The case:

An 80-year-old woman underwent a right reverse total shoulder arthroplasty for cuff tear arthropathy with no complications. She was discharged 3 days after surgery with well-controlled pain. However, 6 days postoperatively, she reported the onset of excruciating pain in her right shoulder, and conventional radiographs, including an axillary radiograph, were obtained.

Figure: A conventional axillary radiograph showing a stress fracture of the scapular spine.

Your diagnosis?

For answer see page 492
Diagnosis:

Scapula Fracture and Os Acromiale After Reverse Total Shoulder Arthroplasty

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This case represents an unusual combination of an asymptomatic os acromiale with a superimposed symptomatic stress fracture of the scapular body in a patient with a reverse total shoulder arthroplasty (RTSA). The conventional axillary radiograph (Figure 1) shows the fracture of the scapular spine, which cannot be fully appreciated by an anteroposterior radiograph. However, the computed tomography (CT) image (Figure 2) shows the difference in the appearance of these 2 distinct entities, emphasizing the importance of the physical examination to determine which entity was causing the symptoms in this patient.

The RTSA is a relatively new procedure, based on a concept introduced by Grammont and Baulot, which has been performed in the United States since 2004. The major indications for this type of surgical procedure are represented by painful and symptomatic rotator cuff tear arthropathy, and failed shoulder arthroplasty where there is no functioning rotator cuff. Less common indications for the reverse prosthesis include rheumatoid arthritis with associated rotator cuff arthropathy, posttraumatic arthritis with malunion or nonunion of the tuberosities with rotator cuff dysfunction, acute comminuted 3- and 4-part fractures of the proximal humerus, and reconstruction of the shoulder after some tumors. Complications after RTSA are common and include those often associated with other shoulder procedures (infection, instability, and nerve injury). However, there are several complications unique to RTSA, including scapular notching, glenoid baseplate failure, component disassociation, and scapular stress fractures. The more common complications (eg, scapular notching, glenosphere fixation failure, and joint instability) have been well described in the literature. However, scapula stress fractures after RTSA have been infrequently reported.
The term os acromiale is used to define failure of an acromial ossification center to fuse to the acromion. According to Johnston et al., os acromiale was first described by Gruber in 1863. He distinguished 3 anatomical subtypes in relation to the size of the fragment. An os acromiale usually involves the mesoacromion, which is the location of the nonunion site in the acromion, just behind the acromioclavicular joint. The reported frequency in anatomical and radiographic studies ranges from 1.3% to 30%, and the incidence is higher in men and African Americans. Bilateral involvement is relatively common, with the incidence rates ranging from 33% to as high as 62%. Os acromiale is also frequently detected as an incidental radiographic finding in approximately 10% of asymptomatic shoulders in the general population.

**CASE REPORT**
An 80-year-old right-hand-dominant woman had a history of rotator cuff tear arthropathy treated with bilateral RTSA. She had previously undergone surgery on her left shoulder successfully with a RTSA. She had no complications, had complete relief of her pain, and was extremely satisfied with her motion of the shoulder as tolerated. The patient was interested in surgical intervention, this fracture was treated nonoperatively. She had no symptoms related to the os acromiale, so no treatment was necessary for that lesion. The patient was followed monthly for 3 months and because of continued pain she underwent a CT scan of her scapula 8 months postoperatively. It showed a nonunion of the scapular fracture with the presence of the asymptomatic os acromiale. However, at 10 months after her fracture, she reported no pain and was satisfied with her motion. She needed only nonsteroidal anti-inflammatory medications periodically for pain relief and had required no further treatment. At last follow-up (11 months later), her fracture was not completely healed but she had no pain.

**DISCUSSION**
This case shows the importance of recognizing the difference between an os acromiale and a scapular stress fracture in a patient with a RTSA. The key to making the diagnosis of a scapular stress fracture after RTSA is the physical examination where the pain is more posteriorly located than with an os acromiale. The use of axillary radiographs is helpful in making this diagnosis because anteroposterior views will not reveal the fracture. However, CT scanning may be necessary in determining the exact location and the extent of the fracture because the prosthesis may obscure the fracture detail in the axillary view.

Scapular stress fracture is an uncommon, but known, complication of RTSA. The incidence of scapular stress fracture after RTSA has been reported to be 0.9% to 7.2% (average, 5.8%). Because some of these scapular fractures may not be seen without axillary radiographs or with CT, it is possible that the incidence of these fractures is higher than that reported in the literature.

It is also important to distinguish an os acromial from other stress fracture variants seen in the scapula after RTSA. Crosby et al. described acromial fractures that can include small avulsions to fractures of the body of the acromion. In their study, the most common scapular fracture variations were type II scapular fractures, which are fractures through the acromion just posterior to the acromioclavicular joint. In this patient, the authors had preoperative radiographs that showed the os acromial, so it was known that the os acromial was not a postoperative stress fracture of the acromion.

The symptoms of a scapular fracture typically include pain in the posterior shoulder, but the pain can mimic lung abnormalities (eg, pulmonary embolus or pneumonia). Although scapu-
lar fractures are more posterior than an os acromiale or stress fractures of the acromion, it can sometimes be difficult to distinguish these lesions on physical examination alone. Stress fractures of the acromion and the scapula can cause pain and loss of shoulder motion.

Treatment of scapular stress fractures can be nonoperative or surgical. In most instances, the fractures can be treated without surgical intervention, and in the authors’ experience most patients are not interested in additional surgery on their shoulders after having a shoulder replacement. Nonoperative treatment includes cryotherapy, medication, and range of motion as tolerated. Bracing or sling use is indicated for symptomatic cases only.

There is currently no consensus as to the appropriate treatment of scapular or acromial fractures after RTSA. The location of the fracture and the degree of symptoms are the main variables when considering surgical vs nonoperative treatment. Several studies have found that the clinical result of RTSA is decreased in patients with scapular or acromial fractures.27-30

Crosby et al22 concluded that type I RTSA scapula fracture (small avulsions of the anterior acromion seeming to occur at the time of surgery) can be treated successfully with supportive care. They recommended that type II RTSA scapula fractures be treated with an acromioclavicular joint resection if the fracture appears stable, but if the fracture appears unstable, then it is best treated with distal clavicle excision and open reduction and internal fixation of the fracture. They thought that symptomatic type III RTSA scapula fractures (displaced fractures of the postero-acromion or scapular spine) should be treated with open reduction and internal fixation. Several studies have shown that the fractures involving the acromial base at the scapular spine have inferior clinical outcomes and that surgical intervention can result in improved pain and function.27-30

The existence of an os acromiale before a RTSA does not seem to be a contraindication to a satisfactory clinical result postoperatively. Mottier et al31 reviewed cases of acromion stress fracture or os acromiale among a consecutive series of 240 RTSAs implanted between 1995 and 2003. They concluded that acquired or congenital acromial lesions (ie, os acromiale) are not a contraindication for a prosthetic. Walch et al30 retrospectively reviewed 41 patients who, before undergoing RTSA, had evidence of acromial insufficiency, including 23 with an os acromiale. Of the 41 patients, 4 were diagnosed with a postoperative fracture of the acromion. Despite the fact that the 4 patients had inferior clinical results, the authors concluded that preoperative acromial insufficiency does not preclude a satisfactory clinical result in most patients.

REFERENCES

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