[Imaging]

Sports Health Orthopaedic Magnetic Resonance Imaging Challenge: Shoulder Pain From a Fall While Surfing

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CHALLENGE

A 16-year-old right-hand-dominant boy who is a competitive swimmer presents with dominant shoulder pain.

He is referred by his family care doctor and another orthopaedic surgeon, who are concerned about shoulder instability based on radiographs that they interpret as a Hill-Sachs lesion.

The patient reports that the injury occurred about a month before presentation, when he fell directly onto his right shoulder while surfing in the ocean.

He had immediate onset of pain but did not have a sensation of instability of the shoulder.

Anteroposterior (AP) radiographs in internal and external rotation, axillary radiographs, and T2-weighted magnetic resonance imaging (MRI) studies are provided.

What are the findings? What is the diagnosis?

FINDINGS

A minimally displaced greater tuberosity fracture of the proximal humerus with no Hill-Sachs or labral lesions.

DIAGNOSIS

A minimally displaced greater tuberosity fracture.

RADIOGRAPHIC DIAGNOSIS

In a patient with shoulder trauma, radiographic series should include AP views of the shoulder in internal (Figure 1) and external (Figure 2) rotation, as well as an axillary view (Figure 3).[12] An AP view in internal rotation is best for visualizing Hill-Sachs lesions, whereas AP views in external rotation are best for showing greater tuberosity lesions.[5,11] More specialized views, such as the Stryker Notch or West Point views,[8,9,11] may provide increased sensitivity for detecting Hill-Sachs lesions; in particular, the Stryker Notch view has been shown to have 100% specificity for visualizing Hill-Sachs lesions when combined with a Didiee view and an AP view with internal rotation.[4] However, obtaining these views may be impractical because radiology technicians are often unfamiliar with them and positioning of the patient may be difficult because of pain.

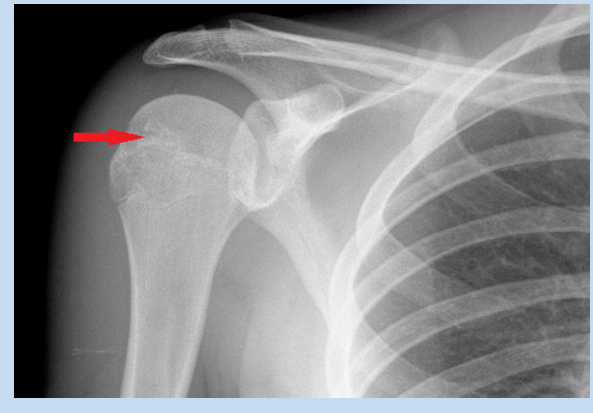

Figure 1. Anteroposterior radiographic view with internal rotation showing a greater tuberosity fracture (arrow).

Familiarity with the advantages and characteristics of various radiographic views is helpful for distinguishing Hill-Sachs lesions from greater tuberosity fractures.

DISCUSSION

This case shows the importance of distinguishing a Hill-Sachs lesion from a greater tuberosity fracture.

This patient was sent to us for possible surgical correction of shoulder instability based on a misinterpretation of the initial radiographs and, as a result, the wrong diagnosis.

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DOI: 10.1177/1941738112438040

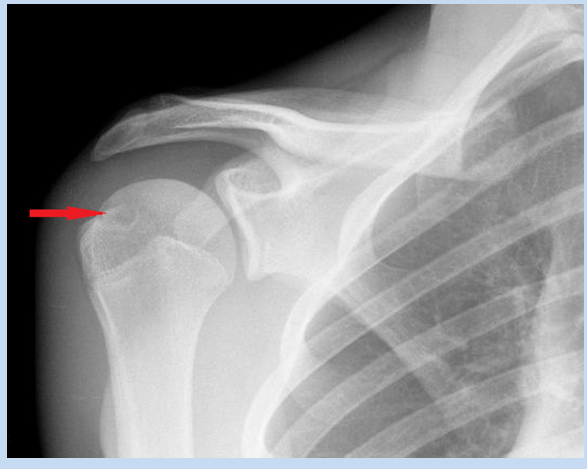

Figure 2. Anteroposterior radiographic view with external rotation showing a greater tuberosity fracture (arrow).

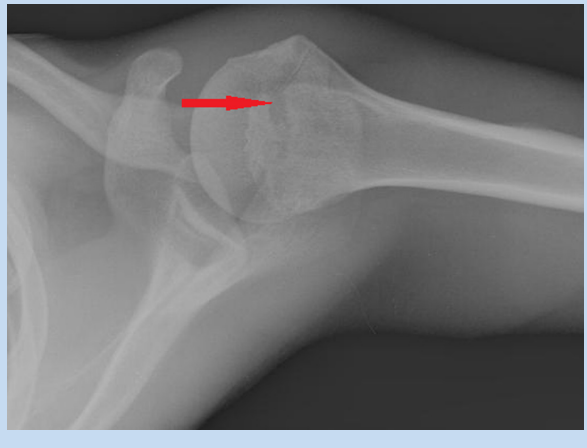

Figure 3. Axillary radiograph showing a greater tuberosity fracture (arrow).

This case also highlights the importance of synthesizing the history, physical examination, and radiographic evidence to determine an accurate diagnosis and treatment plan.

The injury occurred when the patient was thrown to the sand while surfing, landing on his lateral right shoulder.

He reported only pain at the time of injury, with no sensation of instability.

He said specifically that he did not land with his arm in abduction or external rotation, which is the most common mechanism of anterior shoulder instability.

Although the patient could possibly have had an anterior instability episode, the mechanism of injury and the subsequent radiographic studies did not support a Hill-Sachs compression fracture caused by a shoulder instability episode.

The mechanism of injury in this patient was more consistent with a greater tuberosity fracture than with an anterior shoulder dislocation.

Figure 4. Conventional anterior radiograph of the shoulder in internal rotation showing a Hill-Sachs lesion.

Studies have found that direct shoulder impaction forces are the most common mechanism to produce isolated greater tuberosity fractures.[2,5,6] With this mechanism, lateral forces on the shoulder cause the greater tuberosity to impinge against the glenoid or acromion.[5,6] Patients often describe localized tenderness over the lateral aspect of the shoulder.

However, the mechanism of injury was not diagnostic in this patient, and additional imaging was necessary.

In contrast, Hill-Sachs compression lesions are located on the articular surface of the posterior humeral head and are particularly associated with anterior shoulder dislocations.[7] The Hill-Sachs lesion is created when the relatively soft posterosuperior humeral head impacts the harder bone of the anterior glenoid rim.

The incidence of Hill-Sachs lesions in primary anterior dislocations is as high as 47% to 51% after a first-time anterior dislocation.[3] Such instability episodes may also result in fracture-dislocations of the proximal humerus, which are typically visible on prereduction radiographs and differ from nondisplaced greater tuberosity fractures in character and treatment.

The location of the humeral head defect is important in distinguishing a Hill-Sachs lesion from a greater tuberosity fracture (Figure 4).

Hill-Sachs lesions tend to be more posterior in the humeral head and may involve an island of intact cortical bone between the defect and the greater tuberosity.

Greater tuberosity fractures can typically be detected with conventional radiographs of the shoulder in external rotation, the view in which the tuberosity cortical margin is best shown.

If the exact location of the defect is not known after conventional radiographs, then computed tomography or MRI

Figure 5. Axial magnetic resonance image showing a greater tuberosity fracture (arrow). There is no evidence of Hill-Sachs fracture.

is recommended (Figure 5).[1,5,6,12] Greater tuberosity fractures are often overlooked; the initial examiner misses the fracture more than 50% of the time.[10]

Although uncommon, greater tuberosity fractures can occur as a result of an anterior shoulder dislocation.[6] In these instances, there is typically a large tuberosity fracture, and the patient describes a dislocation episode.

Patients with a fracture dislocation of the humeral head typically do not have concomitant Hill-Sachs lesions, so a careful history and additional study with computed tomography or MRI can help determine the correct diagnosis.

MRI can be helpful in determining if there are lesions associated with instability, such as those of the anterior labrum or anterior glenoid rim fracture.[5,6]

TREATMENT

The treatment of an isolated greater tuberosity fracture depends on many variables, especially the amount of displacement of the fracture, the age and activity level of the patient, the presence of other injuries, and the quality of the bone.

Most minimally displaced greater tuberosity fractures do not need surgery, and most heal with nonoperative treatment in 2 to 3 months.[2,5,6] However, symptoms such as pain and stiffness can continue for months even after fracture healing, so the patient may require a longer follow-up period to confirm that they have returned to activity.

In addition, if pain is persistent, it could indicate a rotator cuff tear.[5]

In this case, the patient was allowed to perform cross-training activities that would not cause shoulder pain, such as exercise bicycling, elliptical machines, or jogging.

He abstained from shoulder exercises until he was entirely asymptomatic, which was 10 weeks after his injury.

At his last follow-up, 15 weeks after the initial injury, he was swimming at a level equal to that before his injury and had returned to sports with no limitations.

Conventional radiographs showed that the fracture had healed.

CONCLUSION

It is important to distinguish a greater tuberosity fracture from a Hill-Sachs lesion when evaluating conventional radiographs and MRI studies in shoulder trauma.

Imaging studies should always be interpreted in light of the patient's history and physical examination.

An AP view with internal rotation is best for visualizing Hill-Sachs lesions, whereas an AP view in external rotation best shows fractures of the greater tuberosity.

By successfully reconciling the historical, examination, and imaging evidence of a case, the correct diagnosis can be made, and the patient can be treated in a timely and effective manner.

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