Long-term outcome of a transglenoid suture technique for anterior shoulder instability in young adults

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We reviewed the outcome of arthroscopic stabilisation of anterior glenohumeral instability in young adults using the transglenoid suture technique. A questionnaire was sent to 455 consecutive patients who had undergone this procedure between 1992 and 2000. Of these, 312 patients (68.5%) with 313 affected shoulders and a mean age of 20 years (18 to 28) responded.

Outcome was determined by the number of re-dislocations or, in patients who had not re-dislocated, by the disease-specific quality of life as measured by the Western Ontario Shoulder Instability index. During a mean follow-up of 6.4 years (1 to 14), 177 patients (56%) sustained a re-dislocation, including 70 who required a further operation. In 136 patients (44%) who reported neither re-dislocation nor re-operation, the index scores were good (median 90.4%; 28.9% to 100%). No significant peri- or pre-operative predictors of re-dislocation or re-operation were found.

We found a high rate of re-dislocation after transglenoid suture repair in young, physically active patients.

Traumatic anterior dislocation of the shoulder is a common injury. Its lifetime prevalence is estimated to be 2% in the general population¹ and 7% among athletes.² The risk of recurrent dislocation after primary trauma in individuals under 30 years of age has ranged from 26% to 90% after non-operative treatment³⁻⁵ and from 13% to 50% after operative treatment.⁵⁻⁸ The common findings at arthroscopy of the glenohumeral joint after the first anterior dislocation include haemarthrosis, a Hill-Sachs lesion, a Bankart lesion, a bony Bankart lesion, loose bodies, synovitis, a rotator cuff tear, humeral avulsion of the inferior glenohumeral ligament and a capsular tear.^{5,9,10}

Various methods of surgical treatment are available, which include both open and arthroscopic techniques. Most of these focus on repair of the anterior capsulolabral complex, which is the principal passive anterior stabiliser of the shoulder.¹¹ An arthroscopic transglenoid suture technique, also known as the Caspari technique, has been used since 1988.¹² The rate of recurrence of dislocation after operative treatment by this method ranges between 0% and 49%.¹³ Previous studies of this technique have usually included only a small number of patients followed up for a short time. The few studies

with a follow-up of more than five years had small numbers of patients.^{6,8} Transglenoid suture repair allows tightening of the anterior capsule and re-attachment of the capsulolabral complex. However, the technique has received criticism because the capsulolabral complex may be attached too medially to the glenoid rim instead of in its normal anatomical location,⁶ which may lead to a reduction in the effective depth of the glenohumeral cavity.¹⁴ As the infraspinatus muscle is expanded by irrigation fluid during arthroscopy, there is a risk of loose fixation of the sutures.¹⁵ Furthermore, drilling a hole through the neck of the scapula may damage the suprascapular nerve, in between 1.5% and 6% of cases.^{7,16}

A recent meta-analysis investigating whether arthroscopic stabilisation was as effective as open surgery suggested that the failure rate using transglenoid sutures was higher than that using either open surgery or arthroscopic stabilisation using suture anchors or bioabsorbable tacks.¹⁷

The aim of this study was to assess the outcome of the transglenoid suture technique for anterior glenohumeral instability in a young adult population based on the recurrence of dislocation and the number of re-operations undertaken.

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Patients and Methods

In Finland, military service is compulsory for all men, but voluntary for women. Over 80% of men with a mean age of 20 years (18 to 29) complete a period of service of six to 12 months.¹⁸ Between 1992 and 2000 the number of conscripts starting their service each year varied between 20 600 and 30 500.

We studied 455 consecutive military conscripts (449 men, 6 women) who underwent the transglenoid suture technique for first-time or recurrent anterior glenohumeral instability. After emergency care at a civilian hospital, these patients are always transferred to a military hospital. They were identified by a search of the medical records of the hospital between 1992 and 2000, using the appropriate diagnostic codes from the ninth and tenth revisions of the International Classification of Diseases.¹⁹ The inclusion criteria were a traumatic anterior dislocation of the shoulder and/or a post-traumatic recurrent dislocation stabilised arthroscopically using the transglenoid suture technique. Patients with a posterior dislocation, multidirectional instability, a previous stabilising operation on the same shoulder or operation for reasons other than instability were excluded. The study was approved by the Medical Ethics Committee of our hospital.

All 455 patients who met the inclusion criteria and underwent surgery between 1992 and 2000 were sent a questionnaire in 2005. Three further questionnaires were sent to non-respondents. Altogether, 312 patients with 313 operated shoulders responded, a response rate of 68.5%. At operation 308 patients (98.4%) were male with a mean age of 20 years (18 to 28). The most common cause of the initial shoulder dislocation was a sports injury which occurred in 302 patients (97%).

The outcomes assessed were recurrent anterior dislocation and the number of re-operations due to glenohumeral instability during follow-up. Both were thought to be due to failure of the primary operation. In patients who had not redislocated or required a further operation the disease-specific quality of life was measured using the Western Ontario Shoulder Instability Index,¹ which is a reliable method of assessing patients with either anterior or posterior instability.²⁰ It measures four domains: physical symptoms, and pain, sports, recreation and work function, lifestyle and social function, and emotional well-being. A 100 mm visual analogue scale (VAS) where 0 = no pain and 100 = the worst pain and/or disability was used to determine the degree of pain and/or disability experienced by patients in the two weeks before answering the questionnaire. The results were used as outcome variables to describe the function of the operated shoulder. After subtracting the sum score for each patient from 2100 (21 variables each with maximum value of 100) the resulting value was given as a percentage with a higher percentage indicating a better outcome. Patients were questioned about dislocations before and after surgery, re-operations and treatment in other hospitals after their military service. The appropriate medical records were retrieved for review and analysis.

Table I. Characteristics of the patients at the time of surgery

Characteristics	Mean (range)
Age in yrs (mean, range)	20 (18 to 28)
Height in cm (mean, range)	179 (162 to 197)
Weight in kg (mean, range)	77 (55 to 120)
Number of dislocations before operative treatment (%)	
1 to 5	154 (49)
6 to 10	28 (9)
11 to 20	102 (33)
> 20	2 (1)
Missing	27 (8)
Bankart lesion n (%)	272 (87)
Hill-Sachs lesion n (%)	300 (96)

Follow-up continued until either re-dislocation, re-operation for glenohumeral instability or 31 December 2005. Re-operation was defined as further surgery after re-dislocation of the same shoulder. When asked about the year of dislocation, 81 patients (26%) were unable to recall the event.

Table I gives the characteristics of the patients at the time of surgery. The median time between initial dislocation and surgery was 17 months (0 to 200). The right shoulder was involved in 164 cases.

Operative technique. Each operation was performed by one of five senior orthopaedic surgeons (TIV, HKP, OK, V-MN, PJ) using the arthroscopic transglenoid method of suture repair described by Caspari.¹² Under general anaesthesia, the patient was placed in the lateral decubitus position with traction applied to the arm. The posterior portal was used for the arthroscope and the anterior portal for instrumentation. After intra-articular examination and removal of any loose bodies the antero-inferior rim of the glenoid was abraded to expose cancellous bone at the site of reattachment, and a hole was drilled through the neck of the scapula between the 1 and 2 o'clock position for the right shoulder or the 10 and 11 o'clock position for the left. The inferior capsule was detached as necessary. Between three and eight polydioxanone sutures were passed through the labrum and the anterior capsule and then through the drill hole into the posterior scapula. At this stage the traction was released, the sutures were tightened, and the position of the labrum assessed. Knots were tied over the fascia on the dorsal side.

A sling was used for two to four weeks, after which the patients began physiotherapy. The shoulder was gradually mobilised, with a return to all sport activities within three months.

We then determined the number of re-dislocations and re-operations due to glenohumeral instability, analysed the predictors of re-dislocation or re-operation, and evaluated the outcome of the operation.

For statistical analysis, the *t*-test was used for continuous unskewed data, the Mann-Whitney U test for skewed contin-

Table II. Predictors of poor outcome after surgery using a transglenoid suture technique

	Shoulders with re-dislocation or re-operation (%)	Shoulders without re-dislocation or re-operation (%)	p-value*
	Number of shoulders (%)	Number of shoulders (%)	
General laxity			
No	135 (78.9)	117 (86.7)	0.12
Yes	36 (21.1)	18 (13.3)	
IUA [†]			
None	100 (71.9)	104 (80.6)	0.32
Subluxation	24 (17.3)	18 (14.0)	
Luxation	11 (7.9)	5 (3.9)	
Number of sutures			
1	0 (0)	1 (0.8)	0.60
2	2 (1.4)	2 (1.5)	
3	9 (6.3)	7 (5.3)	
4	40 (27.8)	25 (19.1)	
5	46 (31.9)	51 (38.9)	
6	30 (20.8)	24 (18.3)	
7	14 (9.7)	18 (13.7)	
8	3 (2.1)	3 (2.3)	
Number of dislocations			
1 to 5	74 (53.6)	66 (54.1)	0.50
6 to 10	13 (9.4)	12 (9.8)	
11 to 20	51 (37.0)	42 (34.4)	
> 20	0 (0)	2 (1.6)	
Contralateral shoulder laxity			
No	115 (76.2)	117 (86.7)	0.023
Yes	36 (23.8)	18 (13.3)	
Delay to surgery in yrs (mean)	1.9 (0 to 17)	1.9 (0 to 15)	0.68

* the p-values refer to the differences between the two groups. Chi-squared test

[†] IUA, instability under anaesthesia

uous data, and the Kruskal-Wallis test for skewed continuous data between more than two groups. Correlation coefficients were calculated to determine the degree of association between continuous variables. The statistical difference between two independent groups was set to $p = 0.05$. (SPSS Statistical Software, SPSS Inc., Chicago, Illinois) was used. The chi-squared test was used with two-way tables.

Results

After a mean follow-up of 6.4 years (1 to 14), 177 (56.5%) shoulders had a poor outcome and 136 (43.5%) a good outcome with neither re-dislocation nor re-operation. The poor outcomes comprised 107 (34.2%) re-dislocations and 70 (22.4%) re-operations for instability. Of these latter patients, two underwent further surgery on three occasions, six on two occasions and 62 once. The re-dislocations resulted from sports or falling from a height in 41 patients (38%), and from a sudden movement of the shoulder in 50 (47%). In 16 patients (15%) the re-dislocation had been non-traumatic, such as during sleep.

The median time from primary operation to re-dislocation was three years (1 to 13), and to re-operation 3.5 years (1 to 14). Of the re-operations, 22 were carried out within a year of the original procedure.

The association between several variables and re-dislocation was analysed (Table II). No relationship was found between re-dislocation during follow-up and the operating surgeon ($p = 0.41$, chi-squared test). None of the pathological findings noted during arthroscopy correlated with re-dislocation.

The outcome of surgery was analysed only in the 136 shoulders without re-dislocation or re-operation. The median Western Ontario Shoulder Instability index score was 90.4% (28.9% to 100%). There was no statistical difference in the results of the Western Ontario Shoulder Instability index scores for the five operating surgeons ($p = 0.62$, Kruskal-Wallis), and no correlation ($r = -0.043$) between the time from first dislocation to repair and residual symptoms ($p = 0.67$, correlation test). The pathological findings revealed during arthroscopy did not correlate with the Western Ontario Shoulder Instability index outcome.

The number of pre-operative dislocations was not associated with residual symptoms in patients who had not sustained a dislocation during the follow-up period ($p = 0.94$, Kruskal-Wallis). However, dislocation in the contralateral shoulder was associated with an increase in post-operative symptoms (median Western Ontario Shoulder Instability score 79% (57% to 99%); $p = 0.02$, Mann-Whitney U test). Although there was a reduction in symp-

toms with increasing length of follow-up, it did not reach statistical significance ($p = 0.54$, Mann-Whitney U test). There was no difference in outcome between patients who underwent surgery within three months of the initial dislocation and those whose surgery was delayed for more than three months ($p = 0.42$, Mann-Whitney U test).

There were 30 (9.6%) minor post-operative complications: 27 (8.6%) local skin irritations and/or suture infections and three (0.9%) transient nerve lesions. All complications resolved eventually unremarkably with conservative treatment. The only intra-operative complication was a rupture of one or more sutures in 13 patients (4.1%).

Discussion

Traumatic anterior dislocation of the shoulder is a common injury in young adults. The rate of recurrence is up to 100% in those treated conservatively.²¹ It has been suggested that young patients should undergo a stabilisation operation after the first traumatic dislocation.^{10,22} Some risk factors for the development of recurrent instability after arthroscopic stabilisation using suture anchors have recently been proposed as an instability severity index score.²³

We have investigated the outcome of the transglenoid suture technique in young active patients. Because the data for recurrence were based on patient questionnaires, their validity can be questioned, but as all had suffered at least one anterior dislocation before the arthroscopic repair, they could be expected to recognise a recurrent dislocation.

The number of re-operations depended on the symptoms experienced after re-dislocation, the expectations of the patient and the availability of surgery. Overall, we considered the rate of recurrent dislocation to be a better indication of the outcome of operative treatment than the rate of re-operation.

Recurrent dislocation or instability occurred in 177 patients (57%). Previous reports of this technique have described recurrence in between 0% and 49%.^{6-8,13,16,24,25} Our study has the largest number of patients and longest follow-up reported so far, and shows that the rate of re-dislocation increases with time. This was also suggested by a recent retrospective study which compared suture anchors with transglenoid sutures.²⁴

There was no association between the intra-operative findings and the risk of re-dislocation. Although the size of the lesion of the glenoid labrum could be correlated with the rate of re-dislocation after transglenoid suture repair in a previous study,²⁶ no such finding was seen in our study. Previous evidence indicating that the age of the patient at the time of operation is related to the rate of re-dislocation, with the highest rates observed in patients younger than 22 years,^{6,7,25} was confirmed by our study, where the mean age of the patients was 21.6 years.

The number of polydioxanone sutures used did not correlate with a poor outcome. An experimental study in rabbits with arthritic knees has shown that polydioxanone sutures may lose 60% of their initial strength within three weeks owing to the presence of inflammatory synovial fluids.²⁷ If the initial transglenoid sutures become loose because of the expansion of the infraspinatus muscle with irrigation fluid during arthroscopy,¹⁵ or if they lose more than half of their initial tensile strength over three weeks, the labral attachment will be relatively weak at the time of mobilisation of the shoulder. Kagaya et al²⁸ compared absorbable sutures to absorbable plus non-absorbable sutures in the transglenoid technique. Recurrence of dislocation was higher when only absorbable sutures were used (26% vs 6%).²⁸ Moreover, the effective depth, i.e., the distance from the most lateral extent of the anterior labrum to the medial extent of the glenoid cavity, was smaller after transglenoid suture repair than when using the suture anchor method.¹⁴

Of the re-dislocations in our study, 40 (37%) occurred during sport by the same mechanism that caused the original dislocation. However, in other studies using different repair techniques the re-dislocation rates were lower, even though the patients continued to participate in diverse activities, including both collision and contact sports.^{29,30} It seems evident that the re-dislocations sustained by our patients during sports were the result of a repair that was weaker than that achieved with other techniques. The only factor in our study associated with re-dislocation was the occurrence of dislocation of the contralateral shoulder, a finding that suggests general laxity in these patients.

The subjective outcome was assessed using the Western Ontario Shoulder Instability index questionnaire in those patients who did not re-dislocate. None of the pre-operative or intra-operative variables studied showed any correlation with the Western Ontario Shoulder Instability index scores. The median Western Ontario Shoulder Instability index score was 90.4%, which is similar to that found by Kirkley et al⁸ using the transglenoid suture technique for repair after the initial dislocation. Shoulder function was good in patients who did not re-dislocate. When comparing Western Ontario Shoulder Instability index scores after the repair in our study with those seen after non-operative treatment in a prospective, randomised study,⁸ the scores were higher in the operatively-treated group (90.4% vs 74.8%).

Our results indicate that the risk of redislocation is substantial if anterior glenohumeral instability is treated by transglenoid suture in young adults. The subjective outcome is good if re-dislocation does not occur and the risk of other complications is low. We agree with Mologne et al¹⁶ that this technique should not be recommended for young athletic patients with glenohumeral instability.

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