosis or wanted to know the extent of the tear for preparation of surgery. Skipping a lateral scapular view would decrease the effective radiation dose approximately by 0.15 mSv, which is not a large dose reduction. From a financial perspective, it is now commonplace to bundle 2 or more views together under the same billing code. Thus, there would be little additional cost saving from skipping an x-ray view. We acknowledge that this does not provide a strong basis for skipping a lateral scapular view. However, from a perspective of evidence-based practice, this might have a value in decluttering our practice by shaving off unnecessary routines and rendering additional efficiency.

Our study has additional limitations that are important to note. First, our study was not designed to assess if the changes over the 2 clinical vignette–based surveys were due to the addition of a lateral scapular radiograph, individual surgeons' intraobserver variability, or a combination of both. Second, the clinical vignette–based survey used in our study has not been validated for its responsiveness and reliability for detecting the influence of adding the lateral scapular view on surgeons' capability to make an accurate diagnosis. The survey might not have had an appropriate number of certain cases that are sensitive to the presence or absence of a lateral scapular radiograph. Our study found that the diagnostic accuracy of the surgeons did not change substantially after adding the lateral scapular view. Third, we could not perform a priori sample size calculation because of a lack of previous work in this field and reference parameters. Fourth, the surgeons who participated in the second part of the study were all aware of the purpose of the study, which might have influenced the way they responded to the survey questions. Having said that, we took measures to minimize potential bias. First, there was a 4-week interval between the two surveys. By the time the surgeons sat for the second survey, they barely remembered how they had answered the survey 4 weeks ago. There were 4 questions for each case, and the total number of questions they answered was 200 at each survey. Without remembering how they responded at the first survey, it is very unlikely that the surgeons could have skewed their answers to one way or another. Second, the survey was designed in such a way that the surgeons were not able to directly associate the questions with the research hypothesis. Third, the large number of questions and a large amount of clinical data presented for each case that the surgeons had to go over likely prevented them from biasing their answers to the direction that they might have desired.

Conclusions

The present study found that many surgeons routinely obtain a lateral scapular radiograph during the initial evaluation of patients with a nontraumatic shoulder condition. The most common reason for obtaining a lateral scapular radiograph was for better characterization of the acromial morphology. Contrary to this finding, our clinical vignette–based survey showed that the clinical utility of the lateral scapular view was not as substantial as its widespread use among surgeons. The addition of a lateral scapular radiograph did not appear to improve surgeons' diagnostic accuracy or affect their decision-making on the treatment plan in this patient population. Our findings suggest that most patients with a nontraumatic shoulder condition may not benefit from this additional radiograph in the presence of other orthogonal views.

Disclaimers:

Funding: No funding was disclosed by the authors.
Conflicts of interest: The authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Balke M, Banerjee M, Vogler T, Akoto R, Bouillon B, Liem D. Acromial morphology in patients with calcific tendinitis of the shoulder. Knee Surg Sports Traumatol Arthrosc Off J ESSKA 2014;22:415-21. https://doi.org/10.1007/s00167-012-2327-5.
2. Berkes MB, Dines JS, Birnbaum JF, Lazaro LE, Lorich TC, Little MTM, et al. The Axillary View Typically Does Not Contribute to Decision Making in Care for Proximal Humeral Fractures. HSS J Musculoskelet J Hosp Spec Surg 2015;11:192-7. https://doi.org/10.1007/s11420-015-9445-9.
3. Bianchi S, Prato N, Martinoli C, Derchi LE. Shoulder Radiography [Internet]. In: Davies AM, Hodler J, editors. Imaging of the Shoulder: Techniques and Applications. Berlin, Heidelberg: Springer; 2004. p. 3-13.
4. Brems-Dalgaard E, Davidsen E, Sloth C. Radiographic examination of the acute shoulder. Eur J Radiol 1990;11:10-4.
5. Bright AS, Torpey B, Magid D, Codd T, McFarland EG. Reliability of radiographic evaluation for acromial morphology. Skeletal Radiol 1997;26:718-21.
6. Chalmers PN, Beck L, Miller M, Kawakami J, Dukas AG, Burks RT, et al. Acromial morphology is not associated with rotator cuff tearing or repair healing. J Shoulder Elbow Surg 2020;29:2229-39. https://doi.org/10.1016/j.jse.2019.12.035.
7. Goud A, Segal D, Hedayati P, Pan JJ, Weissman BN. Radiographic evaluation of the shoulder. Eur J Radiol 2008;68:2-15. https://doi.org/10.1016/j.ejrad.2008.02.023.
8. Greenspan A, Beltran J. Upper limb I: Shoulder girdle. In: Orthopedic Imaging: A Practical Approach. Philadelphia: Lippincott Williams & Wilkins; 2015. p. 107-61.
9. Haygood TM, Langlotz CP, Kneeland JB, Iannotti JP, Williams GR, Dalinka MK. Categorization of acromial shape: interobserver variability with MR imaging and conventional radiography. AJR Am J Roentgenol 1994;162:1377-82.
10. Horsfield D, Renton P. The "other view" in the radiography of shoulder trauma. Radiography 1980;46:213-4.
11. Jacobson SR, Speer KP, Moor JT, Janda DH, Saddemi SR, MacDonald PB, et al. Reliability of radiographic assessment of acromial morphology. J Shoulder Elbow Surg 1995;4:449-53.
12. Kornguth PJ, Salazar AM. The apical oblique view of the shoulder: its usefulness in acute trauma. AJR Am J Roentgenol 1987;149:113-6.
13. Liotard JP, Cochard P, Walch G. Critical analysis of the supraspinatus outlet view: rationale for a standard scapular Y-view. J Shoulder Elbow Surg 1998;7:134-9.
14. Mayerhoefer ME, Breitenseher MJ, Roposch A, Treitl C, Wurnig C. Comparison of MRI and conventional radiography for assessment of acromial shape. AJR Am J Roentgenol 2005;184:671-5. https://doi.org/10.2214/ajr.184.2.01840671.
15. McLAUGHLIN HL. Posterior dislocation of the shoulder. J Bone Joint Surg Am 1952;24 A:584-90.
16. Moghadamian ES, Bosse MJ, MacKenzie EJ. Principles of mangled extremity management. In: Rockwood and Green's Fractures in Adults. Philadelphia: Lippincott Williams & Wilkins; 2009. p. 429-51.
17. Neep MJ, Aziz A. Radiography of the acutely injured shoulder. Radiography 2011;17:188-92. https://doi.org/10.1016/j.radi.2011.01.006.
18. Neer CS. Displaced proximal humeral fractures. I. Classification and evaluation. J Bone Joint Surg Am 1970;52:1077-89.
19. Richards DP, Glogau AI, Schwartz M, Harn J. Relation between adhesive capsulitis and acromial morphology. Arthrosc J Arthrosc Relat Surg Off Publ Arthrosc Assoc N Am Int Arthrosc Assoc 2004;20:614-9. https://doi.org/10.1016/j.arthro.2004.04.062.

20. Sidor ML, Zuckerman JD, Lyon T, Koval K, Schoenberg N. Classification of proximal humerus fractures: The contribution of the scapular lateral and axillary radiographs. J Shoulder Elbow Surg 1994;3:24-7.
21. Silfverskiold JP, Straehley DJ, Jones WW. Roentgenographic evaluation of suspected shoulder dislocation: a prospective study comparing the axillary view and the scapular "Y" view. Orthopedics 1990;13: 63-9.
22. Stehle J, Moore SM, Alaseirlis DA, Debski RE, McMahon PJ. Acromial morphology: effects of suboptimal radiographs. J Shoulder Elbow Surg 2007;16:135-42. https://doi.org/10.1016/j.jse.2006.05.004.
23. Wallace WA, Hellier M. Improving radiographs of the injured shoulder. Radiography 1983;49:229-33.
24. Wang JC, Hatch JD, Shapiro MS. Comparison of MRI and radiographs in the evaluation of acromial morphology. Orthopedics 2000;23:1269-71.