Revision arthroscopic capsulolabral reconstruction for recurrent instability of the shoulder

From the University of British Columbia, Vancouver, Canada

We have investigated the outcome of arthroscopic revision surgery for recurrent instability of the shoulder after failed primary anterior stabilisation. We identified 40 patients with failed primary open or arthroscopic anterior stabilisation of the shoulder who had been treated by revision arthroscopic capsulolabral reconstruction and followed up for a mean of 36 months (12 to 87). There were 34 men and six women with a mean age of 33.1 years (15 to 48). Details of the patients, the technique of the primary procedure, the operative findings at revision and the clinical outcome were evaluated by reviewing the medical records, physical examination and the use of the Western Ontario shoulder instability index score, the American Shoulder and Elbow Surgeons score and the health status questionnaire 12.

Recurrent instability persisted in four patients after the revision arthroscopic procedure. At the final follow-up, the mean American Shoulder and Elbow Surgeons score was 81.1 (17.5 to 99.5) and the mean Western Ontario shoulder instability index score was 68.2 (20 to 98.2). Quality-of-life scoring showed good to excellent results in most patients.

Arthroscopic revision capsulolabral reconstruction can provide a satisfactory outcome in selected patients for recurrent instability of the shoulder provided that no large Hill-Sachs lesion is present.

Arthroscopic repair for anterior instability of the shoulder is an established method of treatment which yields reproducible results and has a low rate of recurrence.1-7 Historically, the results of arthroscopic stabilisation have not been as reliable as those of open surgery.8-13 However, as a direct result of the developments in arthroscopic equipment, advances in techniques and the growing experience of arthroscopic surgeons, the outcome of arthroscopic stabilisation is now improving.14 Reported rates of recurrent instability for arthroscopic surgery range between 0% and 43%,8-13 but most of these studies date from the early arthroscopic era.

Revision for failure of previous surgery on the unstable shoulder with open procedures, has a rate of failure ranging between 8% and 39%.15-20 Arthroscopic revision is becoming a popular alternative because of the advantages of reduced morbidity, early functional rehabilitation and a potentially improved range of movement.21 In addition, lesions once deemed to be an indication for open surgery are now treatable by arthroscopy. It is the opinion of the authors that sizeable glenohumeral bony defects remain the only absolute contraindication to an arthroscopic approach.

There are few reports of the clinical outcome of arthroscopic revision surgery for failed repair for instability of the shoulder.21-24 The reasons for failure after anterior stabilisation, whether open or arthroscopic, have been reported to include bony defects of the anterior glenoid, capsular redundancy, tears of the lateral capsule and the presence of a new Bankart lesion.15,17,18,25,26

Our aim was to report our experience and evaluate the outcome of our arthroscopic revision technique. In addition, we have attempted to determine which factors, surgical or patient-based, predict a good or poor outcome in order to ascertain which patients are suitable for such revision repairs.

Patients and Methods
We examined the operating records of the two senior surgeons (WDR, JML) and identified 88 patients who had undergone revision arthroscopic capsulolabral reconstruction between 2000 and 2007. A total of 18 patients for whom the arthroscopic procedure was abandoned because of findings of considerable loss of glenoid bone or engaging Hill-Sachs lesions were not assessed further. The criteria used by the senior surgeons to make these
decisions were in accordance with those reported by Burkhart and De Beer.27 Of the remaining 70 patients there were 55 who had undergone primary open or arthroscopic anterior stabilisation or another non-anatomical anterior stabilising operation such as the Magnusson-Stack procedure or thermal capsulorrhaphy, with symptoms of recurrent instability treated by revision arthroscopic capsulolabral reconstruction. However, we excluded 15 more patients, eight who had inadequate medical records and seven who required treatment of other shoulder pathology such as repair of the rotator cuff or stabilisation of the acromioclavicular joint or whose pre-operative diagnosis of instability due to capsulolabral lesions was incorrect and another diagnosis such as a superior labrum from anterior instability due to capsulolabral lesions was made. The purpose of our study was not to assess the outcome of isolated SLAP lesions, although if missed at the initial operation, it is recognised that they may be a cause of failure of the primary stabilisation procedure.

With respect to concomitant pathology, we were able to determine from the records that none of the lesions necessitating exclusion were recognised at the primary procedure and must have occurred in the interval between this operation and presentation for recurrent instability. Therefore 40 patients were eligible for the study.

From the medical records details regarding dominance, previous surgical procedures and a history of recurrent instability were obtained (Table I). The operation notes of the revision procedure were reviewed to determine the findings of examination under anaesthesia, the presence and size of any Hill-Sachs lesion, the number of anchors used and their position on the glenoid rim, whether closure of the rotator interval was performed and whether any chondral degeneration was noted. Of the 40 patients, five were noted to be Workers’ Compensation cases.

Once the patients had been identified, they were contacted and a follow-up visit was arranged. All were evaluated by a single examiner (RVP). They completed the American Shoulder and Elbow Surgeons score (ASES),28 the Western Ontario shoulder instability index29 and the health status questionnaire 12 (HSQ-12) quality-of-life outcome measure.30 The ASES scoring system is a 100-point scale composed of a visual analogue pain score (50 points) and a functional score (50 points). The Western Ontario Shoulder Instability Index is a validated, shoulder-instability-specific outcome scale in the form of a self-administered questionnaire. The HSQ-12 produces a score from 0 to 100 on eight domains as follows: health perception, physical functioning, role limitation due to physical health problems, role limitation due to emotional problems, social functioning, bodily pain, mental health and energy. The higher the score, the better the outcome. There are no scoring algorithms to aggregate the eight domains.

**Radiological assessment.** All the available imaging was reviewed. Investigations were tailored to the patients’ history, clinical presentation and findings. If there was suspicion of an injury to the rotator cuff, a SLAP injury, other intra-articular soft-tissue injury or doubt over the presence of a Bankart lesion, then MRI was requested. This was later superseded by magnetic resonance arthrography because of its greater sensitivity. If loss of glenoid bone was a concern, plain radiographs were obtained which included anteroposterior, lateral and axillary views. This was supplemented by CT if more accurate quantification of loss of glenoid bone was required.

**Operative technique.** All the operations had been undertaken by one of the senior authors. Under anaesthesia the range of movement and the stability of the shoulder were assessed, testing for translation in the anterior and posterior directions. This was graded as grade 0 (no translation), grade 1 (translation less than the margin of the glenoid), grade 2 (translation beyond the margin of the glenoid with spontaneous reduction) and grade 3 (translation beyond the glenoid margin without spontaneous reduction). All the procedures were performed with the patient supported in the lateral decubitus position and the shoulder abducted by approximately 45° and flexed 20° while traction was applied using a weight of 5 kg.

Diagnostic arthroscopy was performed through a standard posterior portal. Particular attention was paid to the evaluation of loss of bone at the anterosuperior glenoid and posterolateral defects of the humeral head. Any Hill-Sachs lesion identified was inspected intra-operatively to ensure that it did not engage the anterior rim of the glenoid in abduction and external rotation of the shoulder.

Under direct vision, using an 18-gauge spinal needle, an anterosuperior portal was placed ideally directly adjacent to the proximal portion of the tendon of biceps and another just above the superior aspect of the tendon of subscapularis. Two 6.5 mm cannulae were then inserted into each portal after sequential dilatation using a switching stick, ensuring that these portals gave an adequate view of the anterior rim of the glenoid and access to the inferior rim, respectively. With the arthroscope in the anterosuperior portal, the anterior glenoid was checked to rule out the posterolateral defects of the humeral head. Any Hill-Sachs lesion identified was inspected intra-operatively to ensure that it did not engage the anterior rim of the glenoid in abduction and external rotation of the shoulder.

<table>
<thead>
<tr>
<th>Table I. Clinical details of the 40 patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age in years (range)</td>
</tr>
<tr>
<td>Gender (%)</td>
</tr>
<tr>
<td>Dominant limb (%)</td>
</tr>
<tr>
<td>Sports participation (%)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

VOL. 90-B, No. 11, NOVEMBER 2008
be large then the decision was made to proceed with revision arthroscopic stabilisation. The articular surfaces were assessed using a modification of the Outerbridge classification in which grades 0 and 1 were classified as mild, grades 2 and 3 as moderate and grade 4 as severe.

Careful assessment of the posterior labrum was performed using a probe. Minor scuffing of the posterior labrum was debrided and larger tears repaired using techniques similar to those for anterior labral lesions.

Next, the labrum and scarred anteromedial capsule were mobilised from the antero-inferior neck of the glenoid using an elevator. The labrum was mobilised as far as the six-o’clock position. The bony edge of the glenoid was then debrided with a shaver to remove fibrous tissue and to prepare a bleeding bony bed to aid healing of the labrum on to the margin of the glenoid. A rasp was used to initiate bleeding when necessary. If the position of previous anchors was evident, the site was noted and the location defined as being in the upper or lower halves of the glenoid. Revision of the anterior anchor repair was then performed. We aimed to place the first anchor as close to the 5:30 position as possible from the anterior portal. With the use of a suture passer, as much capsulolabral tissue as possible was taken to carry out the repair through the standard suture shuttling technique. The repair was continued up the anterior margin of the glenoid placing anchors approximately 5 mm apart and 2 mm on to the articular rim until the capsulolabral tissue was thought to be adequately re-approximated to the glenoid margin and capsular redundancy obliterated. If anchors were placed in the upper half of the glenoid this was noted. Repairs were probed for stability and the range of movement of the shoulder was checked before reversing the anaesthesia.

Rehabilitation. All the operations were carried out as a day-case. A shoulder immobiliser was applied in the operating theatre and the patient was instructed to wear it at all times for the first two weeks, except for bathing and therapeutic exercises. During the first six weeks, passive range-of-movement exercises were advised, allowing up to 90° of forward flexion, 45° of abduction and 30° of external rotation. After six weeks, active assisted exercises were performed as tolerated for up to 90° of abduction and 45° of external rotation. Prone extension, scapular stabilisation exercises and internal rotation stretching exercises were also commenced. At eight weeks the patient progressed to full active range-of-movement exercises as tolerated and passive stretching for end ranges of movement. Elasticated resistance bands and light weights were used during exercises to strengthen the rotator cuff, deltoid and scapular stabilisers. After 12 weeks, the patient was allowed to jog and to begin a functional progression back to work and advanced weight training. At six months after surgery a return to non-contact sports was allowed with contact sports delayed until nine to 12 months had elapsed.

Results

The mean follow-up was 36 months (12 to 87) with a mean interval from the primary surgery to the revision of 72 months (5 to 308). The primary stabilisation procedures are shown in Table II. A total of eight patients had re-injured the affected shoulder during non-contact overhead activity such as brushing the hair, volleyball and basketball. The remaining 32 had sustained their injuries while participating in activity involving physical contact and/or when falling. The mode of failure was recurrent dislocation in 18 patients, a single dislocation with persistent apprehension in three, a single dislocation with multiple subsequent subluxations in six and multiple subluxations in 13.

Radiological findings. Radiological investigation before revision had identified a Hill-Sachs lesion in 17 patients which was confirmed at operation, but there was inadequate radiological evidence available from the primary procedure to judge whether this was a new finding. In three patients a Hill-Sachs lesion was thought to have been present from the radiological evidence, but this was not confirmed at operation. Conversely, eight patients who were not thought to have had a Hill-Sachs lesion from radiological investigation were found to have one at operation.

Some loss of glenoid bone was identified radiologically in five patients. Two of these had CT evidence of bone loss which was confirmed intra-operatively and found to be minor in both cases. In four patients, minor loss which had not been detected radiologically pre-operatively, was found during the procedure.

Arthroscopic findings. The results of examination under anaesthesia are detailed in Table III. No patient was locked in the dislocated position during this examination. Bankart lesions were seen in 36 patients. Isolated posterior labral lesions which were deemed to be responsible for the symptoms were found in four and were therefore repaired. The anterior capsulolabral tissues were carefully inspected in these four patients, since three had demonstrated multidirectional instability during examination under anaesthesia, but no significant anterior pathology was discovered. From the operation records we could not determine whether this examination had been carried out on the contralateral shoulder for comparison in these three, but at the final follow-up, two of the three had stable operated shoulders and the other had grade 1 anterior translation, but no symptoms of instability. All three patients were also found to have mild generalised joint laxity. We

### Table II. Primary stabilisation procedures in the 40 patients

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Bankart repair</td>
<td>16</td>
</tr>
<tr>
<td>Arthroscopic Bankart repair</td>
<td>19</td>
</tr>
<tr>
<td>Arthroscopic Bankart and posterior labrum repair</td>
<td>1</td>
</tr>
<tr>
<td>Magnusson-Stack procedure</td>
<td>2</td>
</tr>
<tr>
<td>Capsular shrinkage</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
</tr>
</tbody>
</table>

Unknown findings

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capsular shrinkage</td>
<td>1</td>
</tr>
<tr>
<td>Magnusson-Stack procedure</td>
<td>2</td>
</tr>
<tr>
<td>Arthroscopic Bankart and posterior labrum repair</td>
<td>1</td>
</tr>
<tr>
<td>Open Bankart repair</td>
<td>16</td>
</tr>
<tr>
<td>Arthroscopic Bankart repair</td>
<td>19</td>
</tr>
<tr>
<td>Arthroscopic Bankart and posterior labrum repair</td>
<td>1</td>
</tr>
<tr>
<td>Magnusson-Stack procedure</td>
<td>2</td>
</tr>
<tr>
<td>Capsular shrinkage</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Procedure classification

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Bankart repair</td>
<td>16</td>
</tr>
<tr>
<td>Arthroscopic Bankart repair</td>
<td>19</td>
</tr>
<tr>
<td>Arthroscopic Bankart and posterior labrum repair</td>
<td>1</td>
</tr>
<tr>
<td>Magnusson-Stack procedure</td>
<td>2</td>
</tr>
<tr>
<td>Capsular shrinkage</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Procedure classification in which grades 0 and 1 were classified as mild, grades 2 and 3 as moderate and grade 4 as severe.

#### Procedure classification in which grades 0 and 1 were classified as mild, grades 2 and 3 as moderate and grade 4 as severe.

#### Procedure classification in which grades 0 and 1 were classified as mild, grades 2 and 3 as moderate and grade 4 as severe.

#### Procedure classification in which grades 0 and 1 were classified as mild, grades 2 and 3 as moderate and grade 4 as severe.
assume that the multidirectional instability found on examination under anaesthesia in these three patients, despite the intra-operative findings of isolated posterior labral lesions, was as a result of inherent joint laxity which manifested itself to a greater degree under anaesthesia. The remaining patient did show posterior translation.

At arthroscopy the position and number of suture anchors were noted. A mean of 0.85 anchors (0 to 3) was used and most were located in the lower half of the glenoid (Tables IV and V). None of these anchors was removed because they were loose or to facilitate placement of an anchor as part of the revision procedure. At revision the mean number of anchors used was 2.43 anchors (1 to 3), most of which were also in the lower half of the glenoid (Tables IV and V).

In all patients the capsulolabral tissue had adhered to the glenoid neck and required extensive mobilisation. After revision all patients had adequate restoration of capsular tension with the humeral head properly centred in the glenoid.

We found some degree of chondral degeneration in 17 patients. Using our modification of the Outerbridge classification32 14 patients showed mild and three moderate changes.

Clinical outcome. The rate of recurrent instability after revision arthroscopy was 10% (four patients). At the final follow-up, the mean ASES score was 81.1 (17.5 to 99.5) and the mean Western Ontario shoulder instability index score was 68.2 (20 to 98.2). The HSQ-12 scores are outlined in Table VI. All patients maintained or demonstrated improved range of movement. The mean forward flexion was 165.5° (140° to 185°) and the mean external rotation 60° (40° to 85°). When compared with external rotation on the contralateral side, no significant difference was found (t-test independent paired; p = 0.78). There was no correlation between a poor outcome and the varying pathology found at the revision operation including osteoarthritis. We also compared the ASES and Western Ontario shoulder instability index outcome measures and external rotation in patients who had all the anchors at revision surgery placed in the lower half of the glenoid margin with those who had one or more placed in the upper half. No significant difference in outcome (ASES, chi-squared; Western Ontario Shoulder instability index, chi-squared; p = 0.71) or external rotation (chi-squared; p = 0.54) was detected.

Return to activity. In 32 patients a return to a sport was achieved at a mean of 7.8 months (4 to 12) after surgery.
Most patients returned to a level of competition in the same sport which was similar to that achieved when their shoulder was stable.

Complications. No other complications occurred. With regard to the four patients with recurrent instability after revision, this was due to an injury in an assault in one and contact activity in three. Two have undergone further procedures. The first had an open re-revision with a Bankart repair and a HemiCAP (Arthrosurface Inc., Franklin, Massachusetts) implant was used to treat a large engaging Hill-Sachs lesion. The second also underwent an open further Bankart repair and a Weber derotation osteotomy was carried out to treat a large engaging Hill-Sachs lesion. The third patient is awaiting further surgery, but has had poor compliance with rehabilitation and has psychosocial problems. The fourth patient decided against a further operation after having been counselled carefully.

Discussion

Our findings suggest that revision arthroscopic capsulolabral reconstruction is as good as an open revision procedures. Kim et al\textsuperscript{21} described the first series of arthroscopic revision Bankart repairs in a prospective study of 23 patients of whom five experienced recurrent instability. The surgical technique was similar to ours. Creighton et al\textsuperscript{22} assessed 18 patients who had been treated for failed repair of instability by revision arthroscopic labral fixation. They noted five failures, three for recurrent instability and two for pain. In a series of 12 patients undergoing revision arthroscopic Bankart repair, Neri et al\textsuperscript{23} noted three failures at a mean follow-up of 34.4 months. Full data were only available for 11 patients, with 73\% showing a good to excellent outcome. The last two studies also used similar surgical techniques, but closure of the rotator interval was performed more often in both. In our study, there was recurrent instability in four patients at a mean of 36 months (12 to 87) which is consistent with, if not better than, published rates of recurrence with open revision procedures.\textsuperscript{15,20}

Arthroscopy allows full assessment of both the anterior and posterior aspects of the glenohumeral joint and the potential for a closure of 180\textdegree as described by Warner, Kann and Marks.\textsuperscript{33} As a result, the four patients in our series who had posterior labral lesions were treated by posterior capsulolabral reconstruction and all had a good outcome. We believe that this is better than the open procedure because of the ability to visualise the posterior lesion and thus prevent unnecessary overtensioning of the anterior capsulolabral tissues which may be carried out in error.

We consider that the posterior labral lesions seen in our series occurred either as a result of further injury to the shoulder or chronic stretching of the posterior tissues after the primary procedure or because the lesion was missed at the primary procedure.

In the four patients with recurrent instability, we were unable to identify any pre- or intra-operative factors which might have predicted a poor outcome with revision arthroscopic repair, although the small numbers of patients prevent meaningful statistical interpretation of these observations. It should be noted that all four had two anchors placed in the lower half of the glenoid. The two who have undergone further revision procedures to address large engaging Hill-Sachs lesions had moderately-sized postero-lateral defects of the humeral head at the time of arthroscopic revision. We assume that because of recurrent instability, the defect increased in size such that it became an engaging lesion and required treatment. This suggests that the number and position of the anchors may have contributed to their poor outcome. However, one of the remaining patients with recurrent instability was not seen to have a Hill-Sachs lesion at operation.

The success of the reconstruction depends on adequate re-tensioning of the capsulolabral complex. Consequently, adequate advancement of the complex may require placement of anchors in the upper half of the glenoid margin. This does not appear to have any detrimental effect on the patient.

Functional and quality-of-life scoring produced good results in most patients at follow-up. The range of movement was also well maintained. Chondral injury was seen in a large proportion of patients probably resulting from recurrent instability. Therefore it may be appropriate to warn patients that related discomfort may not improve with revision stabilisation.

Although we believe that an all-arthroscopic technique can be used in almost all cases of recurrent instability occurring from soft-tissue lesions, it is important to appreciate that bony defects are also a cause and should be addressed by the use of open techniques of bone reconstruction. Rates of recurrent instability have been reported to be as high as 67\% when arthroscopic Bankart repairs have been performed in patients with considerable bone loss and to reach 89\% in athletes participating in contact sport.\textsuperscript{27}

Causes of failure after primary and revision procedures for instability include the age of the patient, large Hill-Sachs lesions, participation in contact sports, a poor soft-tissue envelope, arthritic changes and technical errors at operation.\textsuperscript{5,26,34,39} We recognise that due to the limited number of patients in our series and a mean follow-up of only three years the long-term outcome for arthroscopic revision for instability remains uncertain. Manta et al\textsuperscript{40} showed that failure rates for arthroscopic capsulolabral repair increased when follow-up was continued for up to five years. Studies involving multicentre evaluation may be required since overall the number of patients with recurrent instability is small. We also appreciate that a weakness of our study was the moderate heterogeneity of the varying primary procedures and lesions found at revision. The retrospective nature, without a control group of patients treated non-operatively or by open revision for comparison, is also a deficiency. Lastly, no standardised pre-revision radiological protocol was in place and no pre-operative scores for function and pain were available for interpretation of the post-operative outcome.
We have shown that in carefully selected patients this procedure can provide stability in most and give results comparable with those of primary arthroscopic and open stabilisation procedures. Arthroscopic revision for recurrent instability of the shoulder should be considered as a reliable option for such patients except in the presence of considerable defects of the glenohumeral bone.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References