Rotational humeral osteotomy for recurrent anterior dislocation of the shoulder associated with a large Hill-Sachs lesion

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J Bone Joint Surg Am. 1984;66:1443-1450.

Rotational Humeral Osteotomy for Recurrent Anterior Dislocation of the Shoulder Associated with a Large Hill-Sachs Lesion

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ABSTRACT: **Rotational subcapital osteotomy of the humerus for recurrent anterior dislocation of the shoulder associated with a large Hill-Sachs lesion was performed first by us in 1964 as a trial. From 1967 through 1981, 207 rotational humeral osteotomies were performed. Follow-up was possible on 180 of these shoulders. The over-all redislocation rate was 5.7 per cent and the rate of non-traumatic redislocation, 1.1 per cent. Limitation of motion of more than 10 degrees was present in only 3.9 per cent, the maximum limitation of external rotation being 15 degrees in one patient. The average loss of external rotation was less than 5 degrees, without noticeable diminution of power or function in most patients. The results as graded by a standard rating scale were good to excellent in 90 per cent, fair in 3 per cent, and poor in 7 per cent of the patients.**

The fair and poor results were due to redislocation, delayed union or non-union, post-traumatic arthritis, and over-rotation at the osteotomy site. Reoperation was necessary in two patients with a non-traumatic recurrence, in six patients with delayed union or non-union, and in one patient with excessive rotation at the osteotomy site. Plate removal was performed one to two years postoperatively in 107 of the 180 shoulders. Of the 321 recurrent dislocations seen over the fourteen-year period, 65 per cent were associated with a moderate to severe posterior-superior impression fracture of the humeral head (Hill-Sachs lesion). During this time, rotational subcapital humeral osteotomy with shortening of the subscapularis tendon and capsule proved to be a mechanically sound and clinically successful operation for recurrent anterior dislocation associated with a moderate to severe defect of the humeral head.

More than 250 different types of operation have been devised for the treatment of recurrent anterior shoulder dislocation[20]. Most of the procedures in common use can be grouped into specific categories: reconstruction of the glenoid rim or labrum (Bankart and Perthes procedures)[2,3,6,28], shortening and reinforcement of the tissues in the pre-glenoid compartment (Gallie and Le Mesurier, Gerster, Magnuson, and Putti-Platt)[8,9,15,19,20,26], enlargement of the glenoid cavity or building of a block using bone grafts (Bristow, Eden, Hybbinette, Latarjet, Moseley, and Trillat)[7,12,16-18,23,33], and transfer of tendinous insertions (Connolly and Saha)[4,31]. All of these procedures can give excellent functional results.

In 1964, one of us (B. G. W.) first performed a rotational humeral osteotomy for recurrent anterior dislocation of the shoulder associated with a large Hill-Sachs lesion. The idea stemmed from the rotational osteotomy of the humerus for birth injuries of the brachial plexus, as described by Wickstrom et al.[39]. This procedure included a subcapital osteotomy of the humerus, medial rotation of the humeral head through 25 degrees, and shortening of the subscapularis tendon and capsule anteriorly. The eventual success of this trial case was judged over a three-year period, during which time no further such procedures were attempted. Subsequently, from 1967 to 1969, twenty-seven procedures were performed, and the results in these patients were first reported[34] in 1969. Later the procedure was described in several publications[5,31,32,36], and numerous follow-up studies have been reported in the German literature[10,11,22,24,34,35,37,38], but none in English.

The primary indication for this rotational osteotomy as opposed to more common soft-tissue reconstructive procedures such as Bristow, Bankart, and Putti-Platt repairs is a recurrent anterior dislocation in the young, active patient who has a moderate to severe Hill-Sachs lesion. Rowe et al.[30] defined a mild Hill-Sachs lesion as a defect 2.0 centimeters long and 0.3 centimeter deep; a moderate one, as a defect 4.0 centimeters long and 0.5 centimeter deep; and a severe lesion, as one 4.0 centimeters long and 1.0 centimeter deep. The pathological mechanism and other features of the lesion were also described by Malgaigne[21], Hermodsson[13], and Hill and Sachs[14]. The importance of this large posterior-superior defect in the humeral head in the causation of recurrent anterior dislocation of the shoulder was also discussed by Saha[31] and by Weber[34-38]. When abduction and external rotation of the arm bring the depressed irregular surface of the humeral head in contact with the anterior rim of the glenoid, anterior displacement of the humeral head occurs (Fig. 1-A).

The osteotomy of Weber provides another surgical option for the treatment of recurrent anterior dislocation of the shoulder associated with a moderate to severe Hill-Sachs lesion. This osteotomy prevents engagement of the large

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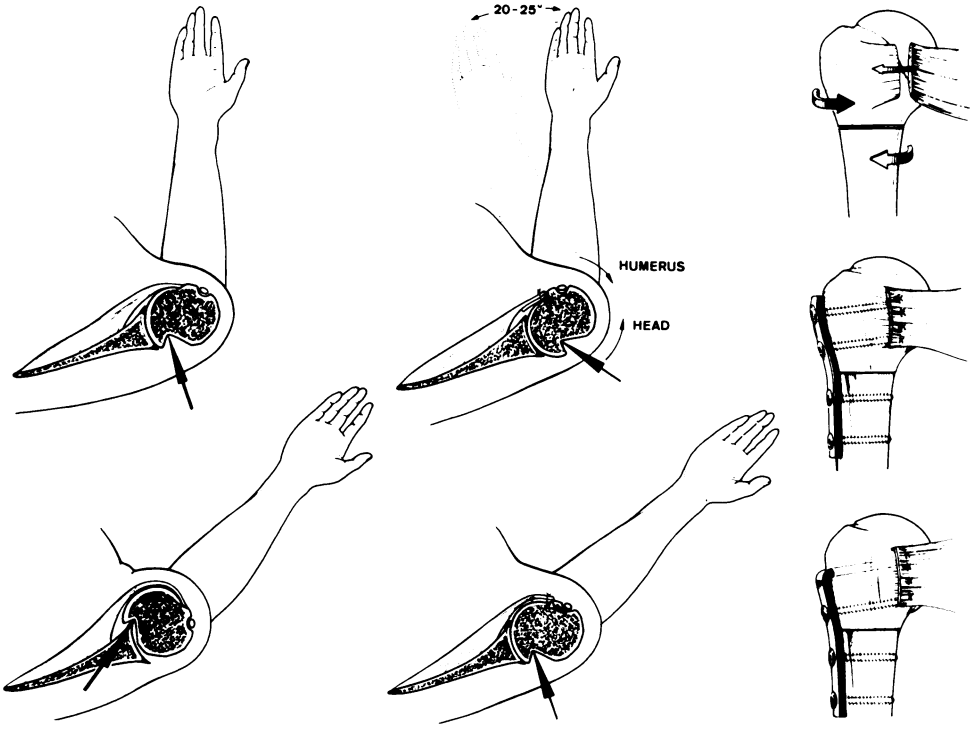

FIG. 1-A FIG. 1-B FIG. 2

Fig. 1-A: Drawings showing a posterior-superior impression fracture of the humeral head (arrow), with the arm in neutral rotation (above) and in external rotation (below). In external rotation the lesion slips over the anterior rim of the glenoid.

Fig. 1-B: After rotational osteotomy, the humeral shaft is rotated externally with respect to the humeral head, so that in neutral rotation of the shoulder (above) the humeral head defect is shifted more posteriorly. In external rotation (below) the defect can no longer slip over the anterior lip of the glenoid.

Fig. 2: Original techniques, using four-hole dynamic compression or short right-angle blade-plates.

posterior-superior humeral defect on the glenoid rim by limiting external rotation of the joint, while at the same time preserving full external rotation of the arm. Shortening of the subscapularis tendon and capsule reduces external rotation of the shoulder joint by 20 to 25 degrees, and thereby prevents dislocation. This loss of external rotation, however, is compensated for by the feedback of rotation provided by the osteotomy, which permits full external rotation of the arm without noticeably diminishing its internal rotation (Fig. 1-B).

The purpose of this paper is to bring up to date our experience with rotational osteotomy in 180 patients (including the twenty-seven reported previously[34]) during the fourteen-year period from 1967 through 1981, and to describe the surgical modifications that have been developed since the original reports.

Materials

From 1967 through 1981, 321 operations for recurrent dislocation of the shoulder were performed at our hospital. These included thirty-eight Bankart-Mueller procedures[25] for a detached labrum or lesion of the glenoid rim, thirty-seven iliac-bone grafts and twenty-eight transfers of the coracoid process for dysplasia of the glenoid, eight Putti-Platt or Magnuson procedures for attenuated or stretched soft tissues, 207 rotational osteotomies for a moderate to severe Hill-Sachs lesion, and three combined procedures that included rotational osteotomy and Bankart-Mueller repair because of concomitant Bankart and Hill-Sachs lesions. This study, however, was limited to the patients who had had a rotational osteotomy during the aforementioned fourteen-year period.

Two hundred and five patients had had 207 osteotomies (two patients had bilateral dislocation). Of these 205 patients, twenty-five were lost to follow-up and 180 were reexamined by us. Their ages ranged from fifteen to sixty-seven years (mean age, 29.5 years). The male:female ratio was 4:1, and the distribution between the right and left sides was the same. There also was no appreciable difference in the frequency of dislocation on the dominant and non-dominant sides in the left-handed and right-handed patients.

The indication for performing a rotational osteotomy in all of these patients was recurrent anterior dislocation associated with a moderate to severe Hill-Sachs lesion. This lesion was demonstrated in all 207 shoulders preoperatively by roentgenograms, and the size of the lesion was confirmed at the time of surgery.

Method

Roentgenographic Evaluation

Preoperative roentgenographic visualization of the moderate to severe posterior-superior defect in the humeral head was possible in all patients. The tangential projection of Hermodsson[13] and the projection described by Connolly[4] in which the tube is angled 30 degrees caudad with the patient supine were the most effective roentgenograms.

However, most of these large defects can be seen easily on the standard roentgenographic views.

Surgical Technique

During the first twelve years of this study, a short right-angled blade-plate or a four-hole dynamic compression plate was used for fixation of the osteotomy (Fig. 2)[10,22,35,37,38]. In 1978, however, the procedure was modified and a semitubular plate was used for fixation[34]. This modification was introduced because of cases of delayed union in the early part of the series that we thought might have been due in part to the relative stiffness of the plates being used. We therefore began to use a more elastic semitubular plate for fixation in this metaphyseal area.

For this modified technique, the approach is through a deltopectoral incision that is extended distally in an s-shaped manner for approximately four to five centimeters along the anterolateral aspect of the upper part of the arm. However, the incision is not extended distally from the deltopectoral groove until the size of the Hill-Sachs lesion is confirmed. The tendon of the subscapularis is exposed by retraction of the deltoid laterally and of the conjoined tendon medially using curved blunt retractors. The origin and insertion of the deltoid are not released; therefore, the axillary nerve is protected. With the shoulder in full external rotation, the subscapularis tendon and underlying part of the capsule are divided by a vertical incision placed one centimeter medial to the insertion of the tendon into the humerus. During the first few years of the study, the capsule was separated from the overlying subscapularis before these two structures were divided. However, dividing these two closely adherent structures was difficult, and one incision through both proved to be satisfactory. The medial cut end of the combined tendon and capsule is tagged with four absorbable sutures which are used subsequently in the repair. The glenohumeral joint is then inspected. Preoperative roentgenographic evidence of a Hill-Sachs lesion is confirmed by palpation of the posterior aspect of the humeral head. Also, after abduction-external rotation and dislocation of the shoulder one can see the impression fracture. The size of the lesion can be measured at this time. It is also interesting to visualize the slipping of the defect anteriorly over the glenoid rim as dislocation occurs.

While the joint is open, it is very important to inspect the glenoid rim and labrum for any lesions and to look for the presence of loose bodies or other joint lesions. If a significant tear of the glenoid labrum is present, it should be repaired by suturing the labrum to the anterior part of the glenoid rim[25,29,34]. It should be noted, however, that during this fourteen-year period only three of the 207 shoulders with a major Hill-Sachs lesion also had a Bankart lesion that required a combined osteotomy and Bankart repair.

Once the joint has been inspected and the presence of the Hill-Sachs impression fracture is confirmed, the humerus is exposed for the osteotomy. The tendon of the long head of the biceps should first be located along the anteromedial aspect of the humeral shaft. A vertical periosteal incision is then made *lateral* to the tendon, and blunt Hohman retractors are placed subperiosteally laterally and medially to expose the proximal part of the humeral shaft. The deltoid is retracted using the laterally placed Hohman retractor, and distal release of its insertion is not necessary. The next step is the preparation of the semitubular plate (Fig. 3). A six-hole AO-type semitubular plate is flattened with a hammer at one end so that the end and the part between the two holes nearest the end are completely flattened. The plate is then bent between the second and third holes nearest the flattened end, forming an angle of 80 to 85 degrees. The part of the plate between the third and fourth holes must also be contoured in the opposite direction to fit flush against the proximal part of the humeral shaft. This so-called cold-working of the plate is done at the time of surgery, and has not been associated with breakage of the AO plate.

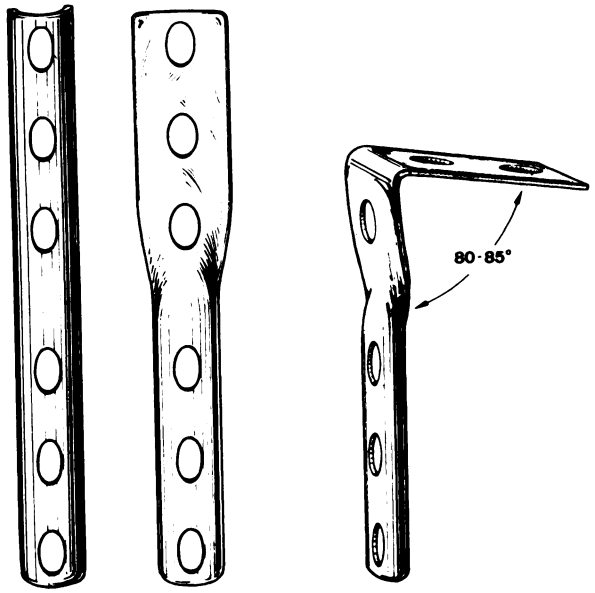

FIG. 3

Preparation of the semitubular plate (see text).

The blade portion of the plate is driven halfway into the relatively soft bone in the proximal part of the humerus, approximately 25 degrees posterior to the frontal plane, after the cortex has been penetrated with an osteotomy (Fig. 4-A). This allows room to perform the osteotomy. Two guide-pins are placed, one proximal to the plate in the humeral head and the other distal to the osteotomy and angled 25 degrees *anterior* to the proximal pin. After osteotomy, the fragments are rotated to bring the pins into the same vertical plane to ensure the correct amount of rotation (Fig. 4-B). The osteotomy site, which is between the third and fourth holes of the plate, is above the insertion of the deltoid and near the upper edge of the insertion of the pectoralis major. The Hohman retractors must be kept in position to protect the long biceps tendon medially, and the bone should be cooled by irrigation as the osteotomy cut is made with an oscillating saw.

After the osteotomy the plate is driven in the rest of the way, the head is *internally* rotated on the humeral shaft

by 20 to 25 degrees (25 degrees only with a large defect), and the previously placed guide-pins are brought into a straight vertical line. Next the plate is secured on the shaft with a bone clamp, and a cortical screw is placed through the third screw-hole into the hard cortical bone just above the osteotomy. Cortical screws are then placed in the fourth, fifth, and sixth holes of the plate, locating them distally in the holes to provide compression (Figs. 5-A and 5-B). An additional anterior two-hole semitubular plate can be used in extremely muscular patients or in athletes who must resume training as quickly as possible (Figs. 6, 7-A, and 7-B).

After the wound has been well irrigated, the medial and lateral parts of the subscapularis tendon and capsule are overlapped and sutured with the previously placed absorbable sutures, and are shortened by approximately one to two centimeters. This shortening is necessary in order to limit the external rotation of the humeral head and to compensate for the redundancy of the anterior structures that is produced by the rotational osteotomy. The wound is closed with deep

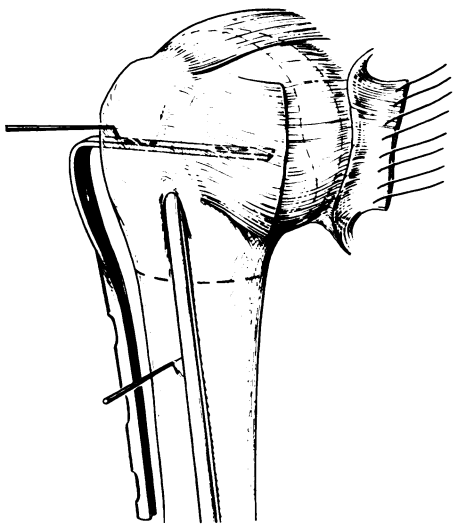

FIG. 4-A

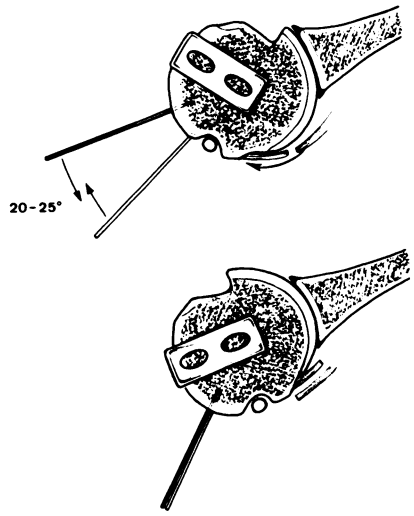

FIG. 4-B

Fig. 4-A: Tagged subscapularis tendon and capsule are reflected. The plate is driven in partially, leaving room to perform the osteotomy between the third and fourth holes. The distal guide-pin is angled 20 to 25 degrees anteriorly with respect to the proximal pin.

Fig. 4-B: Cranial-caudal view showing the proximal guide-pin angled 20 to 25 degrees posterior to the distal guide-pin (above). After osteotomy, the guide-pins are in the same vertical plane. The subscapularis tendon and capsule are overlapped, and the humeral head is rotated posteriorly to prevent engagement of the defect with the glenoid (below).

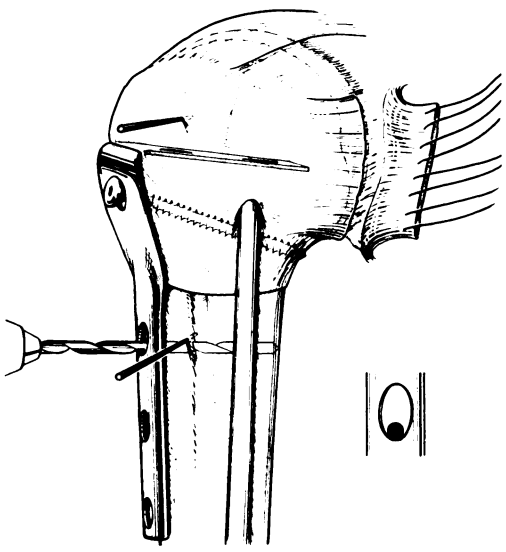

FIG. 5-A

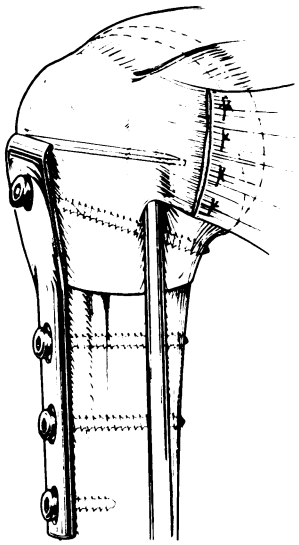

FIG. 5-B

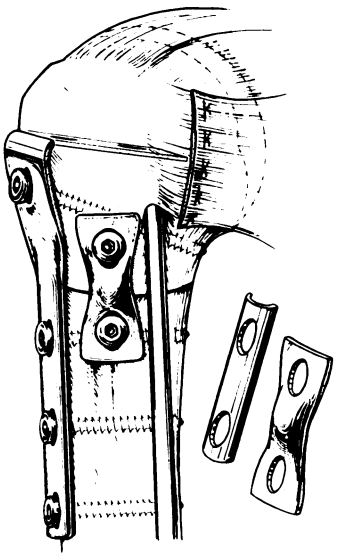

FIG. 6

Fig. 5-A: Eccentric placement of the drill-hole distally (inset) in the fourth, fifth, and sixth holes in the plate provides compression across the osteotomy.

Fig. 5-B: Completed fixation, with shortening of the subscapularis tendon and capsule.

Fig. 6: A two-hole semitubular plate, flattened on both ends (inset), is applied anteriorly, with the screws directed away from those placed previously.

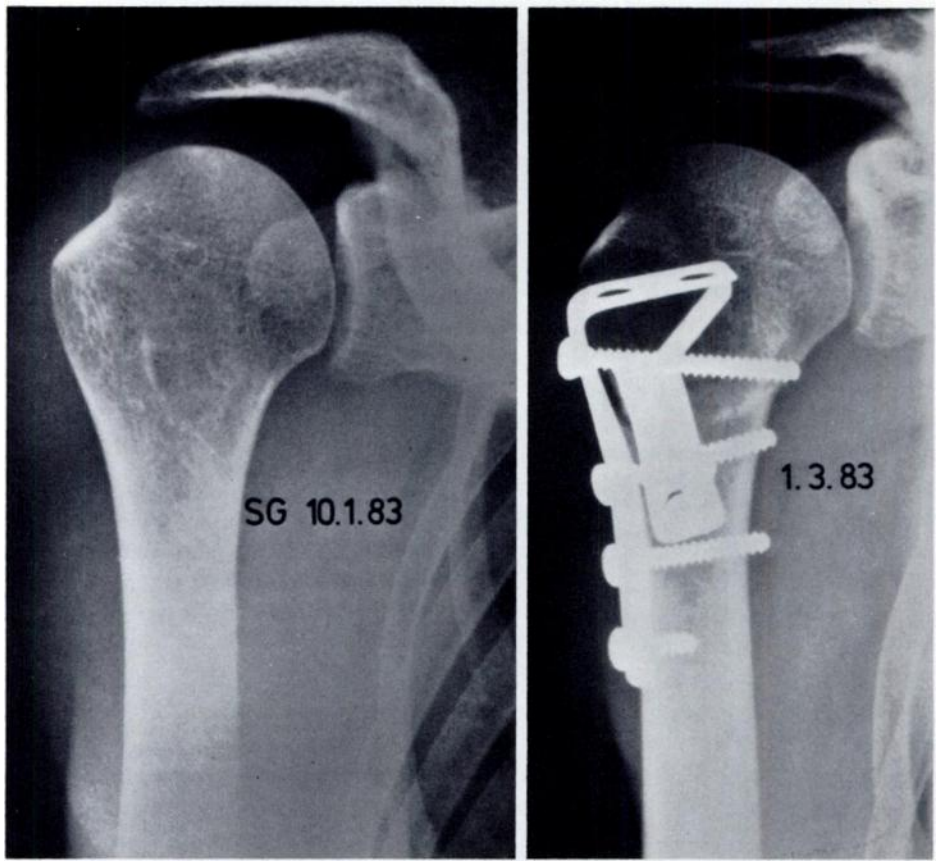

FIG. 7-A FIG. 7-B

Fig. 7-A: Anteroposterior roentgenogram demonstrating an impression fracture of the humeral head in a twenty-five-year-old man who was active professionally in ski acrobatics.

Fig. 7-B: Fixation was accomplished using a standard six-hole semitubular plate and an additional anterior two-hole semitubular plate.

and superficial drains in place.

The average duration of surgery was one and one-half hours.

Postoperative Care

Aftercare is very simple: a sling is used for three to four days, and then is discontinued when active motion is begun. Full activity and exercise against resistance may be anticipated after six to eight weeks, depending on the extent of the healing of the osteotomy. Full sports activities, including throwing games and tennis, can be resumed twelve to sixteen weeks after the operation.

Results

The subjective assessment was based on an interview of the patient and a questionnaire, with special attention being paid to the patient's opinion of the surgery, the extent of the patient's return to activities and sports, limitations of motion, loss of strength, pain, stability, and the patient's grading of the function of the involved shoulder. The objective assessment included a comparison of the motion of the two shoulders, manual testing of strength, the findings by the apprehension test done with the arm abducted and externally rotated, and the presence of muscle atrophy or other complications. The length of follow-up ranged from twenty-five months to thirteen years (average, eight years).

For the roentgenographic assessment, true anteroposterior, lateral, and axillary roentgenograms were made. We evaluated osseous union of the osteotomy, evidence of late degenerative changes in the glenohumeral joint or of myositis ossificans, and breakage or loosening of the implants.

The over-all results were graded as excellent, good, fair, or poor using the rating scale described by Rowe et al.[29] for the results of the Bankart procedure. In this 100-point scoring system, 50 points are given for stability; 30, for function; and 20, for motion. Of the 180 shoulders, 129 (71 per cent) were graded excellent; thirty-four (19 per cent), good; five (3 per cent), fair; and twelve (7 per cent), poor.

There were ten recurrences in this series, an incidence of 5.7 per cent. In two of these shoulders, redislocation occurred without significant trauma (a 1.1 per cent rate of non-traumatic redislocation). One of these patients who had had multidirectional dislocations continued to have posterior dislocations. The other had had recurrent anterior dislocations which at reoperation were found to be due to a large detachment of the labrum. Both patients did well after reoperation: a posterior bone graft in the first and a Bankart repair in the second. The other eight recurrences were caused by significant trauma: three motorcycle accidents, one fall while rock-climbing, two automobile accidents, and two downhill-skiing injuries. Whether the repeat dislocations in these shoulders were due to a fault of the previous operative

reconstructions or to the degree of trauma was impossible to determine. Seven of these eight patients did well without further recurrence after conservative therapy. The other patient continued to have recurrences, but refused further operative intervention.

A decreased range of motion with a loss of more than 10 degrees of external rotation or abduction, or both, was found in seven (3.9 per cent) of these patients. The maximum loss of glenohumeral abduction was 20 degrees, in two patients, and the maximum loss of external rotation was 15 degrees, in one patient. The average loss was less than 5 degrees. Two of these seven patients had roentgenographic evidence of post-traumatic arthritis.

One patient had too much internal rotation of the proximal fragment (40 to 50 degrees), with a resultant loss of internal rotation of the shoulder. A secondary corrective osteosynthesis was required to restore full motion to this shoulder. All of the other patients had no significant loss of internal rotation (less than 5 degrees).

Review of the roentgenograms made at follow-up revealed post-traumatic arthritic changes in two shoulders, as already noted; no cases of myositis ossificans; no breakage or loosening of the implants; and six cases of delayed union or non-union.

Four patients had a postoperative hematoma requiring drainage, two patients required manipulation under anesthesia during the early postoperative course to regain motion, and one had a superficial infection with *Staphylococcus albus* that was treated successfully with intravenous antibiotics. Six patients in the early part of the series who had been treated with a dynamic compression plate or blade-plate had a delayed union or non-union. Four of them had repeat fixation using a right-angle blade-plate, and two had fixation with the modified semitubular plate. All healed after repeat osteosynthesis without bone grafts.

Eighty-seven of the 180 patients were actively involved in athletics before they began to have recurrent dislocations of the shoulder. Seventy-three had participated in amateur sports, which included rock-climbing, slalom snow-skiing, handball (a throwing sport, different from American handball), gymnastics, tennis, and squash. The other fourteen patients had been active in professional sports, including hockey, freestyle ski acrobatics, rock-climbing (guide), and tennis. Two of the previously mentioned recurrences after trauma occurred in this group of eighty-seven athletes. One amateur rock-climber had a severe fall and a repeat anterior dislocation, which was treated conservatively and did not recur. One downhill skier had a recurrence after a ski accident; this was also treated successfully by conservative therapy. All of the other amateur athletes and all of the professional athletes returned to their former levels of athletic endeavor. Although a relatively low percentage of these athletes participated in throwing sports, the other sports mentioned required stability and power of the involved shoulder. We made no objective measurements of the strength of these shoulders but did make a gross assessment of muscle power and noted whether the patient had returned to previous activities and sports.

We recommend that all patients who are less than fifty years old have the implant removed one to two years postoperatively, and this was done in 107 of the 180 shoulders. It required only limited exposure of the humeral shaft, without opening the joint.

Discussion

The incidence of a significant Malgaigne Hill-Sachs impression fracture of the humeral head was 65 per cent in the 321 shoulders with recurrent anterior dislocation that were operated on from 1967 to 1981. This incidence is comparable to the over-all incidences in other series[4,29]. The lesion was demonstrated preoperatively in all of the shoulders in our series, using the roentgenographic techniques previously mentioned.

In the 1978 series of Rowe et al.[29], the Hill-Sachs defect was found in 77 per cent of the shoulders and was mild in 27 per cent, moderately severe in 58 per cent, and severe in 15 per cent. After Bankart repair, the patients with a mild defect had 100 per cent good to excellent results with no recurrences; those with a moderately severe defect, 95 per cent good to excellent and 5 per cent poor results (including three recurrences); and those with a severe defect, 94 per cent good to excellent and 6 per cent poor results, with one recurrence. There was a 5 per cent incidence of recurrence in the eighty shoulders with a sizable Hill-Sachs lesion, whereas the entire series of 145 shoulders was found to have a recurrence rate of 3.5 per cent. This difference was considered acceptable by the authors. In 1984, Rowe et al.[30] concluded that "a Hill-Sachs lesion of the humeral head may play a role in the development of recurrent dislocation after surgical repair". This lesion was found in 76 per cent of the shoulders that they reoperated on.

The surgical procedures that have been suggested for the treatment of an unstable shoulder with a severe Hill-Sachs lesion include: a bone graft for the anterior part of the glenoid rim[27], transplantation of the infraspinatus tendon into the head defect[4,30], humeral osteotomy[31,34-38], and massive tightening of the structures in the anterior compartment of the shoulder so that sufficient external rotation is lost to prevent the defect from coming into contact with the glenoid rim[1,26,31,34,38].

Transfer of the infraspinatus tendon into the defect has been used by Connolly[4] in the treatment of patients with large defects of the humeral head. He reported on fifteen patients treated by this procedure, with satisfactory results in all but one. The chief indication was an unstable shoulder with a large defect associated with conditions such as a seizure disorder or chronic locked anterior dislocation.

The determination of the essential lesion in any patient with recurrent anterior dislocation of the shoulder is complex. In nearly all traumatic dislocations, excluding the few patients with congenital dysplasia of the glenoid[5,31], either a Bankart lesion or a Hill-Sachs lesion is the primary reason for the recurrent dislocation[29,38]. In a few shoulders an attenuated or atrophic muscle-tendon mantle or capsule may

be present in the absence of the Hill-Sachs and Bankart lesions. If preoperative roentgenograms show a significant Hill-Sachs lesion, we begin the operation with the intention of performing a humeral osteotomy. However, the full incision is not made until the joint has been opened and the size of the defect is confirmed by exposure. Also, at this time the surgeon can determine if a significant Bankart lesion is present. It is of interest that only three of the 321 shoulders operated on at our hospital had concomitant major Hill-Sachs and Bankart lesions that required combined repair (all three had excellent results but are not included in this series). The importance of the accompanying Bankart lesion was illustrated by the case of the patient with a non-traumatic recurrence who had a previously missed major labral lesion.

The technique described really combines two operations for recurrent anterior dislocation: shortening of the subscapularis and capsule, and rotational osteotomy of the humerus. The shortening of the capsule and subscapularis is necessary to maintain the humeral head in relative internal rotation and to reduce the redundancy of the tissues after rotational osteotomy. Scarring of the capsule and of the subscapularis does occur to some extent, but this has not been a problem with respect to loss of motion of the shoulder or ability to return to sports activity for our patients, since the external rotation of the distal fragment of the humerus compensates for the anterior shortening.

The procedure has certain disadvantages that must be noted. The incision that is required is longer than the incisions that are used for most standard soft-tissue repairs, and a second operation to remove the implants is recommended for all patients who are less than fifty years old. Complications including malrotation, postoperative hematoma, and delayed union or non-union can develop, as was the case early in our series. However, after the new surgical techniques were developed and we gained more experience, the complication rate dropped to less than 2 per cent during the last three years of the study.

This procedure is offered as an option for young, active patients who have recurrent anterior dislocation of the shoulder combined with a moderately severe or severe Hill-Sachs lesion. It has proved to be a mechanically sound and clinically successful operation in properly selected patients.

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Roentgenographic Demonstration of Instability of the Shoulder: The Apical Oblique Projection

A TECHNICAL NOTE

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It often is difficult to prove, roentgenographically, that a shoulder is unstable. For this purpose, the apical oblique roentgenogram that we are describing is effective. It utilizes positioning that has not been reported on previously and provides a coronal profile of the glenohumeral joint. When present, intra-articular fractures, as well as dislocation or instability, are demonstrable. We reviewed the roentgenograms of thirty consecutive patients who had a clinical diagnosis of instability of the glenohumeral joint. The review revealed several advantages to the method. The Hill-Sachs lesion was revealed in many shoulders with anterior dislocation, and significant fractures of the glenoid margin were also documented.

Technique

Ordinarily the patient is seated upright, but if that position is inadvisable the roentgenogram may be made in the supine position. The cassette is held vertical if the patient is seated and horizontal if he or she is supine. The chest is placed in the 45-degree posterior oblique position relative to the x-ray tube, the uninjured shoulder being rotated away from the cassette (Fig. 1). The injured shoulder is steadied in a comfortable position and may be immobilized with a sling. The central x-ray beam is directed not only at an angle of 45 degrees to the coronal plane[2] but also 45 degrees caudally[3]. A coronal roentgenogram of the glenohumeral joint is thus made (Fig. 1). Because of the 45-degree oblique position of the chest relative to the film, the x-rays pass tangential to the articular surface of the glenohumeral joint and to the posterolateral aspect of the humeral head. The base of the coracoid process arising from the superior neck of the scapula appears as a ring, just medial to the glenoid and midway between the anterior and posterior margins of the glenoid. The ring serves as a reference point.

Observations

We reviewed the cases of thirty consecutive patients with a clinical diagnosis of instability of the glenohumeral joint. One of the patients had long-standing severe limitation of external rotation. The roentgenographic study confirmed that there was an occult posterior subluxation. While the standard anteroposterior roentgenogram revealed proximal migration of the humeral head (Fig. 2-A), the standard axillary lateral roentgenogram failed to show that there was a subluxation because a reduction occurred each time the extremity was abducted (Fig. 2-B). The posterior subluxation was only demonstrable when a coronal roentgenogram of the resting adducted shoulder was made with the apical oblique technique (Fig. 2-C). The other twenty-nine patients had either an anterior dislocation or an anterior subluxation. Thirteen of them had an acute lesion while sixteen had a recurrent lesion. Eighteen of the twenty-nine patients had apical oblique roentgenograms made with the shoulder dislocated and with it reduced. In three patients with an acute injury the apical oblique roentgenograms were made at the time of the acute dislocation but apical oblique roentgenograms were not made after reduction. Eight of the patients with a history indicative of recurrent anterior instability had no documented dislocation.

In twenty-five of the twenty-nine patients, the apical oblique roentgenograms showed a cross-sectional projection of the lesion in the posterolateral sector of the humeral head

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