Osteoarthritis after the Max Lange procedure for unstable shoulders

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Summary. *Thirty-four patients were followed for a mean of 14.4 years after the Max Lange operation for instability of the shoulder. This procedure consists of an anterior capsulorrhaphy with lateralisation of the subscapularis tendon and the insertion of a bone block at the inferior and anterior part of the glenoid. The Rowe score showed 87% good and excellent results. External rotation and abduction were significantly limited as compared to the normal side. Radiographs revealed osteoarthritis in 47%. Double contrast computed tomography in 18 cases showed a bony defect in the anterior and inferior part of the humeral head in 12 who had significantly limited external rotation as compared to those without the defect. Lateralisation of the subscapularis tendon with limitation of external rotation may lead to increased contact stress and shear forces at the anterior rim of the glenoid which contributes to the development of osteoarthritis.*

Résumé. *Trente quatre patients, après avoir été opérés selon la méthode de Max Lange (imbrication du tendon souscapulaire et greffe d'un bloc osseux au niveau antéro-inférieur de la glène) ont été suivis pendant une durée moyenne de 14,4 ans. Le score de Rowe révéla que les résultats ont été positifs et excellents à 87% (quatre vingt sept pour cent). La rotation externe et l'abduction ont été assez limitées ($p < 0,05$) par rapport à l'épaule non opérée. Une radiographie révéla chez 47%*

(quarante sept pour cent) des patients une arthrose de l'épaule concernée. La tomographie par ordinateur à double contrastes ($n = 18$) a révélé chez 12 (douze) patients un défaut antéro-inférieur de la tête humérale et chez ces mêmes patients une rotation externe limitée en comparaison avec les patients ne présentant pas la même anomalie osseuse ($p = 0,04$). On suppose qu'une latéralisation du tendon souscapulaire avec limitation de la rotation externe entraîne une augmentation de la force de contact et de frottement sur le bord antérieur de la glène par laquelle est favorisée l'arthrose de l'épaule.

Introduction

The reported results of operations for dislocation of the shoulder are mainly concerned with the recurrence rate [1, 2, 5, 8], but pain, limitation of movement and osteoarthritis are also documented [3, 4, 9, 10]. Tight repair by anterior capsulorrhaphy may contribute to osteoarthritis [4, 9, 11].

We report a retrospective long-term review of patients who had the Max Lange operation which is an anterior capsulorrhaphy with lateralisation of the subscapularis tendon and the insertion of a bone block at the inferior and anterior part of the glenoid [7].

Patients and methods

Forty-five patients responded to the invitation for follow-up; 34 showed up for clinical examination and radiographs. The

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Fig. 1. Diagram showing the site of the extra-articular bone block (I)

other 11 replied by letter and did not show up; they were excluded. There were 25 men and 9 women with a mean age at operation of 29.5 years (range 13 to 71 years). In 15 the left, and in 19 the right, shoulder was involved; in 17 the dominant side was affected.

Before operation, each patient had an average of 37 episodes (range 3 to 150) of dislocation of the shoulder, the initial dislocation being the result of an injury in every case. The main complaint was painful dislocation which limited daily activity. Two patients had both shoulders operated on, but only one side was evaluated in the statistical analysis.

Operative technique

The Max Lange operation is carried out through a delto-pectoral approach. Subscapularis is exposed and detached from the lesser tuberosity in 20° of external rotation at the glenohumeral joint; the tendon is separated from the lax capsule. The antero-inferior rim of the glenoid is exposed and a bone block inserted (Fig. 1). The subscapularis is then reattached to the lesser tuberosity with the arm in 20° of internal rotation; the anterior capsule is repaired by overlapping.

At follow-up, the clinical results were evaluated by the Rowe score [13]. Examination included the measurement of the active and passive range of movement of both shoulders. Internal and external rotation were measured with the patient

Fig. 2. CT arthrography showing a gap between the bone block and the bed into which it was inserted at operation 17 years previously

supine and the arm in 90° of abduction and the elbow flexed 90°. Abduction and anteversion were measured with the patient standing.

Anteroposterior and axillary lateral radiographs were taken of both shoulders of every patient. Osteoarthritis was classified by Hawkins and Angelo's method [4].

Statistical analysis (ANOVA) was used for comparison of the range of movement at both shoulders employing Graph Pad Instat TM® software.

Results

The average length of follow-up was 14.4 years (range 5 to 28.5 years) at a mean age of 43 years (range 24 to 79 years). No patient had instability or a recurrence of the dislocation.

The patient's satisfaction was excellent in 28 (82%) and good in 6 (18%). The Rowe score showed excellent results in 23 (67%), good in 7 (21%), fair in 2 (6%) and poor in 2 (6%). The 2 patients with a fair result showed significant limitation of movement with moderate limitation of function, but their shoulders were stable. One patient with a poor result had a deep infection after revision operation and needed arthrodesis of the shoulder. The other was 71 years of age at operation and complained of poor function and significantly limited movement, although the shoulder was stable.

Twenty-eight were taking part in sport, of whom 14 had returned to their previous level, but none was professional. Sixteen were manual labourers, one of them had some problems but was able to cope with them. Eighteen were non-manual workers, but one had given up being a hairdresser because of instability of her shoulder.

The range of movement of the affected shoulder was restricted, the mean values being abduction

Fig. 3. CT arthrography showing the anterior bone defect (arrow) in the humeral head 14 years after operation

168° and external rotation 40° ($p < 0.05$) compared to the normal side (abduction 179°, external rotation 66°). There was no significant difference between the active and passive ranges.

Radiological outcome

Plain radiographs showed osteoarthritis of the glenohumeral joint in 16 patients (47%); mild in 10, moderate in 4 and severe in 2. The xenograft block was in situ in 19 and dislocated in one. In the remaining 14, the graft was not visible in conventional radiographs.

CT showed the bone block at the antero-inferior rim of the glenoid in the 18 patients who had this examination. None showed a solid fusion between the block and the scapula (Fig. 2), and in one case the block was completely displaced from its bed. In 12 patients, CT with contrast arthrography showed a large defect in the antero-inferior part of the humeral head (Fig. 3). The Hill-Sachs lesion was visible in 15 and the anterior glenoid labrum was absent.

There was no correlation between the number of preoperative dislocations and the development of osteoarthritis (linear regression analysis, $r^2 = 0.002$).

Discussion

The Max Lange operation aims to prevent instability of the shoulder by lateralisation of the subscapularis tendon and by buttressing the anterior part of the capsule so that external rotation is restricted. This lateralisation has been associated with the greatest restriction of external rotation at long-term follow-up [2, 6, 7, 11, 12], and this may

Fig. 4. Diagram indicating the centres of rotation and displacement vectors: 1 = humeral head; 2 = glenoid; 3 = biceps tendon; 4 = lesser tubercle of the humerus; 5 = greater tubercle. + = the centre of rotation in a normal shoulder. • = the instant centre of rotation at the point of maximum external rotation which is the insertion of subscapularis after lateralisation. Dotted line = displacement vector of the humeral head in a normal joint. Unbroken line = the displacement vector of the humeral head after lateralisation of the subscapularis tendon and at the extreme of external rotation

protect against recurrence of the dislocation [4, 7, 8, 12] as shown in our study. The Putti-Platt repair also produces restricted external rotation [4, 5, 9], although it has been suggested that this limitation is only temporary and needs not to be treated [7, 12].

Lateralisation of the tendon and tightening the capsule may influence the biomechanics of the joint [4]. In the normal shoulder the instant centre of rotation is approximately at the centre of the humeral head. The displacement vector is tangential to the glenoid surface representing the displacement vector of the head. If an anterior capsulorrhaphy is very tight at the point of excursion of external rotation, the site at which the subscapularis inserts lateral to the lesser tuberosity becomes the new instant centre of rotation. A vector drawn perpendicular to the line joining the new centre and the contact point describes the new displacement vector of the humeral head. This new vector is directed towards the glenoid and head rather than tangentially to the glenoid surface (Fig. 4). As a result, shear and compression forces occur at the anterior part of the glenoid and head which increase as the attempted forced external rotation is at its most outward point.

In our series, 12 patients who had CT arthrography showed anterior bone defects in the humeral head and all had significant restriction of ex-

ternal rotation (mean 36°) compared with the 6 who did not have a defect and whose average external rotation was 46°. Hawkins and Angelo reported on 10 patients after the Putti-Platt repair with restriction of external rotation (mean -5°) and painful osteoarthritis of the shoulder [4]. We interpret the humeral bone defect in our cases to be due to the change in biomechanics produced by limited external rotation with subsequent increase of contact stress when this movement is forced. Hawkins and Angelo mentioned the change in biomechanics and related it to the development of osteoarthritis [4]. We were also able to demonstrate the reaction of bone to increased forces in those with restricted external rotation. In addition, 47% of our patients developed some degree of osteoarthritis, but none suffered pain.

The inserted bone block does not influence the development of osteoarthritis because it is extra-articular and not in contact with the head provided the head is stable; it may contribute to stability by the formation of scar tissue reinforcing the anterior capsule.

We could not demonstrate any correlation between the number of dislocations and the occurrence of osteoarthritis. There is only one report on dislocation arthropathy in which this relation was also not established [14].

Our findings lead us to recommend that restriction of external rotation should be avoided in the treatment of the unstable shoulder.

References

1. Altchek DW, Warren RF, Skyhar MJ, Ortiz G (1991) T-Plasty modification of the Bankart procedure for multidirectional instability of the anterior and inferior types. *J Bone Joint Surg [Am]* 73: 105–112
2. Brav EA (1995) An evaluation of the Putti-Platt reconstruction procedure for recurrent dislocation of the shoulder. *J Bone Joint Surg [Am]* 37: 731–741
3. Bryan RS, Di Michele JD, Ford GL Jr, Cary GR Jr (1969) Anterior recurrent dislocation of the shoulder. Report of a series of the Augustine Variation of Magnuson-Stack repair. *Clin Orthop* 63: 177–180
4. Hawkins RJ, Angelo RL (1990) Glenohumeral osteoarthritis. A late complication of the Putti-Platt repair. *J Bone Joint Surg [Am]* 72: 1193–1197
5. Hovelius L, Thorling J, Fredin H (1979) Recurrent anterior dislocation of the shoulder. Results after the Bankart and Putti-Platt operations. *J Bone Joint Surg [Am]* 61: 566–569
6. Krödel A, Melzer C (1986) Langzeitergebnisse nach operativer Versorgung der habituellen Schultergelenkluxation in der Technik nach Eden-Hybinette-Lange. In: Blauth, Ulrich (eds) *Spätergebnisse in der Orthopädie*. Springer, Berlin Heidelberg New York, pp 39–41
7. Lange M (1944) Die operative Behandlung der gewohnheitsmäßigen Verrenkung an Schulter, Knie und Fuß. *Z Orthop* 75: 162–170
8. Leach RE, Corbett M, Schepis A, Stockel J (1982) Results of a modified Putti-Platt operation for recurrent shoulder dislocations and subluxations. *Clin Orthop* 164: 20–25
9. Lusardi DA, Wirth MA, Wurtz D, Rockwood CA Jr (1993) Loss of external rotation following anterior capsulorrhaphy of the shoulder. *J Bone Joint Surg [Am]* 75: 1185–1192
10. McDonald P, Hawkins RJ, Fowler PJ, Miniaci A (1992) Release of the subscapularis for internal rotation contracture and pain after anterior repair for recurrent anterior dislocation of the shoulder. *J Bone Joint Surg [Am]* 74: 734–737
11. Melzer C, Manz P, Krödel A, Stütz H (1989) Operative therapy for recurrent shoulder dislocation with special regard to long-term clinical and radiological results using M. Lange technique. Springer, Berlin Heidelberg New York, pp 107–111
12. Osmond-Clarke H (1948) Habitual dislocation of the shoulder. The Putti-Platt operation. *J Bone Joint Surg [Br]* 30: 19–25
13. Rowe CR, Patel C, Southmay WW (1978) The Bankart procedure: a long-term end result study. *J Bone Joint Surg [Am]* 60: 1–16
14. Samilson RL, Prieto V (1983) Dislocation arthropathy of the shoulder. *J Bone Joint Surg [Am]* 65: 456–460