

Long-term outcome of Rockwood capsular shift for recurrent shoulder dislocation

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ABSTRACT

Purpose. To review the long-term outcome of Rockwood capsular shift for recurrent shoulder dislocation secondary to trauma.

Methods. Records of 30 males and 4 females who underwent Rockwood capsular shift for recurrent (≥ 2 episodes) anterior shoulder dislocation were reviewed. An additional Bankart repair with different techniques was performed in 24 of the patients by 2 different surgeons. The outcome was assessed using the Western Ontario Shoulder Instability Index (WOSI) and the Western Ontario Osteoarthritis of the Shoulder (WOOS) index questionnaires, the modified Rowe score, and the Constant-Murley score. Shoulder range of motion (ROM) was measured. Degenerative joint changes were evaluated on radiographs.

Results. During a mean follow-up of 13 (range, 10–16) years, 6 (18%) patients had a mean of 1.2 recurrent dislocations. Four of the patients reported a traumatic event during recurrent dislocation. Of the 6 patients, 3 had undergone a Bankart lesion repair. Better Rowe

and adjusted Constant scores were associated with lower age at first dislocation, at the index surgical procedure, and at follow-up. Four patients developed glenohumeral osteoarthritis: 2 were mild or moderate and 2 were severe and symptomatic. Glenohumeral osteoarthritis was associated with follow-up duration ($p=0.03$) and poorer Rowe score ($p=0.012$), adjusted Constant score ($p=0.001$), and WOOS score ($p=0.006$). **Conclusion.** Rockwood capsular shift can preserve shoulder ROM, with rates of recurrent dislocation and degenerative joint changes comparable with other techniques.

Key words: shoulder dislocation; treatment outcome

INTRODUCTION

The rate of recurrent anterior shoulder dislocation after surgery varies from 0% to 57% in the long term. It can be due to inappropriate patient selection, unrecognised or underestimated pathological changes (such as bony Bankart lesions or large Hill-Sachs defects), incongruous surgical

technique, previous surgeries, poor compliance with rehabilitation, younger age at surgery, high functional demands, and early return to contact sports.¹⁻⁵ The rate of glenohumeral osteoarthritis ranges from 10% to 100% when treated with surgery, and up to 60% when treated conservatively over a 25-year period.⁶⁻⁸ Rockwood capsular shift combined with Bankart repair is a viable treatment option.⁹ This study reviewed the long-term outcome of Rockwood capsular shift for recurrent shoulder dislocation secondary to trauma.

MATERIALS AND METHODS

Records of 30 males and 4 females who underwent Rockwood capsular shift for recurrent (≥ 2 episodes) anterior shoulder dislocation between 1993 and 1999 were reviewed. An additional Bankart repair with different techniques was performed in 24 of the patients by 2 different surgeons specialised in shoulder surgery. Patients with multidirectional instability, voluntary dislocation, previous surgery on the affected shoulder, signs of glenohumeral osteoarthritis, associated rotator cuff tear, or superior labral tear from anterior to posterior were excluded, as were patients with a bony Bankart lesion who were treated with bone block procedures.

Patients were asked to complete the Western Ontario Shoulder Instability Index (WOSI) and the Western Ontario Osteoarthritis of the Shoulder (WOOS) index questionnaires.^{10,11} Two independent assessors evaluated the functional outcome using the modified Rowe score^{12,13} and the Constant-Murley score.¹⁴ Strength was measured using an electronic dynamometer, and shoulder range of motion (ROM) using a goniometer.

Seven of the patients were available for interview through telephone only, and in 4 of them preoperative Constant score and Rowe score were not assessed.

The anterior/posterior drawer test and the sulcus sign were used to assess residual laxity, which is defined as looseness of passive shoulder stabilisers.¹⁵ Apprehension was tested by stressing the shoulder in external rotation at 90° of abduction and with the relocation test.¹⁶ The Brighton criteria were used to evaluate general joint laxity.¹⁷ Degenerative joint changes were evaluated on radiographs.⁶

Surgery was via a deltopectoral approach. The clavipectoral fascia was divided vertically along the lateral border of the conjoined tendon and the superior 2/3 of the subscapularis tendon was transected with an L-shaped incision, staying 2 to 3 cm medial to the bicipital groove. The tendon was

carefully separated and reflected off the underlying capsule. Three or 4 stay sutures were passed in the medial edge of the tendon and the inferior intact third of the subscapularis tendon was bluntly separated from the capsule. The capsule was divided vertically, midway between its attachment on the glenoid rim and the humeral head, all the way down to the axillary pouch. By placing a humeral head retractor, the joint was carefully explored. If a Bankart lesion was present, the capsulolabral complex was repaired to the decorticated glenoid rim by means of transosseous sutures or suture anchors before performing the capsular shift. Absorbable horizontal sutures were placed in the medial aspect of the capsule, inferior to superior. The medial capsular edge was then shifted laterally and superiorly and sutured under the lateral aspect of the capsule in order to double-bread it. The extent of the antero-inferior capsular laxity determined the degree of imbrication necessary to reduce the glenohumeral joint volume. In patients with severe antero-inferior capsular laxity, the medial aspect of the capsule was shifted 10 to 15 mm medially and superiorly and imbricated for a distance of 15 to 20 mm by the lateral aspect of the capsule. The lateral stump of the capsule was double-breasted by taking it medially and superiorly and suturing it down to the anterior surface of the medial aspect of the capsule. All sutures were placed and tied with the arm held in 20° to 25° of external rotation and 20° to 30° of abduction. The subscapularis was repaired with strong non-absorbable sutures avoiding any shortening of the tendon. The subcutis and skin were closed without leaving any drain in the wound.

Postoperatively, gentle pendulum exercise and passive flexion exercise up to 90° in the supine position were allowed on day 1. A sling was applied for 4 weeks, after which stretching exercises in all planes and light activities of daily living were allowed. At about 6 to 8 weeks after reaching a functional ROM, strengthening exercises for the deltoid, rotator cuff muscles, and scapula-stabilising muscles were started using a rubber band. Competitive sports or maximal effort was not allowed until full recovery of motion and strength; this usually occurred at 6 to 8 months.

The 2-tailed paired *t*-test was used to compare baseline and follow-up ROM and the Rowe and Constant scores. The 2-tailed 2-sample *t*-test was used to compare ROM and the Rowe and Constant scores in patients with or without capsulolabral repair, and in patients with or without glenohumeral osteoarthritis.^{18,19} The 2-tailed Fisher's exact test was used to compare the recurrence rate and apprehension test in patients with or without capsulolabral repair and to determine the association between residual

instability and degenerative changes. Linear regression was used to determine the association between Rowe and Constant scores and age at surgery, age at follow up, number of dislocations before surgery, delay from first dislocation to surgery, or length of follow-up. A *p* value of <0.05 was considered statistically significant.

RESULTS

During a mean follow-up of 13 (range, 10–16) years, 6 (18%) patients had a mean of 1.2 (SD, 0.45; range, 1–2) recurrent dislocations within a mean of 8 (SD, 4; range, 2–13) years (Table 1). Four of the patients reported a traumatic event during recurrent dislocation. Of the 6 patients, 3 had undergone a Bankart lesion repair. No patient underwent further surgical procedures for recurrent dislocation. No patient fulfilled the Brighton criteria for benign joint hypermobility or had a Beighton score ≥ 4 . All other patients could return to their sporting activities at the same recreational level, with significantly improved shoulder ROM, Rowe

and Constant scores, and WOSI and WOOS scores (Tables 2 to 4).

Of 27 patients evaluated at follow-up using the apprehension test, 9 were positive. Five of whom had recurrent dislocation, and 2 of the 5 had symptoms daily and/or during sport activities. Patients without a Bankart repair had a higher rate of positive apprehension test (6/9 vs. 3/18, *p*=0.026).

In regression analysis, better Rowe and adjusted Constant scores, respectively, were associated with lower age at first dislocation (*r*=-0.47, *p*=0.016; *r*=-0.52, *p*=0.005), at the index surgical procedure (*r*=-0.39, *p*=0.040; *r*=-0.50, *p*=0.008), and at follow-up (*r*=-0.40, *p*=0.038; *r*=-0.52, *p*=0.005).

Of 27 patients evaluated radiologically at follow-up, 4 developed glenohumeral osteoarthritis: 2 were mild or moderate without any limitation in daily activities or shoulder pain and 2 were severe and symptomatic, one of whom occurred bilaterally and the non-operated shoulder presented with a massive rotator cuff tear without any dislocation (Table 5). Glenohumeral osteoarthritis was associated with longer follow-up (13.5 vs. 12.4 years, *p*=0.026) and poorer Rowe score (67.6 vs. 94, *p*=0.012), adjusted Constant score (65.5 vs. 96, *p*=0.001), and WOOS score (75% vs. 83%, *p*=0.006) [Table 6].

Table 1
Patient characteristics

Parameter	Mean±SD (range) or no. (%) of patients
No. of females:males	4:30
Follow-up duration (years)	13±2 (10–16)
Age at primary dislocation (years)	22±9 (11–57)
Age at surgery (years)	27±11 (15–62)
Age at follow-up (years)	39±12 (27–73)
Delay from the first dislocation to surgery (years)	5±4 (0.3–20)
No. of dislocations before surgery	10±9 (3–50)
Patients with additional Bankart repair	24 (71)
Patients involved in recreational sports	7
Tennis	3
Volleyball	2
Triathlon	1
Climbing	1

DISCUSSION

The Rockwood capsular shift is an anatomic procedure and stabilises the shoulder through reinforcement of the capsule by a double-breasting imbrication technique. It can be combined with a Bankart repair if capsulolabral detachment is present. This reconstruction is a modification of the Putti-Platt, Bankart, and Neer capsular shift procedures.¹⁹ One drawback of any capsular shift is the loss of ROM, particularly external rotation.²⁰ The mean loss of external rotation has been reported to be 13.8° (range, 0°–24°)⁸ and 7°,⁹ whereas in our patients, no significant loss of ROM was detected after 13 years. Complete recovery of ROM after capsulolabral

Table 2
Shoulder range of motion of the operated versus contralateral side in 27 patients*

Side	Forward elevation (degrees)		External rotation (degrees)		Internal rotation (vertebra)	
	Preop	Follow-up	Preop	Follow-up	Preop	Follow-up
Operated	155±25 (95–180)	173±26 (45–180)	54±24 (0–100)	58±27 (0–90)	T7±4 (S–T2)	T7±5 (S–T1)
Contralateral	161±18 (110–180)	175±26 (45–180)	61±17 (35–100)	59±22 (5–90)	T5±3 (T1–T11)	T6±5 (S–T1)

* Data are presented as mean±SD (range)

Table 3
Rowe score and Constant score in 27 patients with pre- and post-operative data available*

	Preop (n=27)	Postop (n=27)	p Value
Rowe score	55.6±15.5	91.5±14.7	<0.001
Rowe score distribution			
Excellent (90–100)	0 (0)	20 (74)	
Good (75–89)	7 (26)	4 (15)	
Fair (51–74)	13 (48)	2 (7)	
Poor (≤50)	7 (26)	1 (4)	
Item of Rowe score			
Stability	20.0±10.9	44.1±10.8	<0.001
Range of motion (degrees)	19.6±1.4	18.1±4.2	>0.05
Function	16.1±10.1	29.3±1.8	<0.001
Constant score	76.2±13.2	84.8±15.8	0.04
Adjusted Constant score (%)	82.8±14	91.9±10	0.035

* Data are presented as mean±SD or no. (%) of patients

Table 4
Western Ontario Shoulder Instability (WOSI) score and Western Ontario Osteoarthritis of the Shoulder (WOOS) score in 34 patients

Scoring system	Maximum score*	Mean (range) raw score	Mean±SD %†
WOSI score (n=34)			
Total	2100	370 (52–1635)	82±15
Physical symptoms	1000	160 (19–805)	84±16
Sport/recreation/ work	400	76 (5–326)	81±19
Lifestyle	400	89 (0–307)	78±22
Emotion	300	45 (0–197)	84±14
WOOS score (n=34)			
Total	1900	340 (47–1211)	82±14
Physical symptoms	600	140 (15–513)	77±19
Sport/recreation/ work	500	98 (9–256)	81±14
Lifestyle	500	66 (0–310)	87±18
Emotion	300	44 (0–197)	85±14

* Best score is 0

† Percentage is equal to [(maximum score – mean score) / maximum score] x100

Table 5
Glenohumeral osteoarthritis at follow-up in 27 patients

Glenohumeral osteoarthritis (Samilson-Prieto grade)	No. (%) of patients	
	Operated side	Contralateral side
No (0)	23 (85)	26 (96.3)
Mild (1)	1 (3.7)	0 (0)
Moderate (2)	1 (3.7)	0 (0)
Severe (3)	2 (7.4)	1 (3.7)

reconstruction has been reported.⁴ After a T-based capsular shift, the ROM was even improved in some planes.⁵ In our patients, apprehension and discomfort of the shoulders may have resulted in underestimation of the preoperative ROM. The reflex activation of the rotator cuff due to muscular strain and the onset of apprehension during manipulation can limit active and passive ROM.²¹ ROM assessment under anaesthesia could have been useful.²² Functional decline in the glenohumeral joint secondary to immobilisation is reversible.²³ Although the potential gain in ROM after a capsular shift is not yet known, adaptation of the soft tissues may play a role in recovering full ROM in the long term. Anatomic reconstruction of the subscapularis tendon, as with the Neer and Rockwood techniques, is more favourable for ROM recovery than techniques that rely on mediolateral soft tissue tightening (Putti-Platt) or subscapularis retensioning (Magnuson-Stack).^{1,3}

The rate of recurrent dislocation has been reported to be 0% to 57%. Predictors for recurrence include voluntary instability, previous surgical procedures, age at the time of surgery, the presence of labral tears and bone lesions (e.g. Hill-Sachs or bony Bankart lesion), and patient's functional demands.^{1–5} The type of surgical repair is also a predictor for recurrence; an arthroscopic approach is largely preferred, but it remains debatable whether an arthroscopic or open technique achieves better stability and functional outcome.²⁴ Younger patients have a higher rate of recurrence after a traumatic dislocation,^{25,26} probably because they are more likely to have Bankart lesions and higher functional demand (sport activities).²⁷

Many patients modify their lifestyle and lower their functional demands. Strengthening exercises for the rotator cuff improve glenohumeral stability in mid-range positions where most daily activities are performed. In end-range positions, the cuff is less effective in stabilising the shoulder, and the capsulolabral complex acts as a main stabiliser.²⁸ Physiotherapy is important to achieve good outcome.²⁹

Additional Bankart repair may be associated with a lower rate of recurrent dislocation. Anchor positioning, particularly farther medial placement on the scapular neck, can prevent the bump effect and result in complete recovery of the soft tissue.^{30,31} Furthermore, even with proper positioning of the anchors, whether the soft tissue heals with appropriate tension cannot be verified, and a repaired labrum could have not been the same mechanical properties as a static shoulder stabiliser in non-injured shoulder.

The high ROM and arm position in the scale of the Constant score can bias the evaluation of instability,

Table 6
Association of glenohumeral osteoarthritis with follow-up duration and outcome*

Variable	Patients without glenohumeral osteoarthritis (n=23/27)	Patients with glenohumeral osteoarthritis (n=4/27)	p Value
Follow-up (years)	12.4±1.77	13.5±0.6	0.026
Rowe score	94±12.3	67.6±11.8	0.012
Adjusted Constant score (%)	96±10.9	65.5±7.51	0.001
Western Ontario Osteoarthritis of the Shoulder score (%)	83±11.8	75±2.5	0.006
Western Ontario Shoulder Instability score (%)	83.9±10.9	62.4±28.0	0.222

* Data are presented as mean±SD

which usually does not impair ROM. The Rowe, Constant, WOSI and WOOS scores in our patients were comparable with those repaired by other techniques.^{1,3} Severe rotator cuff injury occurs more frequently in elderly patients and results in poorer clinical outcome.^{24,32}

The rate of shoulder osteoarthritis ranges from 39% to 60% in the long term after conservative treatment and from 9.7% to 100% (mean, 60%) after different surgical techniques.^{1,3,7,8,11,33} The rate was 17% at 4 years after Neer capsuloplasty,¹ whereas it was 68% at 13 years after arthroscopic Bankart repair; nonetheless their clinical outcome was comparable with patients with no signs of osteoarthritis.³³ A large percentage of mild and moderate dislocation arthropathy cannot be detected when only clinical assessment is used in the absence of radiography.³⁴ Factors that contribute to glenohumeral osteoarthritis include the age of the patient at the time of initial dislocation and surgery, the delay between the first dislocation and operation, the presence of a bone lesion, the encroachment on the articular cartilage by hardware, the number of anchors and excessive anterior soft tissue tension after repair. The Rockwood capsuloplasty provides reinforcement of the anteroinferior capsule without any shortening of the subscapularis tendon, in order to avoid an overload of the articular surfaces caused by excessive restriction of motion. Osteoarthritis usually progresses with

time with a consequent higher rate after longer follow-up. Suture anchors or transosseous sutures can jeopardise the integrity of the articular surfaces by direct encroachment.⁷ Capsulolabral repair can increase ROM restriction.

There were limitations to our study. It was a retrospective case series without controls, and thus prone to selection bias. The retrospective nature added an element of uncertainty regarding the circumstances and energy of primary dislocation and the number of dislocations. Magnetic resonance imaging or computed tomography was not used for assessment. Their use could have improved the sensibility in detecting degenerative joint changes. The Constant-Murley score is inadequate for evaluation of instability. Nonetheless, it is one of the most commonly used shoulder scores and has been used to enable comparison of studies.^{35,36}

CONCLUSION

Rockwood capsular shift can preserve shoulder ROM, with rates of recurrent dislocation and degenerative joint changes comparable with other techniques.

DISCLOSURE

No conflicts of interest were declared by the authors.

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