

The Bankart repair illustrated in cross-section

Some anatomical considerations

RALPH B. BLASIER,*† MD, JAMES D. BRUCKNER,‡ LT, MC, USNR,
DAVID H. JANDA,* MD, AND A. HERBERT ALEXANDER,‡ CAPT, MC, USN

*From the *University of Michigan Medical Center, Ann Arbor, Michigan, and the ‡Department of Orthopaedic Surgery, Naval Hospital, Oakland, California*

ABSTRACT

The Bankart repair for chronic anterior shoulder instability effectively addresses the pathologic components responsible for repeated dislocation or subluxation. However, contrary to popular belief, the Bankart repair does not precisely restore the premorbid anatomy. The capsule is reattached to the bony rim of the antero-inferior glenoid deep to and lateral to the torn cartilagenous labrum, thus excluding the labrum from the joint anteriorly. This was demonstrated by cross-sectional cadaver dissections performed to illustrate this complex surgical anatomy to orthopaedic residents in training. In addition, when correlated with double-contrast computerized axial tomography, we noted five predominant patterns of anatomical lesions which by common use have been collectively termed the "Bankart lesion." These are: 1) the rare "classic" Bankart lesion in which the cartilagenous labrum and capsular origin are torn from the glenoid rim; 2) the capsule stripped from the scapular neck and the labrum detached from the glenoid rim remaining fixed to the overlying capsule; 3) the capsule stripped from the scapular neck and the labrum separated from the glenoid rim, but separately; 4) the labrum abraded away and no longer radiographically detectable; and 5) glenoid rim fracture.

The Bankart repair is very effective for the treatment of chronic, traumatic-onset, anterior or antero-inferior shoulder

instability.^{2,7} Many surgeons have settled on the Bankart repair or subtle modifications of the Bankart repair as their surgical treatment of choice for routine cases of anterior instability. Most descriptions of the Bankart repair are careful to state that it is a technically difficult and demanding procedure.⁶ The authors have encountered difficulty in teaching this procedure (exactly as popularized by Rowe^{4,7}) to resident orthopaedic surgeons because of the complex anatomy involved and the limited operative exposure. Because ordinary teaching methods failed to achieve our educational goals, the authors embarked on a series of cross-sectional cadaver dissections and correlative double-contrast computerized tomograms to illustrate the components of the Bankart lesion and the anatomical features of the repair.

ANATOMICAL CONSIDERATIONS

Computerized tomography

Many lesions are associated with shoulder instability. Specifically we are here addressing the anterior labral and capsular lesions most often associated with chronic, traumatic-onset, anterior or antero-inferior shoulder instability. Excluded from this discussion is instability associated with psychiatric disturbances, collagen disorders such as the Ehlers-Danlos syndrome, generalized joint laxity, glenoid hypoplasia, subscapularis rupture, and instability based on fractures such as greater tuberosity avulsions or the posterior humeral head impression fracture.

Excluding these other associated lesions, there remain a number of patterns of injuries to the bony glenoid rim, the cartilagenous glenoid labrum, and the anterior joint capsule which are associated with and lead to anterior and antero-inferior instability of the shoulder. In order to define the precise pathologic lesions present in our patients, our pre-

*† Address correspondence and reprint requests to: Ralph B. Blasier, MD, University of Michigan Medical Center, 1500 East Medical Center Drive, Ann Arbor, MI 48109-0328.

The opinions or assertions expressed herein are those of the authors and are not to be construed as official or as necessarily reflecting the views of the Department of the Navy or of the naval service at large.



Figure 1. A normal double-contrast computerized tomogram. The bony glenoid and the humeral head are well seen. A thin film of contrast coats and outlines the cartilagenous structures. The joint is distended with air. The triangular cross-section of the normal glenoid labral cartilage is clear (black arrowhead). The capsule (white arrow) and its attachment to the scapular neck is obvious. The subscapularis muscle can be seen, but details are not apparent.



Figure 3. The capsule stripped off the lateral scapular neck (white open arrow) "together" with the cartilagenous labrum which is off the bony glenoid (white arrowhead). The capsule (white open arrow) is not completely disrupted and maintains some capsular/periosteal connection, although much more medial than normal.



Figure 2. A classic Bankart lesion. The cartilagenous labrum is clearly seen to be separated from the bony glenoid rim (white arrowhead). The capsule remains attached to the labrum and is no longer attached to the scapular neck (white open arrow).



Figure 4. The capsule stripped from the scapular neck (white open arrow) and the labrum torn off the glenoid (black arrowhead), but separately. This is the pattern we see most commonly.

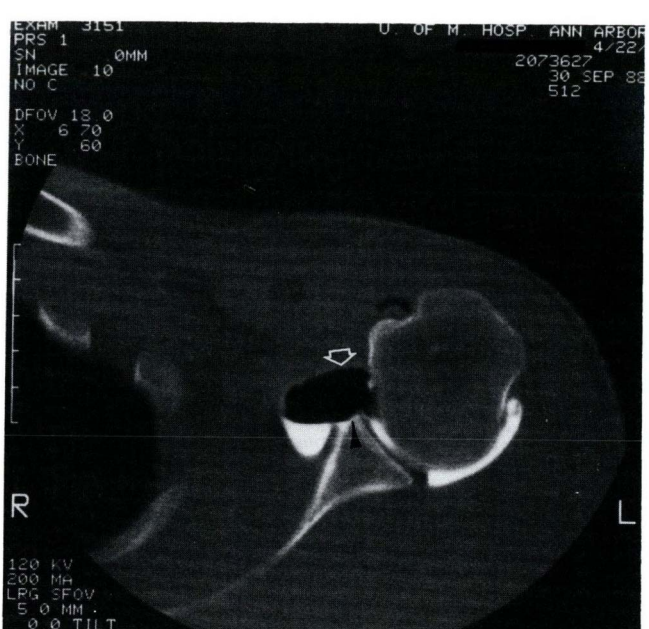


Figure 5. The anteroinferior labrum has been abraded away (black arrowhead). The capsule (white open arrow) is not completely disrupted and maintains some capsular/periosteal connection.

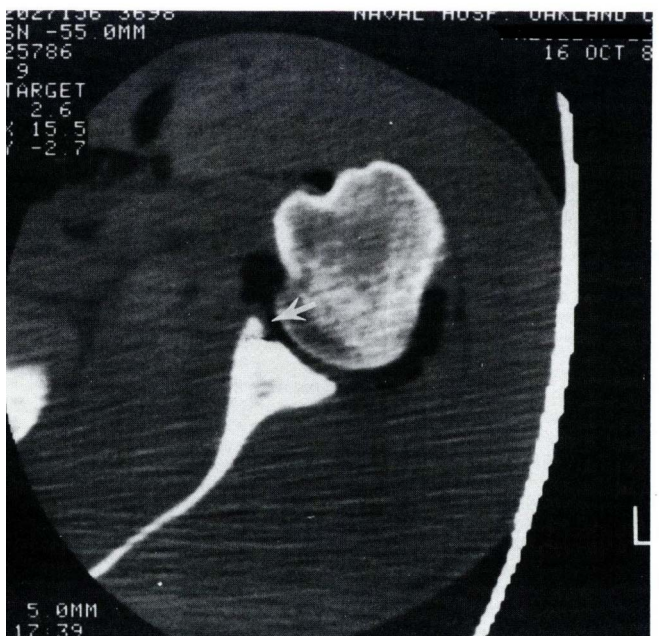


Figure 6. Bony deformity from a malunited glenoid rim fracture. The bony rim is displaced 3 to 4 mm medial to its anatomical position (white arrow), and this loss of bony support allowed the dislocations.

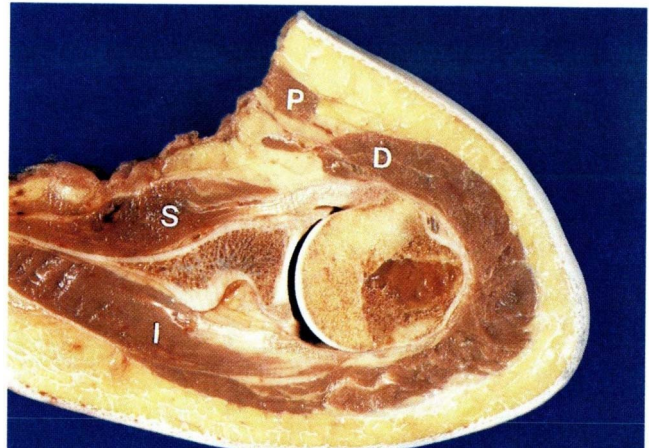


Figure 7. A transverse section from a fresh cadaver, just inferior to the equator of the humeral head in its normal state. The major muscles are labeled for orientation: pectoralis (P); deltoid (D); subscapularis (S); and infraspinatus (I). The bony glenoid and the humeral head are well seen. The triangular cross-section of the normal glenoid labral cartilage is clear. The capsule and its attachment to the scapular neck is well seen.

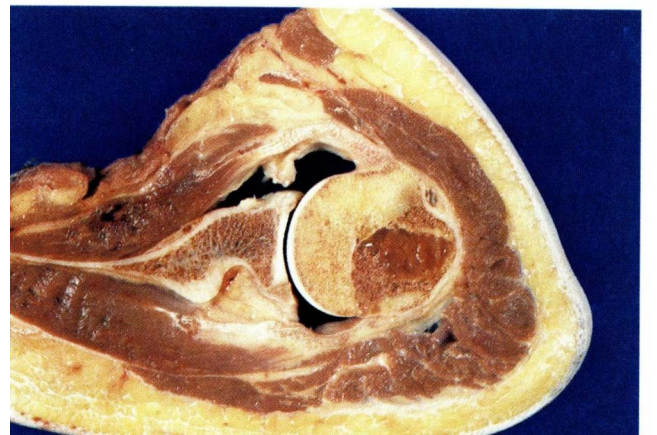


Figure 8. An artificially created "Bankart lesion" similar to that shown by computerized tomography in Figure 3. The labrum is separated from the glenoid, and the capsule is stripped from the scapular neck.

operative assessment includes double-contrast computerized tomography or occasionally arthroscopy. In many of our patients, this results in a decision to repair injured anterior structures by the Bankart procedure. In some cases in which the instability is found to be due to bony glenoid rim insufficiency or posterior humeral head impression fracture, another operation may be selected. In a few cases, however, no surgically repairable lesion is found. For these patients,

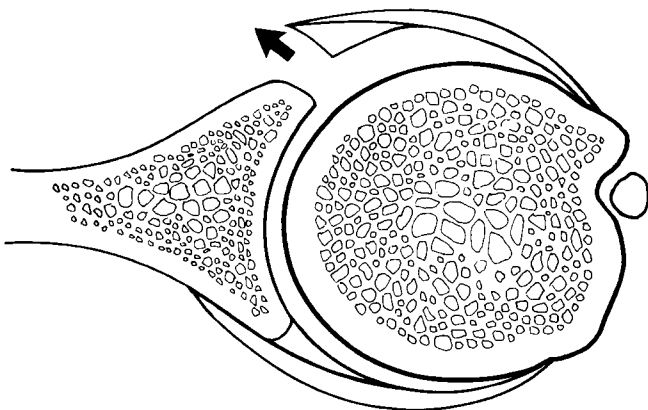


Figure 9. Diagram of a cross-section of the capsule and labrum separated from glenoid rim. A popular misconception is that the dislocation occurs in the interval between the labrum and the rim (arrow).

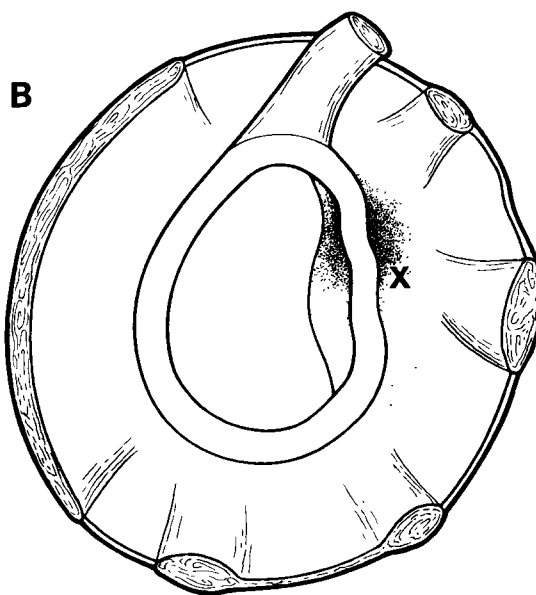
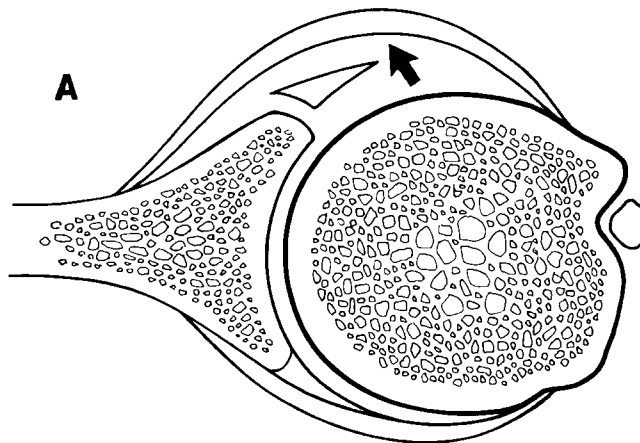


Figure 11. A, diagram of cross-section of capsule and labrum separated from glenoid rim showing labrum pushed medially and dislocation occurring over the labrum and into the overlying capsule. B, diagram looking into the shoulder socket as if from the humeral head showing where the dislocation occurs over the injured labrum and into the capsule.

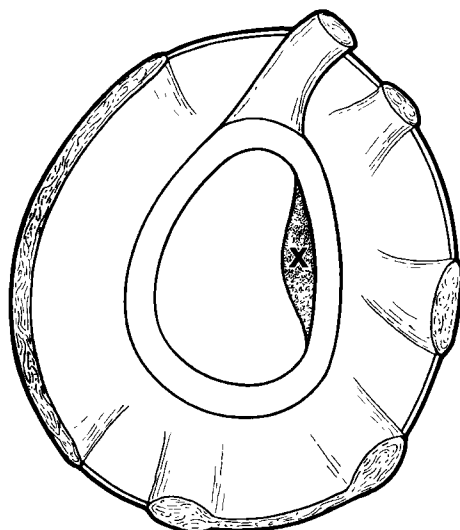


Figure 10. Diagram looking into the shoulder socket as if from the humeral head, showing labrum separated from the rim. Unless there are radial tears in the labrum (and there usually are not), there is not enough room for the dislocation to occur between the labrum and rim ("X").

surgery is delayed while more physical therapy is offered and further observation for psychiatric disturbance or generalized joint laxity is carried out by the surgeon. The physical therapy offered is a combination of internal shoulder rotator strengthening and "provocative" training in which the patient is taught the limits of his stable range of motion.¹

The computerized tomograms have shown several patterns of anterior anatomical lesions, some of which will be illustrated here. The first double-contrast computerized axial tomogram discussed here is from a patient with shoulder pain not based on any anatomical lesion. A representative section from her normal double-contrast computerized tomogram is shown as Figure 1. The boney glenoid and the

humeral head are well seen. A thin film of contrast coats and outlines the cartilagenous structures. The joint is distended with air. The triangular cross-section of the normal glenoid labral cartilage is clear. The capsule and its attachment to the scapular neck is easily seen. The subscapularis muscle can be seen, but not in detail.

The second patient was a previously well female in her late 20s who had her arm forcibly abducted and externally rotated in a minor boating accident. She never had any frank dislocation, but was severely troubled by frequent anteroinferior subluxation. Her double-contrast computerized tomogram (Fig. 2) shows a classic Bankart lesion as described in Bankart's second paper on the subject.² We do

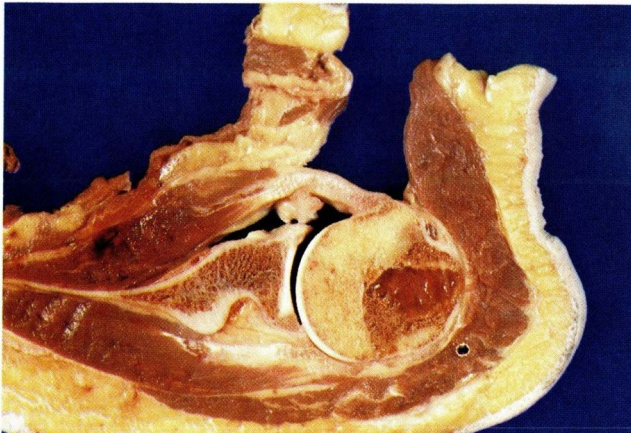


Figure 12. The deltopectoral interval has been opened. The cephalic vein has been taken medially.



Figure 14. Medially, the division between the subscapularis tendon and muscle is clear and blunt dissection suffices.



Figure 13. The development of the plane between the subscapularis tendon and muscle and the underlying capsule. In the lateral 2 cm, the tendon and capsule are confluent and the separation is done sharply.

not see this pattern very often. The cartilagenous labrum is clearly seen to be separated from the boney glenoid rim. The capsule remains attached to the labrum and is no longer attached to the glenoid rim or scapular neck.

The third patient was similarly troubled more by frequent subluxation than frank dislocation. His double-contrast computerized tomogram (Fig. 3) shows the capsule stripped off the lateral scapular neck in tight association with the cartilagenous labrum which is off the boney glenoid rim. The capsule is not completely disrupted and maintains a capsular/periosteal connection, although much more medial than normal. When we do see this pattern, it is commonly in a patient whose problem is chronic subluxation rather than frank dislocation.

The fourth patient had recurring dislocations after an

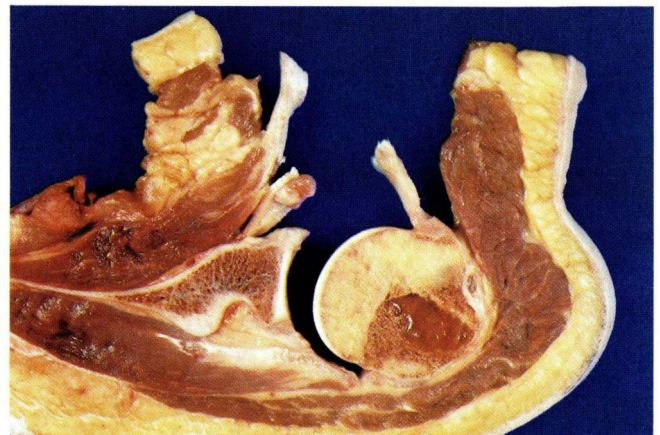


Figure 15. The capsulotomy. The capsule is opened vertically 4 to 8 mm lateral to and parallel to the glenoid rim.

initial traumatic event. His double-contrast computerized tomogram (Fig. 4) shows the capsule stripped from the scapular neck and the labrum torn off the glenoid, but separately. This is the lesion we see most often in "typical" traumatic-onset, chronic anterior dislocation.

The fifth patient under discussion had recurring dislocations, neglected for a prolonged period. His anteroinferior labrum has been abraded away (Fig. 5). This is also a pattern we see commonly on double-contrast computerized tomography.

The last example patient was a healthy young Marine who sustained an anteroinferior glenoid rim fracture from a moderately severe injury. The fracture united promptly, but the patient had frequent subluxations and occasional dislocations. Due to a "dye" allergy, this patient had a single-contrast (air) computerized tomogram (Fig. 6). It can be seen that his rim fracture is united 3 to 4 mm medial to its

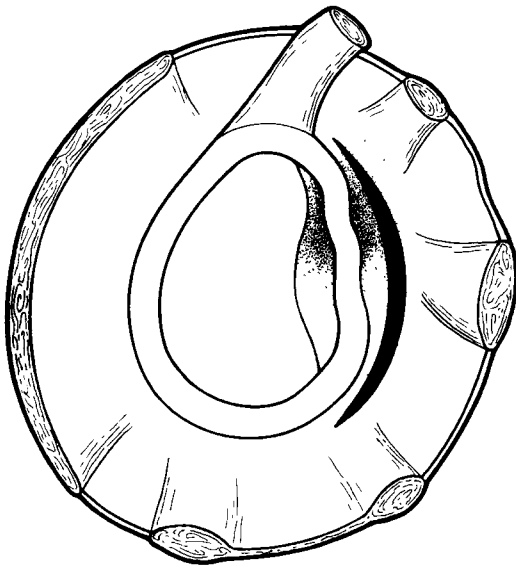


Figure 16. The same capsulotomy diagrammed as if looking into the glenoid cavity.

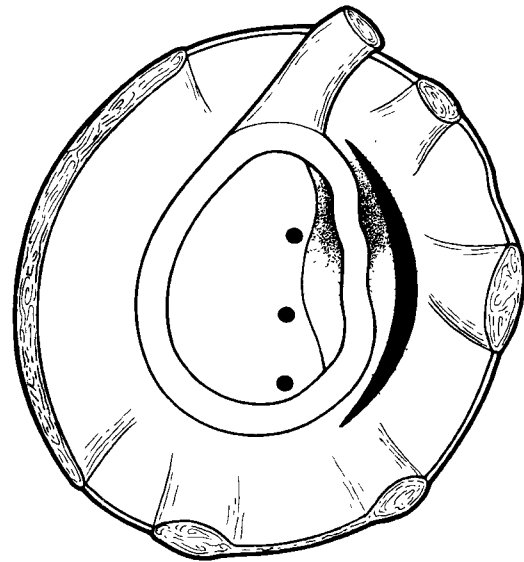


Figure 18. Treating this view into the glenoid cavity as the face of a clock, the suture fixation holes are seen at 2, 4, and 6 o'clock. For patients in which inferior instability is especially prominent, the inferior hole may be carried around posteriorly toward 7 o'clock.



Figure 17. The needle demonstrates the location of the suture holes placed in the glenoid rim.

anatomical position, and this loss of bony support allowed the chronic instability.

Cross-sections

For the cross-sectional demonstration of the anatomical details of the Bankart repair, a 6 mm thick section was taken from a fresh cadaver, just inferior to the equator of the humeral head. Figure 7 shows the section in its normal state. The bony glenoid and the humeral head are well seen. The triangular cross-section of the normal glenoid labral cartilage is clear. The capsule and its attachment to the scapular neck is obvious.

Figure 8 shows an artificially created "Bankart lesion" similar to that shown by computerized tomography in Figure 3. In this case, the labrum is separated from the glenoid,

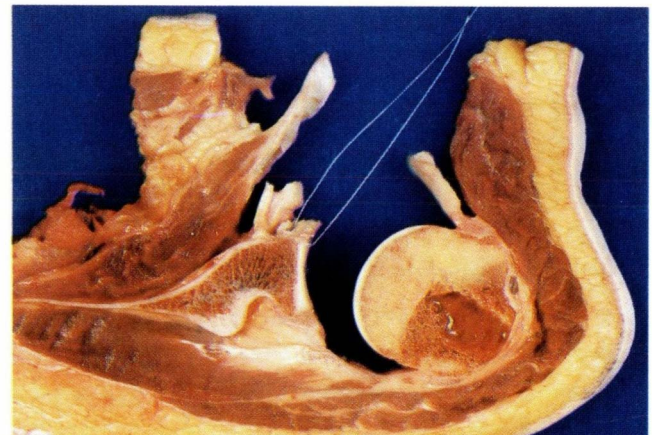


Figure 19. Sutures are placed through the holes in the rim to effect the repair.

and the capsule is stripped from the scapular neck, but the two are left in close association.

A popular misconception is that the dislocation occurs in the interval between the labrum and the rim (Fig. 9). Unless there are radial tears in the labrum, there is not enough room for the dislocation to occur between the labrum and rim (Fig. 10). During the dislocation, the labrum is pushed medially and the humeral head moves over the labrum and into the overly capacious capsule (Fig. 11).

SURGICAL PROCEDURE

To begin the Bankart repair, the deltopectoral interval is developed (Fig. 12). In this case, the cephalic vein has been

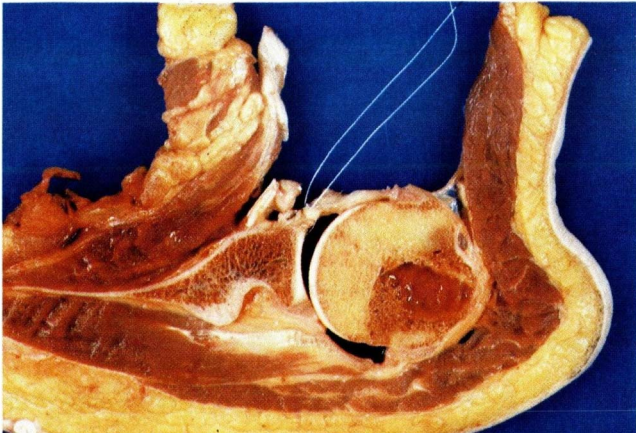


Figure 20. The medial edge of the lateral capsular flap is sutured to the glenoid rim, which has been roughened with an osteotome.

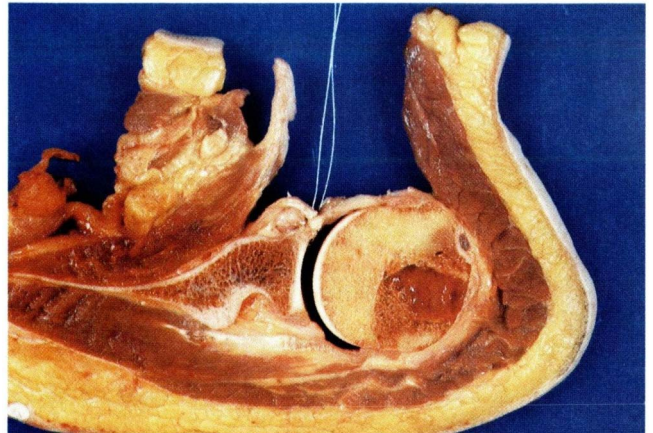


Figure 22. The lateral edge of the medial capsule is tied into the same suture line to provide reinforcement. The cartilaginous labrum is incorporated providing an enhanced soft tissue buttress against anterior translation of the humeral head.

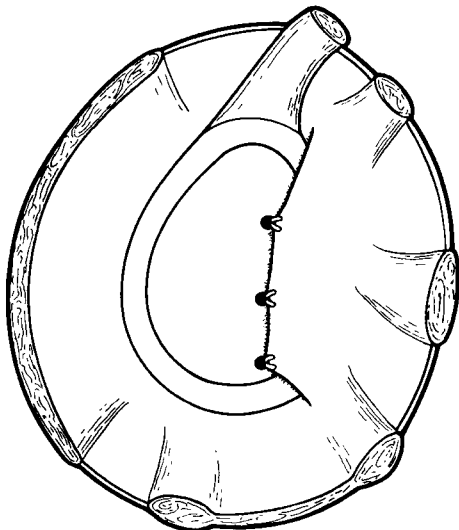


Figure 21. Looking into the shoulder socket showing the medial edge of the lateral capsular flap being secured to the holes in the glenoid rim deep to and lateral to the cartilaginous labrum. The labrum is thus excluded from the anteroinferior aspect of the joint. This routine feature of the Bankart repair has not been emphasized in the past.

mobilized medially as popularized by Henry,³ but it can be just as easily taken laterally if the surgeon prefers. The plane between the subscapularis tendon and muscle and the underlying capsule is then developed. In the lateral 2 cm, the tendon and capsule are confluent and the separation is done sharply (Fig. 13). Medially, the division is clear and blunt dissection suffices (Fig. 14). With the arm in external rotation, the glenoid rim is palpated through the intact capsule. The capsule is then opened vertically 4 to 8 mm lateral to and parallel to the rim (Fig. 15). This is shown as if looking into the glenoid cavity in Figure 16.



Figure 23. The subscapularis insertion is repaired anatomically, without shortening or overlap.

Holes are placed in the glenoid rim, usually at about the 2, 4, and 6 o'clock positions (for a right shoulder) and perhaps even further around toward 7 o'clock for patients in which inferior instability is prominent (Figs. 17 and 18). The sutures that will effect the repair are threaded through these holes (Fig. 19). The medial edge of the lateral capsular flap is sutured to the glenoid rim, which has been roughened with an osteotome (Fig. 20). This is quite straightforward in situations such as those illustrated here in which the labrum is torn from the glenoid rim, and is easily understood in cases in which the labrum has been abraded away. For cases in which the capsule is lax but the labrum is uninjured, Rowe and Zarins⁵ have developed a modification of the Bankart repair in which the medial edge of the lateral

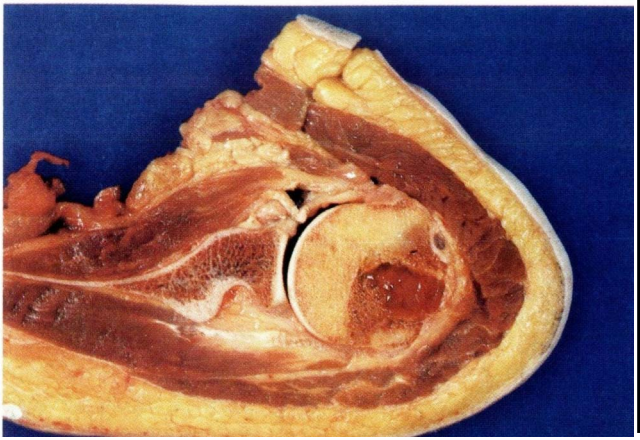


Figure 24. The final result. The repair attaches the fibrous capsule directly to bone without intervening cartilage. The cartilagenous labrum has been converted to an extraarticular structure in the anterior and anteroinferior aspects of the joint.

capsular flap is brought down to the glenoid rim by sutures through the labrum rather than by sutures through bone. The medial edge of the lateral capsular flap ends up deep to and lateral to the cartilagenous labrum as in the standard Bankart repair.

Figure 21 diagrams the medial edge of the lateral capsule being sutured to the boney glenoid rim deep to and lateral to the labral remnant. The resulting extracapsular position of the labral remnant (unless it has been abraded away) is a necessary feature of the standard Bankart repair, which is rarely described.

The lateral edge of the medial capsule is tied into the same suture line to provide reinforcement (Fig. 22). The cartilagenous labrum is thus incorporated into the repair,

further adding strength by providing an enhanced soft-tissue buttress against anterior translation of the humeral head. The subscapularis insertion is repaired anatomically (Fig. 23). The deltopectoral interval is reapproximated.

Figure 24 shows the final result. It is important to note that this repair attaches the fibrous capsule directly to bone without intervening cartilage. Many other orthopaedic operations firmly fix fibrous tissue to bone, but few depend on the healing of fibrous tissue to cartilage or the healing of cartilage to bone. The cartilagenous labrum has been converted to an extraarticular structure in the anterior and anteroinferior aspects of the joint.

CONCLUSION

In summary, the Bankart repair preserves the overall anatomy of the shoulder more than many alternative operations for shoulder instability. The Bankart operation repairs the capsule to the bone of the glenoid rim without intervening cartilage. The anatomy is distorted to the extent that the cartilagenous labrum, when present, is moved from its normal intraarticular position to an extraarticular position where it further buttresses the humeral head against anterior translation.

REFERENCES

1. Alexander AH, Grant JM: Provocative program for recurrent dislocation. *Orthopaedics Today*, page 8, March 1985
2. Bankart ASB: The pathology and treatment of recurrent dislocations of the shoulder joint. *Br J Surg* 26: 26, 1938
3. Henry AK: *Extensile Exposure*. New York, Churchill Livingstone, 1970, pp 27-28
4. Rowe CR: Bankart procedure for recurrent anterior dislocation of the shoulder. *Strat Orthop Surg* 2: 1-11, 1982
5. Rowe CR, Zarins B: Recurrent transient subluxation of the shoulder. *J Bone Joint Surg* 63A: 863-872, 1981
6. Rowe CR: Acute and recurrent dislocations of the shoulder. *J Bone Joint Surg* 44A: 998-1008, 1962
7. Rowe CR, Patel D, Southmayd WW: The Bankart procedure: A long-term end result study. *J Bone Joint Surg* 60A: 1-15, 1978