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ANTERIOR RECURRENT DISLOCATION OF SHOULDER

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The current concept of the causes of the anterior recurrent dislocation of the shoulder is Bankart's lesion and/or elongation and consequent weakness of the tendon of the key muscle subscapularis produced by trauma of the first episode. Operating surgeons of the British Commonwealth of Nations and North American countries will agree that Bankart's lesion is not found in operations in a good number of cases nor can elongation of the tendon of subscapularis be substantiated by direct observation. The chances of post-operative recurrence of Putti-Platt and Bankart's operations are considerably high according to some surgeons. Osmond Clarke has treated "50–60 cases of post-operative recurrence done by others in his series of 200–250 cases". Moreover, there is always an alteration to scapulo-humeral rhythm, limitation of external rotation and abduction of the gleno-humeral joint, however small. In our experience this limitation of overhead elevation is masked by excessive mobility of the scapula compared with that of the sound side even in those with the best results.

Continental surgeons especially in Germany and Scandinavian countries do not share the above view. They treat their cases by extending the anterior margin of the glenoid by Eden-Hybbinette operation or similar procedures. They get practically no post-operative disability and the chance of recurrence is extremely rare (*Friberg*, 0.66 per cent; *Lange*, none in his series of about 300 cases).

None-too-low incidence of spontaneous recurrent dislocation and unequivocal excellent results (full abduction and external rotation) in 45 cases including three epileptics in a period of ten years of treatment of anterior recurrent dislocation by posterior transfer of latissimus dorsi and recent good results of treatment by rotation osteotomy of the humerus have raised doubt about the accepted causes of recurrence.

This article is written to exploit the new concepts of the shoulder

mechanism in order to establish the aetiology of anterior recurrent dislocation of the shoulder and to outline all possible methods of treatment including posterior transfer of latissimus dorsi. This method of latissimus dorsi transfer was introduced first in 1956 by the author and quoted in the Hunterian lecture of the Royal College of Surgeons of England in 1957.

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS OF THE MECHANISM OF ANTERIOR DISLOCATION

Clinically and radiologically it has been found that most of the head of the humerus projects beyond the anterior glenoid rim when the limb is elevated to the vertical. This spontaneous tendency to subluxation due to the projection of the humeral head starts as the limb is elevated beyond 60° in the scapular plane. It increases with further elevation and especially when it is carried in planes behind the scapular plane. This is inevitable due to normal retrotorsion of the head of the humerus which changes into relative antetorsion with vertical elevation. Reduced retrotorsion of the upper end of the humerus diminishes this tendency. Nature attempts to stem this inherent instability by

1. *Relative Contour of the Head of Humerus and Glenoid Cavity*

Studies on the radii of curvatures of the head of the humerus and the glenoid cavity made possible the classification of this joint into

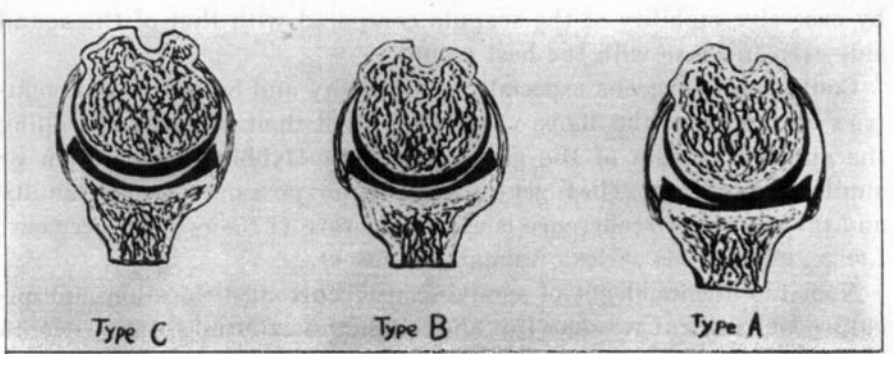


Figure 1. Shows diagrammatically the three types of joint. In type C joint the head of the humerus rides on the margin of the glenoid cavity and labrum in all positions of movement of the gleno-humeral joint. (Saha, A. K.: Theory of Shoulder Mechanism—Descriptive and Applied, Springfield, Ill. Charles C. Thomas, Publisher, 1961. Reproduced by courtesy of Publisher).

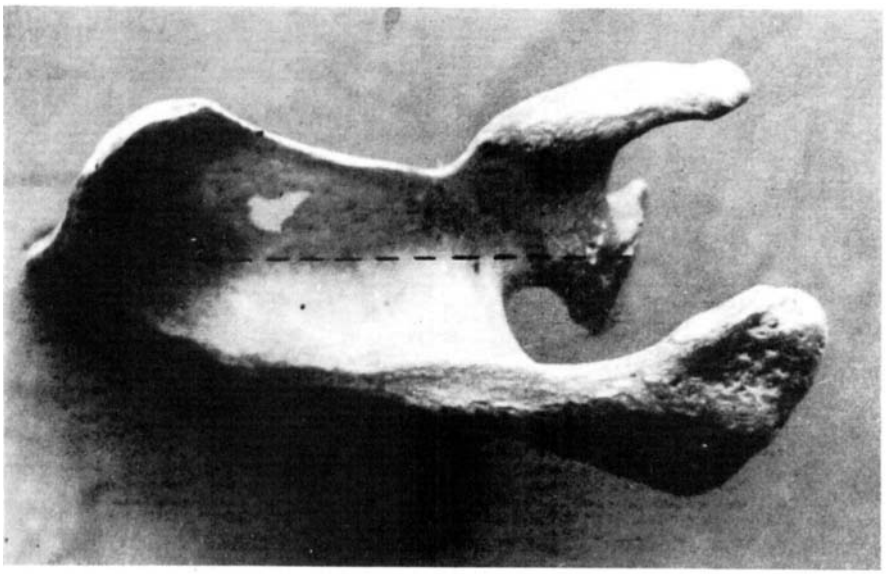


Figure 2. Plan view of the scapula showing the retrotilt of the glenoid in relation to its Axis. This is present in the majority of cases.

three types (Figure 1). In A & B types the humeral head has contact with a good portion of the articular surface of the glenoid in all positions during movement of the gleno-humeral joint. This helps the head to stay in the glenoid cavity.

2. *Tilt of the Glenoid*

This has been studied in macerated specimens by anthropometry and in the living by radiological examination (Figure 2). The latter group included cases of recurrent anterior dislocation either before or after treatment. The majority of normals had a varying degree of posterior tilt of the glenoid. In a small group of normal individuals and in all cases of anterior recurrent dislocations studied, the glenoid tilt was found to be reversed *i.e.*, was an anterior tilt. Obviously the posterior tilt of the glenoid helps to check the tendency to anterior subluxation.

3. *Role of Subscapularis, Infraspinatus and Teres Minor*

During abduction electromyography (Figure 3) shows that the power of the subscapularis rises from 120° to its maximum at 150°, wherefrom it shows a quick and steady fall. Obviously its power is utilised to roll the head of the humerus posteriorly, a movement which coun-

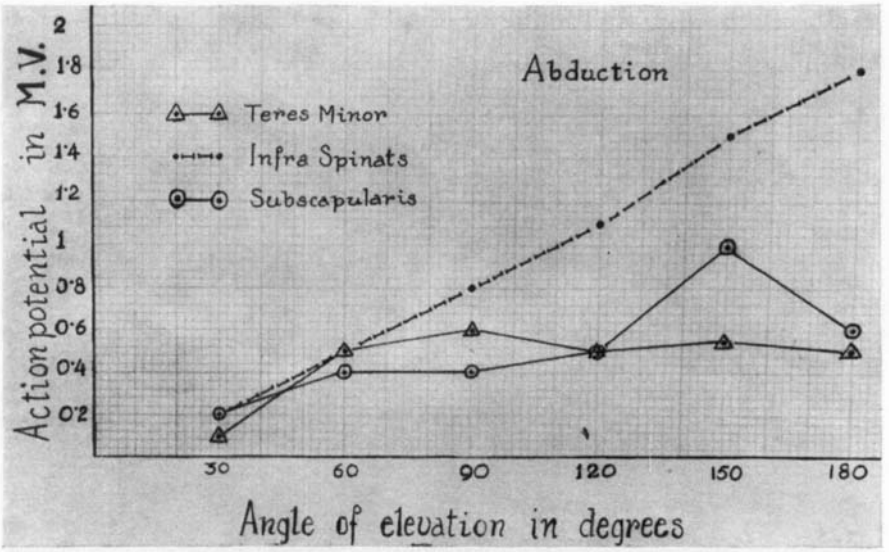


Figure 3. Composite graphical representation of action potential of teres minor, infraspinatus and subscapularis in millivolts during abduction of shoulder in a normal adult. The abscissa represents the angle of elevation in degrees and the ordinate action potential in millivolts. (Saha, A. K.: Theory of Shoulder Mechanism —Descriptive and Applied. Springfield, Ill. Carles C. Thomas, Publisher, 1961. Reproduced by courtesy of Publisher).

teracts the tendency to anterior subluxation. The decline of power of the subscapularis between 150°–180° of elevation at a crucial stage when the relative antetorsion of the upper end of the humerus is taken over by the infraspinatus whose power steadily rises and is maximal at 180°. Though the insertion of infraspinatus is at the posterosuperior surface of the greater tuberosity yet the posterior rolling occurs owing to relative maximum antetorsion of the upper end of the humerus and change of mechanical axis when it reaches the vertical overhead position. Teres minor shows a plateau curve from 60° to 180° and probably is a synergist to infraspinatus and subscapularis.

The above-mentioned factors preventing tendency to anterior subluxation of the head of the humerus during its critical phase of abduction in different planes may not, however, be adequate. This particularly occurs if the force of abduction is sudden and severe. The anatomicophysiological deviations from the normal enumerated below add to this. Without the predisposing factors the dislocation heals after reduction and recurrences are unlikely.

PREDISPOSING FACTORS

1. In type C joint the head of the humerus rides on the glenoid margin and labrum in all positions of movement, the radius of the head being greater than that of the glenoid cavity. During abduction all the stress would naturally fall on the anterior hemi-ring of the glenoid labrum with its maximum effect at this centre. If the attachment of the labrum is strong, the head of the humerus will jump off it and dislocate through a rent in the neighbouring capsule. In those cases where the attachment is weak the glenoid labrum will be shorn off the bony margin for a varying segment depending on the force and degree of abduction (Bankart's lesion). Whether the labrum is detached or not during the first episode, it is liable to secondary detachment, attenuation and fibrillation with repeated dislocations. Rarely the glenoid labrum may not develop and form as it were only a thickened part of the capsule near its attachment. In these cases the recurrent dislocation occurs at a very young age.

2. Increased retrotorsion of the upper end of the humerus may also be a factor in causing anterior recurrent dislocation.

3. Reduced retrotilt or anterior tilt of the glenoid may fail to give protection to head as the limb is raised to the vertical.

4. The power of subscapularis, infraspinatus and teres minor may be inadequate due to congenital weakness, paralysis (poliomyelitis) and elongation (vide supra) and consequent slackness and weakness from previous trauma.

In spontaneous anterior recurrent dislocation the first attack occurs without any trauma while putting the hand into a coat sleeve, behind the head during sleep, bowling in cricket, raising the arm for an overarm stroke in a tennis game etc. Such patients are usually in the late second or third decade of age.

In poliomyelitis with paralysis of either subscapularis or infraspinatus or both there is anterior subluxation of the head of the humerus which increases with attempt to raise the arm overhead.

Thus the cases of anterior recurrent/habitual dislocation belong to one of the three groups, (1) Post-traumatic (2) spontaneous and (3) paralytic. The term 'habitual dislocation' has been exclusively used for paralytic cases. These cases are perpetually subluxated or dislocated and are painless. These can be put back in the socket at ease passively. In a particular case one or more of the above-mentioned predisposing factors may be present.

THEORETICAL BASIS OF THE POSSIBLE METHODS OF TREATMENT OF ANTERIOR RECURRENT DISLOCATION OF THE SHOULDER AND ITS CHOICE IN A PARTICULAR CASE

Neither the block nor the check operations by muscle, tendon and fascia nor repair of Bankart's lesion would remove the cause of recurrence. The causes of recurrence are removed by one or more of the following procedures:

1. *Restoration of the Glenoid Retrotilt by Bone-grafting or Osteotomy*

Eden-Hybbinette operation is the nearest rational procedure in practice. It indirectly restores the tilt of the glenoid and enlarges its gliding surface for the head of the humerus. Treatment by simple osteotomy of the neck of the scapula to increase the retrotilt of glenoid when it is well developed would similarly effect a cure. In the presence of an aplastic glenoid which however is extremely rare, Eden-Hybbinette operation is choice. The method may have to be performed in extremely rare instances of persistent post-operative apprehension and recurrence after other operations and especially in the presence of severe anterior tilt of the glenoid.

2. *Prevention of Undue Anterior Projection of Head of Humerus beyond the Glenoid Margin with Overhead Elevation of the Arm*

Excessive anterior projection of the head of the humerus with vertical elevation may be prevented by limitation of external rotation of the arm or by reduction of retrotorsion of upper end of humerus. The former is done by Putti-Platt and Magnuson-Stack operations. Due to altered mechanism after these operations limitation of the vertical elevation, however small, always occurs. This is masked by the hypermobility of the scapula in the best of results. A rise in power of the subscapularis from shortening its elongated tendon is not justified as it lacks proof.

Alternatively, rotation osteotomy of the upper end of humerus (Saha-Das) will reduce the undue projection (relative antetorsion effect) with the elevation of the arm to the vertical. The operation is extra-articular and does not restrict the movements of the gleno-humeral joint in any direction. This has been successfully tried in anterior recurrent dislocation in non-paralytic cases. The long-term results are however still awaited.

3. *Enhancement of the Subscapularis Power*

The power of subscapularis may be reinforced by a muscle transfer. These muscles should have similar direction of fibres as that of the subscapularis and their rerouting should be possible to the lesser tuberosity without disturbing the nerve and vascular supply. The pectoralis minor and upper two digitations of serratus anterior have been used in habitual paralytic dislocation in flail shoulder. These not only restore the horizontal steerer but also cure the subluxation. These are not suitable in post-traumatic and spontaneous cases of anterior recurrent dislocation owing to technical difficulties due to presence of normal pectoralis major, deltoid, trapezius and levator scapulae.

4. *Enhancement of Power of Infra-Spinatus et Teres Minor*

This has been done with the help of the posterior transfer of the latissimus dorsi to the small tubercle at the lowest posterior limit of greater tuberosity, a point which marks the junction of aponeurotic and comparatively fleshy fibres of teres minor. When latissimus dorsi is the only muscle for reroutine as a horizontal steerer in the treatment of paralytic flail shoulder, it has been found that the habitual dislocation is also cured.

This is the only operation suitable for paralytic, post-traumatic and spontaneous cases. The procedure is described (vide infra) with a report of 45 cases of spontaneous and post-traumatic anterior recurrent dislocation.

MATERIALS

45 consecutive non-paralytic cases of anterior recurrent dislocation of shoulder over a period of 10 years till the end of 1965 are reported. These include 4 cases of Prof. *G. K. Chaudhuri,* F.R.C.S.E., 3 of Dr. *A. K. Das,* F.R.C.S., F.R.C.S.E., and 3 of Dr. *A. Sengupta,* F.R.C.S., and are tabulated below.

The three cases with bilateral anterior recurrent dislocation were epileptic. This was controlled before the operative treatment.

Five of the forty-five cases were spontaneous dislocation, in two of these the first episode happened while throwing a ball, one in his left shoulder during a forward drive of a full toss ball in cricket, one while raising his hand to strike a dog and lastly one with no relevant history.

31 cases had more than 10 recurrences. Eight of these did not require doctor's help during reduction and had innumerable episodes. They could dislocate as easily as they could reduce the dislocation on their own. They had no pain during a slip and the joints were lax, particularly while carrying moderate weights. They came for treatment because of their inability to perform normal manual labour requiring raising and carrying loads. One patient, a shopkeeper could not lift the balance while weighing merchandise for his customer.

The others came because of complete helplessness and severe pain during dislocation and their inability to take part in games and normal activities of life due to apprehension.

Table 1.

Year	Number	Male	Female	Side	Remarks
1956	1		1	Bilateral	Patient epileptic
1957					
1958	4	4		2 right 2 left	
1959	5	5		3 right 2 left	One case developed epilepsy in 1962
1960	4	3	1	3 right 1 left	One spontaneous on the right side while throwing a ball
1961	8	8		7 right 1 left	Two spontaneous; in one case while trying to hit a dog and during normal activity in the other
1962	7	7		5 right 2 left	
1963	5	5		4 right 1 bilateral	Bilateral case was epileptic
1964	3	3		3 right	One spontaneous while throwing a ball
1965	8	8		6 right 1 left 1 bilateral	Left one was spontaneous during forward drive of a full toss ball in cricket. The bilateral case was epileptic

METHOD OF POSTERIOR TRANSFER OF LATISSIMUS DORSI

Under general anaesthesia the patient is tilted by sand bags and adhesive strapping to 45 degrees to the opposite side. The extremity is draped from below to the lower third of the arm and is held and controlled by an assistant during the operation. With the arm abducted to 120° and externally rotated, an incision 6/7 inches in length is made, passing through the junction of the anterior 1/3 and posterior 2/3 of the outer wall of the axilla and parallel to the posterior axillary fold. After incising the axillary fascia the belly of the latissimus dorsi is exposed, its flat tendinous insertion is dissected free from the underlying muscle teres major retracting the neurovascular bundle with the radial nerve disappearing beneath the outer border of the long head of the triceps. The tendon is blended with the teres major and has to be separated with a sharp knife. The tendon thus freed is severed close to its insertion and is

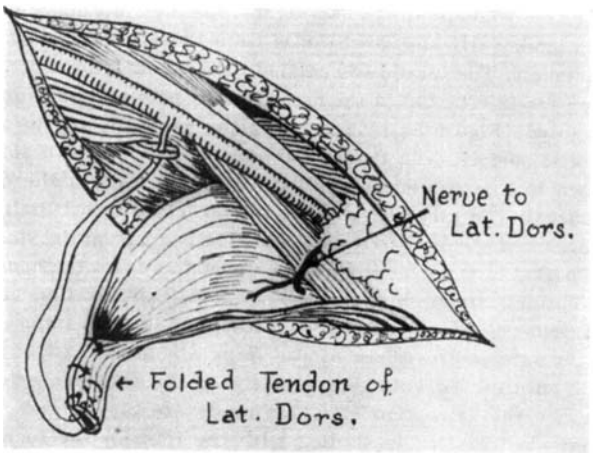
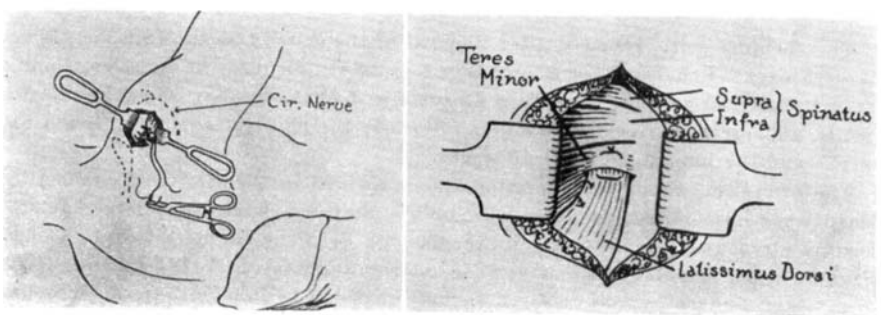


Figure 4. Shows the detached latissimus dorsi tendon folded longitudinally by interrupted silk sutures. A transfixation suture of stout silk is seen passing through its end for rerouting. Its long free ends are held in a haemostat ready for withdrawal between the long head of triceps and deltoid.



a. *b.*

Figure 5 a. Shows the upper end of the humerus through the split muscle fibres and fascia beneath the deltoid. The incision is above the course of the circumflex nerve in dotted line. The latissimus dorsi tendon is seen withdrawn in the depth of wound. Figure 5 b. Diagram showing latissimus dorsi after fixation to the periosteo-aponeurotic pocket at the posterior lower limit of the greater tuberosity of the humerus.

folded on itself for reducing its width by interrupted silk sutures. The folded tendon is transfixed by a mattress sutures ('4' chinese silk) with the free ends projecting from the cut surface of the tendon and ready for rerouting (Figure 4).

The posterior border of the deltoid is identified and freed from triceps. By finger dissection a tunnel is made from about the centre of its posterior border towards the head of the humerus keeping deep to the fascial covering of the deltoid. No sharp instrument should be used, to avoid injury to the branches of the circumflex and radial nerves.

The assistant now adducts, flexes and rotates the arm internally on the chest. An incision (2″) is made vertically downwards from the acromion, just in front of its sharp posterior angle. The incision is carried through the fibres of the deltoid and through its deep fascia. The top of the greater tuberosity and adjoining shaft of the humerus is exposed (Figure 5) by retracting the cut edges of the muscle and its fascia on its deep surface. The tendon of latissimus dorsi with the transfixation sutures is drawn to this wound through the interval between the deltoid and the long head of triceps. The tubercle marking the postero-inferior limit of the greater tuberosity is identified. A small transverse incision is made on the shaft immediately below it and a pocket is made by erasing the upper flap from the bone with the help of a rougine. The latissimus dorsi tendon with its transfixation suture is drawn through this fascio-periosteal pocket and fixed to the under surface of this upper flap by mattress suture. The edges of the flaps are now fixed to the tendon by interrupted silk sutures. All sutures are tied with the shoulder held in the "zero-position" to relax the latissimus dorsi. Wounds are closed and subsequently a thoraco-brachial plaster spica is applied with the limb in the scapular plane abducted to 90°, elbow flexed and hand at the level of the mouth. Special care is taken to check the position. Deviation of the head is likely to occur if the humerus is not kept strictly in the scapular plane with consequent post-operative subluxation and fixation of the head in the new position.

Post-operative Management and Complications

The shoulder spica, renewed after removal of the sutures on the 10th day, is kept for 4–5 weeks. Rehabilitation exercises are given for recovery of function. None of my patients had any guidance from an organised physiotherapy and rehabilitation centre. Complete recovery of function followed; the shortest within a period of 3 weeks and the longest in about 10 weeks.

The complications of the operation were confined to the first ten cases. All of them were immobilised in "zero-position", a postition which was later found to require utmost care in follow-up by skiagraphy. Even the slightest deviation of the limb from the scapular plane may cause anterior subluxation. This happened in two of my cases and remained unnoticed during the period of immobilisation. They have been graded as "poor" after subsequent management.

Recently we have started immoblising the limb either hanging or in 90° abduction (vide supra). Post-operative functional recovery time is longest in the hanging group, intermediate in the group treated in 90° abduction and minimum in those treated in the "zero-position".

Other complications encountered were transient palsy of radial nerve in one case, paresis of the posterior fibres of deltoid in one and occasional pain in four. Scrupulous adherence to technique is the best prevention apart from the last mentioned complication.

RESULTS

Results were classified under four headings:

1. *Excellent* – Painless, full range of movements, scapulo-humeral rhythm comparable with the sound side (with elevation), no recurrence,

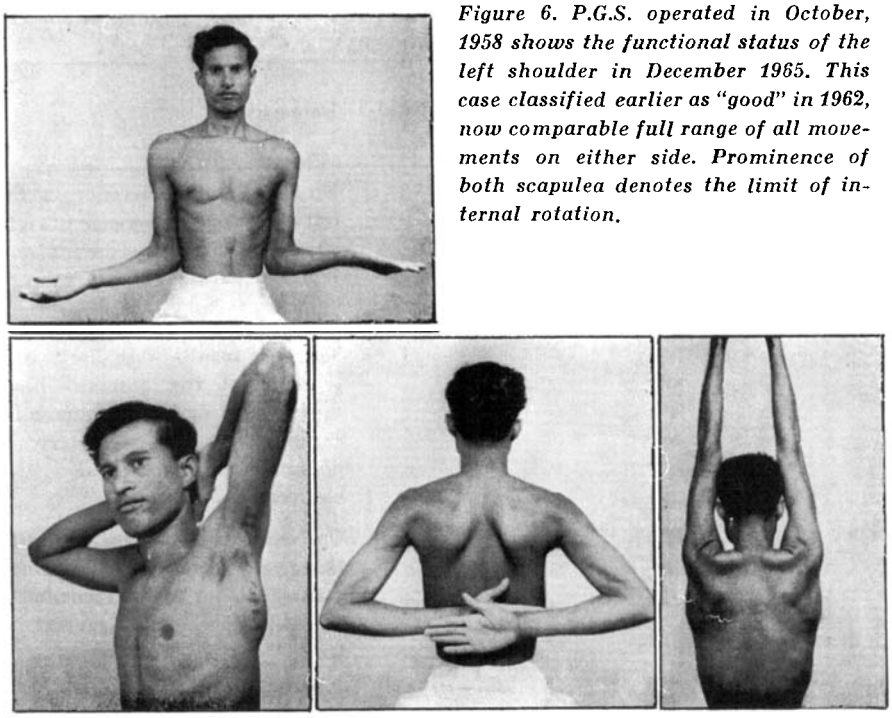


Figure 6. P.G.S. operated in October, 1958 shows the functional status of the left shoulder in December 1965. This case classified earlier as "good" in 1962, now comparable full range of all movements on either side. Prominence of both scapulea denotes the limit of internal rotation.

normal activity including all types of games, swimming and wrestling. Different surgical groups including visitors from other countries could not correctly identify the side of operation on clinical examination in these cases when lightly dressed.

2. *Good* – Painless, just clinically discernible restriction of rotation in one or both directions (10 per cent or less), normal scapulo-humeral rhythm with elevation, no recurrence and normal activity including all games as in 1 (Figure 6).

3. *Fair* – Occasionally painful, restriction of rotation by over 10 per cent but below 50 per cent, no recurrence and slight disturbance of scapulo-humeral rhythm though the vertical elevation is full. Normal activity including all games as in 1.

4. *Poor* – Painful, gross restriction of movements, head of the humerus may not be in the socket, activities restricted to a varying degree.

45 cases including three epileptics with bilateral affection were operated on during last ten years from 1956–1965. The first of the three epileptics had Banker's operation on the right in 1955, *i.e.*, a year be-

Table 2.

Year of operation	Excellent	Good	Fair	Poor	Total	Remarks
1956	1				1	No pain and recurrence in the left shoulder. Recurrence in right shoulder, dislocates during epileptic seizures.
1957						
1958	2			2	4	The poor results were due to dislocation of the humeral head during post-operative immobilisation. They had secondary operations for functional recovery.
1959	5				5	One case developed epileptic fits three years after operation, since controlled, but has no recurrence. He had apprehension several times.
1960	2	2			4	Apprehension thrice during wrestling after the operation. He needed reassurance before he joined the army.
1961	5	3			8	One case had apprehension twice shortly after operation though he now engages in all types of games including fast bowling, golf and swimming without recurrence or apprehension.
1962	6	1			7	
1963	5				5	The epileptic case had only operation on the left side.
1964	2	1			3	
1965	7	1			8	The epileptic case had operation on the left side.

fore the latissimus dorsi transfer on the left. The other two had operations only on the left, the worse of the two sides. All the cases were followed up till the end of 1965 when 35 cases were excellent, 8 good and 2 poor. The two cases of poor results were the second and the fifth of the series. Faulty post-operative management in the "zero-position"

without radiological check up was responsible. They required surgery to make them reasonably fit for work. It will be seen that not a single case came under the grade 'fair'. The very few best results of personal cases of Bankart's and Putti-Platt operations done before 1956 satisfied the criteria of "fair" results in this table.

Two of these cases with right sided anterior recurrent dislocation graded as excellent complained of occasional apprehension during games and wrestling. They required firm reassurance. One of them is at present a combatant army officer and the other, a covenanted officer in a British firm. Both of them engage in all types of games and swimming and the army officer in wrestling as well. One case who had epileptic fits three years after the operation had apprehension several times and is now fully cured both of epilepsy and apprehension.

SUMMARY

There is no single constant pathologic-anatomical change in anterior recurrent dislocation of the shoulder which could be attributable as the cause of recurrence. The changes are the effects rather than the cause.

The aetiology of anterior recurrent dislocation has been described on the basis of the newer concepts of the shoulder mechanism. The mechanism of dislocation in paralytic, post-traumatic and spontaneous cases is dependent on the predominance of one or more of the causes responsible for the recurrence.

45 consecutive cases of post-traumatic and spontaneous anterior recurrent dislocation treated by posterior transfer of latissimus dorsi over a period of ten years are reported. 35 cases show excellent, 8 good and 2 poor results. None of them had recurrence.

RESUME

Il n'y a pas une seule modification anatomique pathologique constante dans la dislocation antérieure récidivante de l'épaule qui puisse être attribuée à une cause récidivante. Les modifications sont plutôt des effets que des causes.

L'étiologie de la dislocation antérieure récidivante a été décrite sur la base de conceptions nouvelles du mécanisme de l'épaule. Le mécanisme de la dislocation dans les cas paralytiques, post-traumatiques et spontanés dépend de la prédominance de l'une ou l'autre des causes responsables de la récidive.

Il est rapporté 45 cas consécutifs à une dislocation antérieure récidividante post-traumatique ou spontanée traités par transfert postérieur du grand sorsal au cours d'une période de dix ans. 35 cas ont donne d'excellents résultats, 8 de bons résultats et 2 des résultats médiocres. Il n'y a pas eu de récidive.

ZUSAMMENFASSUNG

Es gibt keine konstanten pathologisch-anatomischen Veränderungen, die als Grundlage der Dislocatio humeroscapularis anterior habitualis angeführt werden können. Die anatomischen Veränderungen sind eher als Folge und nicht als Ursache der Dislocation zu bezeichnen.

Die Aetiologie der Verrenkung wird vom Verfasser auf der Basis einer neuen Konzeption des Mechanismus des Schultergelenkes beurteilt. Der Verrenkungsmechanismus der paralytischen, der post-traumatischen und der spontan auftretenden Verrenkungen ist vom Vorhandensein einer oder mehrerer Ursachen abhängig.

45 Fälle von posttraumatischen sowie spontan auftretenden Verrenkungen wurden während einer 10-jährigen Epoche durch hintere Transplantation des Musculus latissimus dorsi behandelt. In 35 Fällen waren die Ergebnisse ausgezeichnet, in 8 Fällen gut und in 2 Fällen schlecht. Keine Rückfälle wurden beobachtet.

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