RECURRENT DISLOCATION OF THE SHOULDER


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Paper read at the Annual Meeting of the British Orthopaedic Association, 1947

This paper is based on a review of 180 cases of recurrent dislocation of the shoulder joint occurring in ground staff and air crew members of the Royal Air Force in the six-year period 1940 to 1945. During this period a total of 159 operations was performed for the relief of this disability. The task of analysing such a series has been facilitated by the fact that in a relatively small orthopaedic service such as was developed in the Royal Air Force under the direction of Sir Reginald Watson-Jones, orthopaedic surgeons were well known to each other and had frequent opportunities of discussing together all aspects of their work; and furthermore, by the standardised and very detailed system of case-recording which was in use at all the orthopaedic centres. These factors may reasonably be held to have safeguarded the accuracy of the findings here presented, and to render valid any conclusions based upon them. In recent years the main interest of recurrent dislocation of the shoulder has centred round its pathology, mechanism of production, and operative treatment, and it is with these aspects of the problem that the present study is concerned.

PATHOLOGY

Many explanations have been put forward to account for the tendency to recurrent dislocation of the shoulder, some postulating changes in the capsule or ligaments, some in the bones, and others in the muscles. In fact, however, few of these theoretical explanations bear close analysis. Among recent contributions those of Bankart (1923, 1938) and Hill and Sachs (1940) demand close consideration.

Bankart holds the view that the pathology of all cases is the same, namely detachment of the glenoid labrum from the bone margin of the glenoid cavity in its anterior part. He believes that the dislocation is almost invariably anterior, whereas ordinary or non-recurrent dislocation is inferior. Bankart does not consider that bone changes play a significant part in the causation.

Hill and Sachs, working from the radiological view-point, emphasised the frequent occurrence of bone changes in the head of the humerus in the form of a defect in the postero-lateral aspect of its articular surface. Changes of this nature occurring in association with dislocation of the shoulder had been described previously by several observers, notably Flower (1861), Schultz (1914), and Pilz (1925). Nevertheless the frequency and significance of these changes did not receive general recognition because the defect is not shown in ordinary antero-posterior radiographs of the shoulder, and because the lesion is not easily exposed during operations on the joint through the usual anterior approach.

The bone lesion, according to the description of Hill and Sachs, consists of flattening or depression of the articular surface of the head of the humerus, usually involving its postero-lateral aspect. It is shown radiographically only by taking an antero-posterior film with the arm in internal rotation, or by taking an appropriate tangential projection. In such a film it has the appearance of a groove or depression at the upper and outer margin of the shadow of the humeral head. Furthermore, a sharp dense line of condensation is seen extending downwards from the top of the humeral head and parallel to the axis of the shaft (well shown in Figs. 4 and 6). This represents compaction of the spongy bone previously occupying the space of the defect.
Antero-posterior radiograph of the shoulder with the arm in the neutral position (Fig. 1) shows no defect of the humeral head. The same shoulder radiographed in 60 degrees of internal rotation (Fig. 2) shows a well-defined defect at the upper and outer margin of the shadow of the humeral head.

Antero-posterior radiograph of shoulder with the arm in 90 degrees of internal rotation (Fig. 3) shows no defect of the humeral head. In the position of 50 degrees of internal rotation (Fig. 4) the defect is indicated by a dense line of condensation extending down from the top of the humeral head, parallel with the shaft.
The cause of this defect has been a matter of some uncertainty. Hill and Sachs believed that it was due to compression fracture of the comparatively soft bone comprising the postero-lateral portion of the head of the humerus, caused by impact against the glenoid margin during violent dislocation. In support of this view they cited radiographic evidence that such a defect might be present immediately after a single injury to a shoulder joint which was proved to be normal before the injury.

These two contributions have added fresh stimulus to the study of the pathology of recurrent dislocation of the shoulder; and in the cases under review particular care was taken during operative exposure to note pathological findings which might have bearing on the causation of redislocation. Analysis of the abnormal findings is shown in Table I.

**Table 1**

Analysis of Abnormal Findings in 180 Cases of Recurrent Dislocation of the Shoulder

<table>
<thead>
<tr>
<th>Type of lesion</th>
<th>Number of cases suitably examined</th>
<th>Lesion present</th>
<th>Lesion absent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number</td>
<td>Per cent.</td>
</tr>
<tr>
<td>Detachment of glenoid labrum and anterior capsular stripping</td>
<td>79</td>
<td>69</td>
<td>87</td>
</tr>
<tr>
<td>Bone defect of head of humerus</td>
<td>68</td>
<td>56</td>
<td>82</td>
</tr>
</tbody>
</table>

**Pathological findings**—The glenoid labrum was exposed and closely examined in seventy-nine cases. In sixty-nine cases (87 per cent.) detachment of the labrum from the
bone margin of the glenoid was demonstrated. In ten cases (13 per cent.) the labrum was found to be normally attached. The lesion, when present, had the characteristics described by Bankart. The extent of detachment was variable; its position was always on the anterior half of the circumference of the glenoid margin, either directly anterior or antero-inferior. Not uncommonly the detached portion of the labrum was found to be attenuated, presumably the result of repeated trauma.

Capsule—In association with detachment of the glenoid labrum there was invariably some degree of stripping of the anterior part of the capsule from the front of the neck of the scapula. This finding has been mentioned by other observers, notably Bost and Inman (1942). It can be regarded as an integral part of the lesion described by Bankart.

Head of the humerus—This was studied adequately by radiographic examination in sixty-eight cases. For reasons which are discussed below, radiographic study was not accepted as adequate unless the series of films included at least one, and preferably more than one, projection with the humerus in a position of internal rotation between 50 and 80 degrees. In fifty-six of the cases so examined (82 per cent.), a well-defined bone defect was shown to be present. In twelve cases (18 per cent.) no defect was demonstrated. It is particularly worthy of note that a defect was present in every case which at operation was found to show no lesion of the glenoid labrum. The characteristics of the defect corresponded closely with the description of Hill and Sachs. Typical examples are shown in Figs. 2, 4, 6, and 9.

The bone margin of the glenoid was found to be rounded and eburnated in a proportion of cases in which there was detachment of the glenoid labrum. This finding was more common and more pronounced when dislocation had recurred with great frequency, thus suggesting that it is a secondary change due to repeated trauma.

Discussion—Modern conceptions of the pathology of recurrent dislocation of the shoulder may now be reconsidered in the light of this study of 180 cases. In the first place there appears to be general agreement that the tendency to redislocation always follows upon injury. In this series the condition never developed spontaneously. The injury has usually been a violent initial dislocation, apparently causing damage which is not repaired by the natural processes of healing, thus differing from simple or non-recurrent dislocation in which damage is repaired and the joint restored to normal.

It is also established with reasonable certainty that detachment of the glenoid labrum from the margin of the glenoid cavity, associated with stripping of the anterior part of the capsule from the front of the scapular neck, is a major causative factor in the large majority of cases. But it is not possible to accept the view that this lesion alone is responsible for the tendency to redislocation in every case. It has been shown that in approximately 13 per cent. of cases, in which careful examination of the area was made, the glenoid labrum was attached in a normal manner to the anterior glenoid margin. In these cases, at least, some other factor must be responsible, and there is evidence to suggest that this factor is the defect in the articular surface of the head of the humerus. This was the only lesion found consistently in shoulder joints which showed no detachment of the glenoid labrum. Moreover, as will be shown later, it is a lesion which itself is capable of causing redislocation and which, like detachment of the labrum, is an abnormality incapable of restoration to normal by the natural processes of healing.

Radiographic demonstration of the bone change requires further description. Careful study was made of all radiographs showing the defect, and the degree of rotation of the humerus in each film determined accurately by comparison of the outline of the shadow with radiographs of a normal dried humerus in known degrees of rotation. In this way it was established that the defect is most often demonstrated in profile when antero-posterior radiographs are made with the humerus in 60 to 70 degrees of internal rotation. It was found also that there is slight individual variation in the position of the defect, and consequently
in the radiographic positioning required to demonstrate it. Thus in a few cases the defect was shown most clearly in antero-posterior projections with the humerus in only 50 degrees of internal rotation. Occasionally it was best seen with the humerus in as much as 80 degrees of internal rotation. Only larger defects were demonstrable in films taken with the arm in full internal rotation (100 degrees).

Because of these variations a small defect may easily be overlooked unless several projections are made showing the humerus in positions between 50 degrees and 80 degrees of internal rotation. For this reason it is probable that the incidence of the defect has been
underestimated by most observers. The true incidence may well be even higher than the 82 per cent. recorded in this series.

These two lesions—anterior detachment of the glenoid labrum and bone defect of the humeral head—are often associated in the same shoulder, but they do not necessarily arise simultaneously. It seems probable that in some cases detachment of the labrum occurs first, and that subsequent impacts against the unprotected bone margin of the glenoid cavity cause secondary flattening of part of the humeral head. Once this has occurred it is reasonable to expect an increased tendency to redislocation. Moreover, the larger the defect the greater is the tendency to dislocation. The history so often given in cases of recurrent dislocation supports this hypothesis. At first, dislocation occurs infrequently: this corresponds to the stage of simple detachment of the glenoid labrum. Later, often quite suddenly, the frequency of dislocation is greatly increased: this coincides with the development of a defect in the humeral head. Finally, instability of the joint becomes increasingly disabling: this is explained by gradual enlargement of the defect.

It remains now to consider the manner in which these abnormalities predispose to recurrent dislocation. Detachment of the glenoid labrum removes a small but significant buttress guarding the anterior edge of the glenoid cavity. When the head of the humerus is forced in the direction of the lesion, by whatever mechanism, the detached segment of labrum is displaced over the bone margin of the glenoid into a position in front of the neck of the scapula (Fig. 10). A deficiency is thus created in the anterior rim of the cavity over which the head of the humerus may escape, though it remains within the joint capsule.

A defect of the head of the humerus acts in a comparable manner (Fig. 11). In this case, instead of the buttress being removed, there is deficiency of the part of the head which normally would engage with the buttress. The head is thus able to slide over the anterior margin out of the glenoid cavity. This can occur only when the humerus is in such a position, relative to the scapula, that the flattened defect is in engagement with the anterior glenoid margin. This condition is fulfilled when the arm is in external rotation and abduction. Again the dislocation is always intra-capsular.

MECHANISM OF PRODUCTION

In the past there has been no general agreement as to the mechanism of production of the initial dislocation. In many cases it is difficult or impossible to elicit from the patient an accurate account of the movements sustained by the arm at the time of injury. However, from careful study of the case histories in the present review it has been possible to select a number of cases in which the exact mechanics of injury are known with certainty. These examples are insufficient in number to provide a reliable estimate of the relative frequency of each mechanism, but they do indicate clearly that the mechanism of dislocation is by no means constant, and that recurrent dislocation may be initiated by a number of different
types of injury. There are clear examples in this series of initial dislocation being due to five types of injury:

1. **Fall on the abducted arm** (without hyper-abduction)—In order to understand how such a fall may cause anterior dislocation it is necessary to bear in mind that the plane of the gleno-humeral joint is not in the sagittal plane of the body, but is set at an angle of approximately 45 degrees to the sagittal plane. (The angle is not of course constant, owing to mobility of the scapula.) Therefore, a telescoping force applied to the abducted humerus, such as occurs in a fall on the outstretched arm, or on the outwardly directed elbow, is converted by resistance of the glenoid fossa into an antero-medial force acting in the plane of the gleno-humeral joint (Fig. 12). This may result in forward dislocation of the humeral head. Such type of injury is obviously liable to cause damage both to the anterior glenoid margin and to the head of the humerus. It was by far the most common cause of recurrent anterior dislocation.

2. **A direct blow from behind acting on the head of the humerus**—This is the mechanism described by Bankart who believed that all recurrent dislocations were initiated in this manner. Such a blow may result from a fall directly on the back of the shoulder, or by a fall on the elbow which is directed backwards. As it is driven forwards out of the glenoid cavity the head of the humerus may shear the glenoid labrum from the bone; or the head of the humerus may sustain a compression fracture; or both injuries may occur. This mechanism undoubtedly operates in some cases but it cannot be regarded as the sole cause, or even the most common cause, of recurrent anterior dislocation. Indeed in this series it was relatively infrequent.

3. **Hyper-extension of the abducted arm**—Two similar examples of this mechanism may be quoted. In each case the patient was the pilot of a light aircraft. While manoeuvring the aircraft on the ground, he put the arm out sideways from the cockpit (90 degrees abduction with the arm in the coronal plane). The force of the slip-stream hyper-extended
the arm and caused anterior dislocation of the shoulder. At operation typical detachment of the glenoid labrum was demonstrated. From the mechanical point of view this type of dislocation is depicted in Figs. 13-14. At the limit of extension the anterior capsule becomes taut; further extension must result either in a tear of the capsule, or in stripping of the capsule from the scapular neck. At the same time the humeral head, in displacing forwards by leverage through the fulcrum of the pectoralis major insertion, may shear the anterior part of the glenoid labrum from the bony rim. Though of considerable interest, this mechanism was infrequent.

4. Excessive external rotation in abduction—This mechanism is exemplified by the case of a stores assistant who was carrying a heavy sack across the right shoulder, the arm being abducted 90 degrees and externally rotated so that the forearm was directed upwards, the hand controlling the top of the sack. The sack overbalanced in a direction backwards, thus causing excessive external rotation at the shoulder joint. The joint dislocated forward. The mechanical considerations are comparable with those described in hyper-extension injuries. The limit of external rotation having been reached, the strain on the anterior capsule results either in a tear of the capsule or in stripping of the capsule from the scapular neck. At the same time the head of the humerus moves forwards round a fulcrum formed by the internal rotators of the humerus, and may shear off the glenoid labrum. This mechanism was also infrequent in first dislocations, although of course there is clear evidence that external rotation movements are very often the cause of redislocation, especially when there is a postero-lateral defect of the humeral head.

5. Inferior dislocation—Although in the majority of cases dislocation was forward, it did appear that in some the primary injury was one of hyper-abduction of the arm in relation to the scapula, the head of the humerus being levered downwards out of the glenoid fossa over the fulcrum of the acromion process and the coraco-acromial ligament. It is clear that in inferior dislocation there is less tendency to shearing of the labrum, or impact of the humeral head, and the infrequency of recurrent dislocation from this mechanism is understandable.

OPERATIVE TREATMENT

Clear understanding of the pathology of recurrent dislocation of the shoulder has led to more rational treatment. There has also been accumulation of evidence suggesting that many operations formerly employed have failed to give consistently good results. In the early months of the period under review the tendency in the Royal Air Force was to employ the Nicola operation. The merits of the Bankart operation were known, but surgeons were attracted by the ease and simplicity of the biceps tendon transplant which
had been reported to give equally good results. There was subsequently a trend towards the employment of procedures of the Bankart and Putti-Platt types. This is represented graphically in Fig. 15 and has been justified fully by the results.

In assessing the results of operation account must be taken not only of stability of the shoulder but also of the range of movement regained, and of the presence or absence of significant pain or other symptoms in the shoulder. In the present analysis no case has been included unless the follow-up has extended over a period of not less than two years from the time of operation. This arbitrary period has been adopted as a working basis. Freedom from recurrence of dislocation for two years does not necessarily mean that permanent cure has been effected. Some unsuccessful cases have redislocated only after several years of apparent cure.

The two-year results as far as they concern stability are shown in Table II. With regard to mobility, it has been found that the only movements likely to be restricted after operation are abduction and external rotation. The range of these movements regained within two to five years of operation is depicted graphically in Figs. 16-18. The results will be discussed further with special reference to the Nicola, Bankart, and Putti-Platt operations.

TABLE II

<table>
<thead>
<tr>
<th>Operation</th>
<th>Number of cases observed for two to five years</th>
<th>Recurrence of dislocation</th>
<th>Interval between operation and recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Per cent.</td>
<td>Shortest</td>
</tr>
<tr>
<td>Nicola</td>
<td>59</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Bankart</td>
<td>18</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>Putti-Platt</td>
<td>37</td>
<td>2</td>
<td>—</td>
</tr>
</tbody>
</table>

The Nicola operation—Stability—The results of this procedure were disappointing. In a total of fifty-nine cases operated upon and followed up for two years or more, redislocation occurred in no less than twenty-one cases (36 per cent.). The period before recurrence varied from four to sixty months, with an average of twenty-two months. Failures of this operation were formerly attributed to errors of technique, especially placing the drill-hole too close to the margin of the articular surface of the humerus. This may perhaps be the cause of some failures, but it certainly does not account for all. Redislocation (or re-subluxation, which is a disability almost as severe) has occurred when it has been shown at secondary operation that the drill-hole was correctly placed and the tendon had remained intact. In spite of this the head of the humerus displaced forwards during external rotation, which was seen to occur around an axis formed by the transplanted biceps tendon. It is clear, therefore, that there may be recurrence when there has been neither failure of technique nor rupture of the tendon. Theoretically, in the presence of an intact and well-placed tendon, redislocation is more likely to occur when the intra-articular part of the transplanted tendon is slack, or when there is a large defect in the articular surface of the humeral head especially when associated with detachment of the labrum. It is less likely to occur when the lesion is a detachment of the labrum low down on the anterior wall of the glenoid fossa. Mobility—A full range of shoulder movement is often regained after the Nicola operation. Some limitation of abduction is not uncommon, but the impairment is usually of slight degree. In only two cases was abduction limited significantly. The average range was 168 degrees. External rotation was seldom limited; the average range was 73 degrees; in the majority of cases a normal range was regained (Fig. 16). This is of
significance because it is in full external rotation that a bone defect of the humeral head comes into engagement with the glenoid cavity and may permit redislocation. Pain—A subjective symptom such as pain is always difficult to assess. Nevertheless the observation is inescapable that persistent aching pain in the shoulder region is of disturbing frequency after the Nicola operation. In this series, disability due to pain was considered to be of material degree in twelve cases (20 per cent. of the fifty-nine cases observed for more than two years). The pain may result from irritation of the joint due to injury to articular cartilage during the operation, or from disturbance of the normal anatomy due to interposition of the biceps tendon between its surfaces.

![Fig. 16](image)

Range of abduction and external rotation movement two to five years after Nicola operation.

The Bankart operation — The results of this operation have been satisfactory. Stability—Of eighteen cases of operation followed up for more than two years there was only one recurrence and this was almost certainly due to poor technique because at subsequent re-operation extensive anterior detachment of the glenoid labrum was found still to be present. Mobility—A normal range of abduction is usually regained. The average range in eighteen cases was 166 degrees. Some degree of impairment of external rotation is usual. In only two cases was the normal range regained. The average range of external rotation in eighteen cases was 51 degrees (Fig. 17). Pain—In no case was pain found to be a significant feature following the Bankart operation.

For details of the technique of Bankart’s operation reference should be made to his original accounts. It should be noted, however, that in longstanding cases the glenoid labrum may be so attenuated as the result of repeated trauma that it is impracticable to reattach it to the glenoid margin. In such cases the capsule itself is sutured to the front of the glenoid rim. The operation is not quite universally applicable, for occasionally the glenoid labrum is found to be normally attached. These are the cases in which it is believed that repeated dislocation is due mainly to a defect of the humeral head. Clearly some other procedure must be adopted in such a case.
The Putti-Platt operation—This operation has proved satisfactory in the cases under review. The subscapularis muscle is divided about one inch from its insertion. The front of the neck of the scapula is rawed with an osteotome, adjacent soft tissues are scarified, and the distal portion of the subscapularis muscle is sutured firmly to periosteum and soft tissues in front of the neck of the scapula, the arm being maintained in internal rotation. The proximal portion of the subscapularis is then sutured to the region of the lesser tuberosity, thus overlapping the distal portion. The arm is bandaged to the trunk in internal rotation for a period of four to six weeks, after which active exercises are commenced.

![Diagram of Bankart operation](image)

**Fig. 17**

Range of abduction and external rotation movement two to five years after Bankart operation.

The effect of this procedure is twofold. Anchoring of the tendon of the subscapularis to the front of the neck of the scapula amounts to the formation of a strong ligament which effectively prevents full external rotation at the gleno-humeral joint. This is one of the purposes of the operation, and it is a strong safeguard against recurrence of dislocation, for it is in external rotation that the humerus with a defect in its articular surface is liable to slip forwards out of the glenoid fossa. Secondly, the operation results in the formation of a firm fibrous buttress in the very region where support is required, namely at the anterior margin of the glenoid fossa. **Stability**—In thirty-seven cases of this procedure followed up for two or more years, there were two recurrences. In both instances redislocation resulted from moderately severe violence, which may or may not have been sufficient to cause dislocation of a normal shoulder. In one case the patient sustained severe external rotation strain of the shoulder joint three months after operation while still undergoing rehabilitation. In the second case the shoulder was entirely satisfactory for seventeen months after operation, but it dislocated again as the result of a fall on the outstretched hand. In both cases the instability became recurrent and further treatment was necessary. It is interesting to note that in both these unsuccessful cases a full range of external rotation had been regained after operation. This suggests that the technique may have been imperfect in that the
subscapularis tendon may not have been sutured tightly enough to the anterior scapular region. *Mobility*—A normal or nearly normal range of abduction has been regained in the great majority of cases. The average range was 170 degrees. External rotation is almost invariably limited, often very considerably. The average range regained was 40 degrees (Fig. 18). *Pain*—In no case was pain found to be a significant feature following the Putti-Platt operation.

**Choice of operation**—Comparison of the results of the three operations which have been considered indicates that the Nicola operation is much less certain in its results than either the Bankart or Putti-Platt operation. Improvement in results might perhaps be gained by more careful selection of cases, but the multiplicity of factors involved makes it difficult to predict which case is likely to be treated successfully by this procedure. A further objection lies in the fact that the operation disturbs the normal anatomy of the joint, and may cause aching pain which is persistent and disabling. In view of these facts it is believed that the Nicola operation is seldom, if ever, indicated in the treatment of recurrent dislocation of the shoulder.

Comparing the Bankart and Putti-Platt operations the evidence suggests that there is little to choose between them with regard to results, which have been satisfactory in over 95 per cent. of cases. They both have the advantage that exact pathology may be determined at operation. The Putti-Platt operation is rather more easy to perform efficiently than the Bankart operation, especially if a right-angled electrically driven dental handpiece is not available for making holes in the glenoid margin. Moreover it is applicable to every case, whether caused by detachment of the glenoid labrum or by defect of the humeral head. Against the Putti-Platt operation may be brought the argument that it results in considerable restriction of external rotation movement. Certainly there is a greater limitation of this movement than is usual after the Bankart operation. In practice, however, the disability

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*Fig. 18*

Range of abduction and external rotation movement two to five years after Putti-Platt operation.
from this cause is found to be of a minor degree. In the words of a patient whose final range of external rotation was only 10 degrees: "The almost total lack of external rotation does not seem to affect either my work or sports." There is no doubt that this restriction of movement is a price willingly paid for stability and full confidence in the shoulder.

**SUMMARY AND CONCLUSIONS**

A review of the pathology, mechanism, and operative treatment of recurrent dislocation of the shoulder, based on an analysis of 180 cases, with 159 operations, is presented. From this analysis the following conclusions have been made and appear to be substantiated:

1. The pathology comprises two important elements: (a) anterior detachment of the glenoid labrum from the bone margin of the glenoid, associated with some degree of stripping of the anterior part of the capsule from the front of the neck of the scapula, found in 87 per cent. of cases examined adequately at operation; (b) defect or flattening of the posterolateral aspect of the articular surface of the head of the humerus which engages with the glenoid cavity when the arm is in external rotation and abduction; this defect is demonstrated most readily in antero-posterior radiographs taken with the humerus in 60 to 70 degrees of internal rotation and was shown to be present in 82 per cent. of cases which had been subjected to adequate radiographic examination.

2. The frequency of the humeral head defect has been under-estimated in the past, because of the difficulty of demonstrating it, particularly when the defect is small.

3. Either type of lesion alone may predispose to recurrence of the dislocation.

4. Both types of lesion are often present in the same shoulder. When this is the case the tendency to redislocation is great.

5. The initial dislocation, which results in the development of one or both these persistent structural abnormalities, may be due to very different types of injury, the commonest of which is a fall on the outstretched hand. The factor common to all these injuries is a resultant force acting on the humeral head in the direction of the anterior glenoid margin.

6. In the treatment of recurrent dislocation of the shoulder joint the Nicola operation is unreliable, and it may be associated with a recurrence rate as high as 36 per cent. It is believed that continued instability after this operation is usually due to the presence of a defect of the humeral head.

7. Operative treatment should aim at repairing, or nullifying, the effects of both types of lesion. For anterior detachment of the labrum this involves either suturing the labrum back to the glenoid margin, or constructing some form of anterior buttress, fibrous or bony: for humeral head defects it necessitates some procedure designed to limit external rotation, thus preventing the defect from coming into engagement with the glenoid cavity. Such limitation of external rotation does not constitute a significant disability.

It is with much pleasure that I acknowledge my indebtedness to Sir Reginald Watson-Jones for facilitating this review in every possible way, and for constant stimulation and encouragement; and to Mr H. Osmond-Clarke for valuable advice and assistance. I wish also to extend my thanks to the individual surgeons of the Royal Air Force orthopaedic units for allowing me to review their cases; and in particular to Mr N. Vere-Hodge, who has been of great assistance in helping to trace these cases for follow-up study.

**REFERENCES**


