Radiographic evaluation of the acromion in impingement syndrome

Comparison with arthroscopic findings in 147 shoulders

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ABSTRACT – We analyzed standardized scapulolateral and anteroposterior view radiographs in 147 patients with impingement syndrome to detect a subacromial osteophyte or spur, which should be of value in those patients who require surgical treatment. Standard anteroposterior view radiographs with a fixed tube angulation, 0 and 30 degrees, were compared to anteroposterior view radiographs with individual tube angulation (the radiograph beam was tilted caudally, depending on the slope of the acromion). In all patients, we identified an acromion bony overhang on the anteroposterior view radiographs with individual tube angulation having an average thickness of 5 mm, which correlated well with the intraoperative findings at arthroscopic acromioplasty. In only 35% of the patients did we detect a subacromial osteophyte or spur on radiographs with a fixed tube at 0 degrees angulation and in 92%, we found a false impression of a spur on the 30-degree views because of overexposure.

We conclude that, anteroposterior view radiographs with an individual caudally-tilted X-ray beam, depending on the acromion slope, can show the whole spur and/or size of the osteophyte, on the anterior margin of the acromion.

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Subacromial impingement syndrome is a common disorder involving encroachment of the subacromial space and the underlying rotator cuff tendons. It is found in anatomically predisposed shoulders (Neer 1972, 1983) and is often associated with spur deformation and osteophytes on the anterior margin of the acromion. Impingement in the presence of a bony spur and/or osteophytes can be treated by arthroscopic or open acromioplasty. For this purpose, the acromial morphology must be assessed preoperatively. After surgery, radiographs should show the amount of acromioplasty and appropriately flattened acromion shape (Sampson et al. 1991).

We describe a sensitive radiographic method for visualizing subacromial spur formations and/or osteophytes, taking into consideration the sharpness and slope of the acromion.

Patients and methods

We performed a standard arthroscopic acromioplasty on 147 shoulders (94 men) with impingement syndrome. The patients' mean age was 51 (37–74) years, and the right shoulder had been involved in 86 cases. The indications for surgery included physical signs of impingement, failure of a rehabilitation program and spur formations and/or osteophytes on the undersurface of the acromion. Radiographs were taken preoperatively and postoperatively.

Radiographic technique

Scapulolateral view. The humerus is in neutral rotation. The radiograph beam passes tangentially across the posterolateral chest, parallel to and down the spine of the scapula, and is then directed to the cassette placed perpendicularly to the line over the spine of the scapula at the anterolateral shoulder. The tube is angled caudally 10 degrees. This technique provides a view of the outlet of the supraspinatus tendon unit as it passes below the coracoacromial arch. Sharpness, slope and defor-

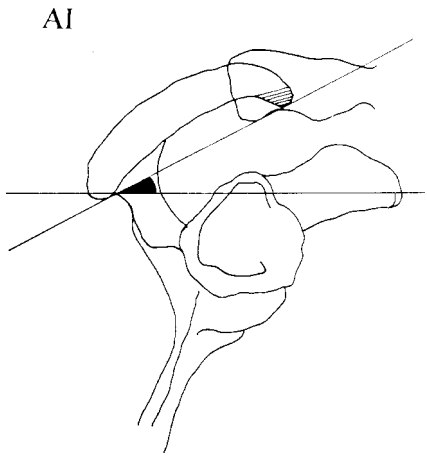


Figure 1. Acromion inclination angle (AI).

mities of the anteroinferior acromion or in the acromioclavicular arch can be seen.

Anteroposterior view. The patient stands erect, arms at the sides, so that the scapula lies flat against the radiograph cassette. The tube is angled caudally at 0 degrees, 30 degrees and, depending on the slope of the acromion-inclination angle, the individual tube angulation.

Preoperative evaluation and planning

In the scapulolateral view, the inclination of the acromion (AI) is the angle between a line from the tip of the anterior acromion to the angulus acromialis and a horizontal line (Figure 1). This AI angle determines the degrees of individual tube angulation on the anterior view radiographs. We determined the shape of the acromion with Bigliani et al.'s method (1986).

In the anteroposterior view, with individual tube angulation, we measured (in mm) the extent of proliferation of the anterior acromion aspect. The extent of bony resection at the arthroscopic procedure was based on this measurement.

Postoperative evaluation included measurement of the acromion inclination angle on scapulolateral view radiographs, and examination of anterior view radiographs with a caudall-tilted radiograph beam, as determined preoperatively.

The whole radiographic examination takes about 15 min. The measurement of the AI angle to determine the individual tube angulation was performed by a radiographic assistant or by one of the authors.

Statistics

The paired t-test was used to analyze results of acromioplasty with removal of bone spurs and the relationship between changes in the acromion inclination angle.

Results

In the 147 patients with impingement syndrome who underwent arthroscopic acromioplasty, we found intertendinous calcific deposits of the rotator cuff tendons in 45 patients (31%), and a tear of the rotator cuff in 48 (33%).

We evaluated the shape of the acromion, using Bigliani et al.'s method (1986), as flat in 8%, curved in 78% and hooked in 14% of the cases. In 35%, the AI-angle was less than 10 degrees, in 7%, more than 25 degrees, and in 58%, it ranged from 11 to 24 degrees.

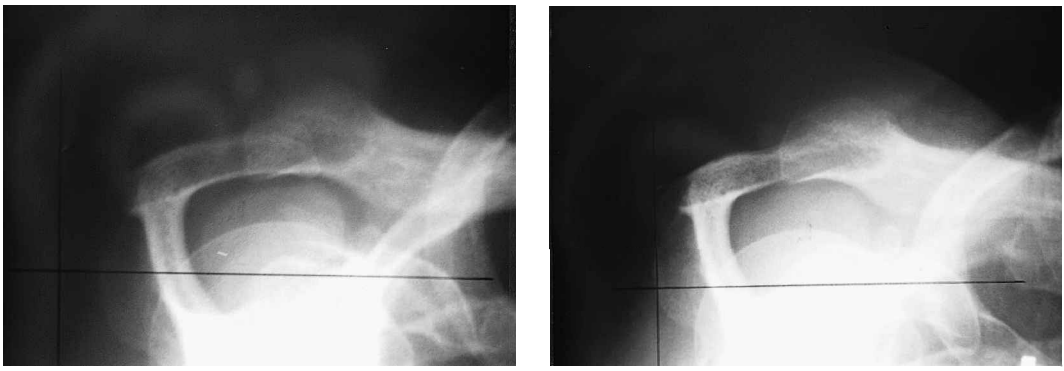
All patients had an acromion bony overhang on the anteroposterior view radiographs with individual tube angulation measuring 5.7 (3–12) mm which correlated with the intraoperative findings. Only 35% of the patients had a subacromial osteophyte or spur on radiographs with a fixed tube at 0 degrees angulation and, in 92%, we found an overexposed false impression of a spur on the 30-degree views.

The average amount of bone resected by acromioplasty was 4.8 (3–7) mm using standard arthroscopic methods. On scapulolateral and anteroposterior views postoperatively, the acromion was flat in all patients. The mean acromion inclination angle was 13 (0–34) degrees preoperatively and 20 (7–39) degrees postoperatively. The mean individual increase in the acromion inclination angle after acromioplasty was 3.4 degrees ($p = 0.0001$). There was also a relationship between the preoperative and postoperative acromion inclination angle ($r = 0.74$).

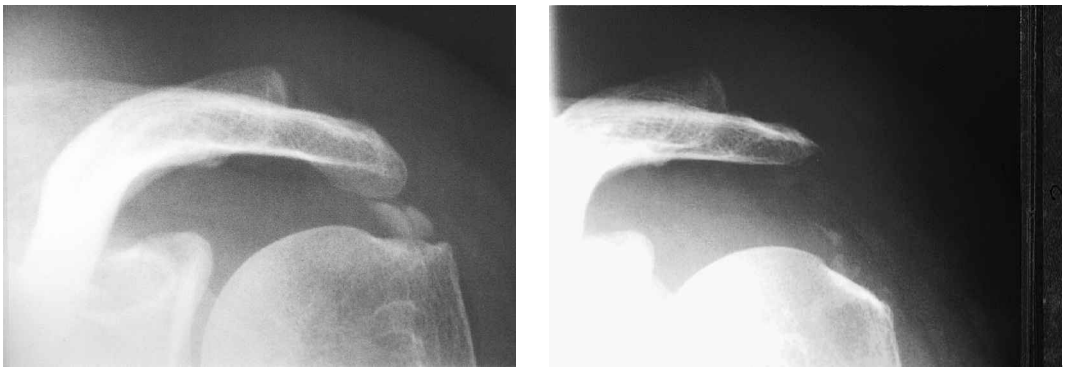
Discussion

One of the components of impingement syndrome pathophysiology concerns the anatomy of the coracoacromial arch (Neer 1983, Matsen and Arntz 1990). Apart from signs of impingement, the usual

Figure 2. A 51-year-old patient with impingement syndrome before and after acromioplasty.



Scapulolateral view: AI angle 11 degrees before and 16 degrees after surgery.



Anteroposterior view: individual tube angulation 11 degrees before and after surgery.

indications for acromioplasty include a nearly normal passive range of shoulder motion, a history of impingement pain exceeding 12 months, and failure of a 6- to 12-month rehabilitation program (Neer 1983). Poor precision of arthroscopic techniques can cause difficulties in evaluating the amount of bony overhang preoperatively and postoperatively on routine radiographic views (Sampson et al. 1991).

The presence of a subacromial osteophyte or spur is important because it may help to find patients who may benefit from surgery. Normal acromial shape and slope vary (Aoki et al. 1986, Matsen and Arntz 1990), and therefore our technique with individual tube angulation appears to be better than other techniques with fixed-tube angulation used to evaluate subacromial spur formations and/or osteophytes. Cone et al. (1984) showed that delineation of subacromial spurs can be improved by tilting the beam 30 degrees caudally. However, such views are frequently overexposed, giving a false impression of a spur. Depending on the acromial slope, this can result in projection of the acromion over the glenoid.

Our technique with individual tube angulation is a sensitive screening method for evaluating acromion morphology. We have found it useful for preoperative estimation of the amount of bone to be removed and assessment the radiographic outcome.

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