Os Acromiale Identified While Utilizing the Swimmer's Lateral Cervical Projection: A Case Report

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ABSTRACT

The swimmer's view is used to evaluate the lower cervical spine as a supplement to the standard cervical spine series. Findings outside of the axial skeleton, such as os acromiale, can also be visualized on the swimmer's view. While os acromiale may be considered an incidental or benign normal variant, it can be symptomatic and associated with disease processes. These include, but are not limited to, shoulder impingement, acromioclavicular osteoarthritis, and rotator cuff pathology.

Key Words: acromion, radiology, anatomic variation, shoulder impingement syndrome, shoulder pain, diagnostic imaging

INTRODUCTION

The standard radiographic cervical spine evaluation consists of an anterior to posterior lower cervical projection, a lateral projection, and an anterior to posterior open mouth projection of the upper cervical spine. To fully evaluate the lowest cervical disc space, visualization of the superior endplate of T1 is required on the lateral projection. If this is not accomplished, a swimmer's lateral view is recommended, herein referred to as a swimmer's view. Cervicothoracic evaluation may be limited due to under penetration in patients who have larger body habitus or who have broad shoulders.[1,2] Twenty-two percent of all cervical spine evaluations at one clinic system utilized the swimmer's view (averages calculated utilizing

Palmer College Clinic data July 2021 through June 2022).

The swimmer's view is designed to evaluate the cervicothoracic spine, yet it can yield additional information about the shoulder girdle such as os acromiale. An os acromiale is a failure of fusion of the ossification center at the distal aspect of the anterior acromion process which typically fuses by 25 years of age. An analysis performed by Yammine showed prevalence of os acromiale to be between 4.2% to 9.6%.[3] The acromion develops from four ossification centers which include the pre-acromion, meso-acromion, meta-acromion, and basi-acromion. The type of os acromiale depends on where the nonunion of the ossification centers occur.[3,4] While this anomaly is well demonstrated on axillary views of the shoulder, complicated patient and receptor positioning may preclude this view from being performed at all facilities. Due to the orientation of an os acromiale it can be difficult to identify on standard anterior to posterior or internal and external rotation views of the shoulder.[5] An axillary view requires the patient to be supine with an abducted arm. The image receptor is placed vertically and contacting the upper aspect of the shoulder with the central ray directed towards the axilla.[2] Radiographic findings of an os acromiale include the double density sign, the ossicle projected over the remainder of the acromion, when observed from an anterior to posterior projection.[6] Os acromiale is typically an incidental finding but can be symptomatic and painful, especially with instability.

This report will explain how radiographic findings included in a swimmer's view can aid in visualization of an os acromiale.

CASE PRESENTATION

A 23-year-old male presented for evaluation and treatment with a chief complaint of neck pain and stiffness following an exercise-related lifting injury. He described pain into his left upper trapezius region which was reproduced with cervical spine left rotation and extension. The diagnosis with the highest clinical suspicion based off the history and physical exam was muscle strain which led the clinician to order cervical spine radiographs. It should be noted that these examination findings do not meet the Canadian Cervical Spine Rule (CCSR) for Radiography in Alert and Stable Trauma Patients. Therefore, the clinician did not follow the recommendation to avoid imaging as outlined by the CCSR reasoning for whiplash type injuries. The likelihood that imaging would provide clinically significant findings for a whiplash type injury is low.[7]

The patient was referred for standard cervical spine images including an anterior to posterior lower cervical spine, lateral cervical, and anterior to posterior open mouth projection. Additionally, due to the superimposition of soft tissues, broad shoulders, and the inability to visualize the superior endplate of T1, a swimmer's view was ordered.

Radiographic findings on the standard cervical three view series included cervical hypolordosis and minor lateral curvature. An os acromiale was identified on the swimmer's view leading the patient to be reassessed for clinical significance (**Figure 1**). The radiographic finding of os acromiale correlated with the patient's symptoms of pain on the superior aspect of the shoulder. Unfortunately, the patient was lost in follow-up. As a result, management thorough rehabilitation and further imaging to assess stability of the os acromiale was not completed.

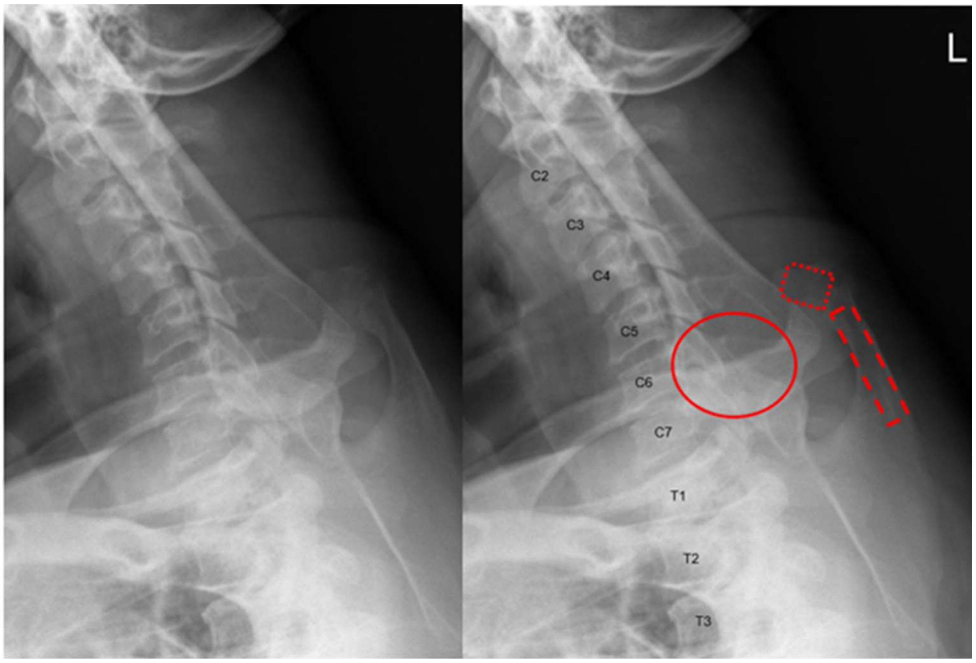

Figure 1: Non-annotated and annotated left lateral swimmer's view. The vertebral bodies are numbered, the left sided humeral head (circle), os acromiale (dotted outline), and remainder of the left acromion process (dashed rectangle) are outlined.

Positioning and Technique

For a swimmer's view lateral projection, the patient may be in a seated or standing position. The seated position is preferred to decrease motion artifact and combat issues related to the patient's ability to maintain the required position, also known as positioning fatigue. The arm closest to the image receptor is raised in full shoulder forward flexion with the elbow extended so that the arm is oriented vertically, next to the patient's ear (**Figure 2**). The image receptor should be placed vertically.[1,2] If the cervicothoracic junction remains under penetrated, the application of alternative techniques such as a caudal tube tilt of 3 to 5 degrees, or a combination of patient rotation and shoulder depression of the arm away from the image receptor can be completed. These techniques are useful for decreasing superimposition of anatomy.[1,2]

Figure 2: The patient is positioned with the arm oriented vertically, running next to the ear.

The source to image receptor distance is set at 40 inches, equivalent to 100 cm. The central ray is centered at the T1-T2 level at the mid axillary plane, with collimation to least 8x10 inches (**Figure 3**).[1] A high mAs and kVp of approximately 85 is necessary for adequate exposure and penetration. Bontrager et al. states that technical factors should be similar to what is required for a lateral thoracic, but in practice this can lead to underpenetrated images.

Figure 3: The central ray is centered at the cervicothoracic junction.

The cervicothoracic junction is denser than the air-filled thoracic cavity, therefore, to provide proper radiographic penetration and tissue detail, the mAs will likely be higher.[2]

The swimmer's view is primarily used to visualize the cervicothoracic junction, but portions of the shoulder girdle are also included within the field of view. On the swimmer's view, the humeral head that projects larger and inferior to the T3-T5 vertebral levels is the side that is positioned farthest away from the image receptor.[1] The swimmer's view is traditionally used for spinal findings, but it may occasionally show appendicular anatomic variations and lesions. Identification and awareness of these findings may contribute to patient presentation and symptomatology, therefore clinical correlation is warranted.

DISCUSSION

Typically, patients with a symptomatic os acromiale present with superior shoulder pain.[8] These patients may also have decreased shoulder motion, especially shoulder abduction, forward flexion, and/or decreased muscle strength. These patients may have difficulty with functional movements such as overhead activities.[8,9] With an unstable os acromiale, muscular pull at the attachment of the deltoid muscle on the terminal aspect of the acromion can cause downward movement of the ossicle during humeral flexion and abduction.[4]

When indicated, further dedicated clinical evaluation and imaging of an os acromiale utilizing MRI can be performed. Additionally, MRI can be used to evaluate lesions occurring in conjunction with os acromiale, such as shoulder impingement, rotator cuff pathology, and degeneration of the acromioclavicular joint. Symptomatic os acromial will present on MRI as high signal intensity at the margins of the pseudoarthrosis with possible sclerotic and cystic changes.[6] Rovesta et al. reported that upon evaluation of 726 shoulder MRI examinations of patients with symptomatic shoulder complaints, 25 (3.44%) of the patients studied had an os acromiale. Of the patients with os acromiale, 72% also had subacromial bursitis and 56% had rotator cuff pathology.[4]

Treatment for os acromiale is typically nonsurgical and includes nonsteroidal anti-inflammatory drugs, corticosteroid injections (especially subacromial), and rehabilitation to address impingement symptoms.[9-11] Targeted exercises used to treat symptomatic os acromiale may include strengthening the internal and external rotator muscles, resulting in depression of the humeral head, scapular stabilization, and serratus anterior strengthening.[12] A systematic review performed by Harris et al. investigated 115 patients with os acromiale who elected for surgical management following failure to respond to conservative care. The patient cohort with os acromiale who failed conservative management were middle aged (49±11 years), had symptoms for about a year (12±8.6 months), and had a meso-acromion type of ossicle. The most common type of surgery was internal fixation, followed by excision and acromioplasty. Patients frequently had concurrent surgical repair of the rotator cuff.[13] The meso-acromion type os acromiale had the most common incidence of adjacent degeneration at the acromioclavicular joint which was present in approximately 66.6% of patients.[3]

CONCLUSION

The swimmer's view is designed to add important radiographic information regarding the cervicothoracic junction. This view can also contribute to the evaluation of the included appendicular skeleton which may clarify the clinical picture. Os acromiale is typically considered an incidental finding but in some cases may be symptomatic. If identified on a radiographic examination, correlation with the patient's clinical history and physical examination findings could indicate the need for further evaluation and can guide clinical treatment and additional imaging.

LIMITATIONS

Limitations of this case presentation include the patient being lost in follow up, therefore follow up management and imaging was not reported upon. The swimmer's view should not be used as a screening tool for os acromiale. Referencing guidelines such as those outlined by CCSR can ensure that best practices in imaging are followed. A clinical need for imaging should be established prior to examination.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

COMPETING INTERESTS

The author declares no competing interests.

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REFERENCES

1. Marchiori DM. Clinical Imaging: With Skeletal, Chest, and Abdomen Pattern Differentials. Elsevier/Mosby; 2014.

2. Bontrager KL. Textbook of Radiographic Positioning and Related Anatomy. Mosby; 2001.

3. Yammine K. The prevalence of Os acromiale: a systematic review and meta-analysis. *Clin Anat*. 2014;27(4):610-621. doi:10.1002/ca.22343

4. Rovesta C, Marongiu MC, Corradini A, Torricelli P, Ligabue G. Os acromiale: frequency and a review of 726 shoulder MRI. *Musculoskelet Surg*. 2017;101(3):201-205. doi:10.1007/s12306-017-0463-2

5. Zlatkin MB. MRI of the Shoulder. Lippincott Williams & Wilkins; 2003.

6. Spiegl UJ, Millett PJ, Josten C, Hepp P. Optimal management of symptomatic os acromiale: current perspectives. *Orthop Res Rev*. 2018;10:1-7. doi:10.2147/ORR.S141480

7. Bussières AE, Taylor JAM, Peterson C. Diagnostic Imaging Practice Guidelines for Musculoskeletal Complaints in Adults—An Evidence-Based Approach—Part 3: Spinal Disorders. *Journal of Manipulative and Physiological Therapeutics*. 2008;31(1):33-88.

8. Roedl JB, Morrison WB, Ciccotti MG, Zoga AC. Acromial apophysiolysis: superior shoulder pain and acromial nonfusion in the young throwing athlete. *Radiology*. 2015;274(1):201-209. doi:10.1148/radiol.14140587

9. Boehm TD, Matzer M, Brazda D, Gohlke FE. Os acromiale associated with tear of the rotator cuff treated operatively. Review of 33 patients. *J Bone Joint Surg Br*. 2003;85(4):545-549. doi:10.1302/0301-620x.85b4.13634

10. Edelson JG, Zuckerman J, Hershkovitz I. Os acromiale: anatomy and surgical implications. *J Bone Joint Surg Br*. 1993;75(4):551-555. doi:10.1302/0301-620X.75B4.8331108

11. Swain RA, Wilson FD, Harsha DM. The os acromiale: another cause of impingement. *Med Sci Sports Exerc*. 1996;28(12):1459-1462. doi:10.1097/00005768-199612000-00003

12. Frizziero A, Benedetti MG, Creta D, Moio A, Galletti S, Maffulli N. Painful os Acromiale: Conservative Management in a Young Swimmer Athlete. *J Sports Sci Med*. 2012;11(2):352-356.

13. Harris JD, Griesser MJ, Jones GL. Systematic review of the surgical treatment for symptomatic os acromiale. *Int J Shoulder Surg*. 2011;5(1):9-16. doi:10.4103/0973-6042.80461