Arthroscopic capsular shift from inferior to superior has an exceptional safety profile and short-term outcomes

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ABSTRACT

Objectives: Arthroscopic Bankart for anterior shoulder instability has a good safety profile but with a relatively high recurrence index. Open surgery has been used to decrease recurrence rates but with a higher complication rate. Arthroscopic capsular shift from inferior to superior (ACSIS) was designed to decrease the recurrence rates without the added morbidity of open surgery.

Methods: An observational retrospective study was conducted to analyze perioperative complications and patient reported outcomes of patients treated with ACSIS to determine the safety profile of the procedure. The patients with anterior traumatic shoulder instability treated with ACSIS between January 2015 and December 2021 were included for the study. The analysis was conducted using SPSS (Version 27). The pre vs. postoperative Western Ontario Shoulder Instability Index scores were compared using a paired sample t-test or Wilcoxon signed ranks test depending on the results of the normality test and Levene's test. The significance level was 0.05 in all analyses.

Results: No intraoperative complications, including bleeding or neurovascular injury, were noted. Additionally, no early postoperative complications, including infection or hospital readmission, were noted. During the follow-up, one patient (3%) had persistent apprehension. The mean Western Ontario Shoulder Instability Index decreased from 66.6 ± 13.10% to 27.9 ± 22% postoperatively (P < 0.001).

Conclusions: ACSIS procedure is safe and has good short-term outcomes with a low recurrence rate at 1-year minimum follow-up.

Level of Evidence: 3 (Observational study).

What are the new findings

- Arthroscopic capsular shift from inferior to superior has improved clinical outcomes postoperatively.
- Arthroscopic capsular shift from inferior to superior is safe, with no trans-operative or early postoperative complications.
- Arthroscopic capsular shift from inferior to superior may decrease instability recurrence by offering the benefits of a capsular shift without the morbidity of an open surgery.
INTRODUCTION

The glenohumeral joint is inherently unstable, making soft tissues critical in the stability of this joint [1,2]. It is estimated that 50% of patients that sustain a shoulder dislocation will suffer a new episode, with this percentage being higher in young populations [3]. Recurrent instability severely impairs the patient’s quality of life and most of these patients benefit from surgical stabilization [3].

Different open and arthroscopic techniques have been described in the literature to address the soft tissue injury [4]. The Bankart procedure was originally described in 1923 and consisted of a capsule-labral repair; this procedure was done open, with a coracoid osteotomy, and a subscapularis tenotomy [5]. This procedure has evolved over time keeping the same principle of performing the capsule-labral repair, but with less surgical morbidity, and is now mainly performed arthroscopically [6]. Even when this procedure is well indicated, it has a high failure rate of approximately 20% [7–9].

Lately, the open Bankart has regained popularity to decrease this failure rate since a better capsular shift can be performed. According to the literature, this technique has a lower recurrence rate compared with the arthroscopic technique [10]. Surgeons performing this surgery are in favor of this technique since a two-limb capsular shift and tensioning can be achieved using open surgery compared with the arthroscopic Bankart [11].

During the conventional arthroscopic Bankart repair, a limited and non-precise amount of capsular shift can be performed [6,12]. Glenoid morphology varies in gender and populations [13,14]. The senior author created a similar technique to the arthroscopic Bankart to obtain a true and consistent anterior capsule-labral shift from inferior to superior. The arthroscopic capsular shift from inferior to superior (ACSIS) technique achieves a consistent capsular shift from inferior to superior (from 3 o’clock to approximately 12 o’clock) of the anterior capsule-labral complex with an arthroscopic surgery. This replicates the shift of one of the two limbs of the open Bankart surgery without the added morbidity of an open surgery. The purpose of this study is to analyze the safety profile of the ACSIS technique and explore the short-term clinical outcomes. We hypothesize that patients treated with ACSIS will not have perioperative or early postoperative complications and will present with improved patient reported outcomes postoperatively at a 1-year minimum follow-up.

METHODS

Design

This study was an observational retrospective study, performed at the Queen Elizabeth Health Sciences Center in Halifax, Nova Scotia. The study was approved by the Nova Scotia Health Research Ethics Board.

Participants

The patients were retrospectively obtained from the surgical database of shoulder instability. Patients were eligible for the study if they were treated surgically with ACSIS between January 2015 and December 2021. The indication for surgery was symptomatic traumatic anterior shoulder instability. All patients were treated with this technique instead of the conventional Bankart starting on June 1, 2019, as per the operating surgeon’s preference. Patients were excluded if they had prior ipsilateral shoulder surgery, glenoid fracture, glenoid bone loss greater than 25% on preoperative computed tomography (CT) 3D imaging, multidirectional instability or posterior instability, clinical follow-up shorter than one year, and/or the diagnosis of a humeral avulsion of glenohumeral ligament (HAGL) lesion. All surgeries were performed by the Senior Author (I.W.).

Surgical technique

ACSIS is an all-arthroscopic technique that is performed under general anesthesia. The detailed surgical technique and portal placement was published by Buckley and Wong [15].

The procedures were performed in a lateral decubitus position with a vacuum beanbag beneath the patient and a pneumatic arm positioner (SPIDER2, Smith & Nephew, Memphis, TN) was utilized. At the beginning of every case, a routine diagnostic arthroscopy following the 15-point routine described by Snyder et al. was performed through the posterior and anterior portals [16]. An antero-superolateral portal was created through the rotator interval just anterior to the biceps and the camera is switched to this portal. A retrograde suture passer (Spectrum II; ConMed, Utica, NY) coming from the anterior portal was used to place a traction suture to the remnant labrum in the anterior face of the glenoid at the 3 o’clock position in a luggage tag configuration. A coblator wand (WEREWOLF, Smith and Nephew, Memphis, TN) was used to release the labrum between the biceps anchor and the traction suture. The same wand was used to release the tissue attached to the anterior aspect of the glenoid until the subscapularis muscle is seen underneath. This release was continued distally until the 6 o’clock position. The traction suture was used to confirm the tissue excursion. An all-suture anchor (Q-FIX, Smith and Nephew, Memphis, TN) placed to the 6 o’clock position, the same retrograde suture device was used to pass the anchor sutures through the tissue while the traction suture is pulled, allowing a progressive shift from inferior to superior. These steps are repeated with a second anchor at the 4 o’clock position. Finally, a knotless anchor (BIORAPTOR, Smith and Nephew, Memphis, TN) was used to secure the traction suture at approximately the 12 o’clock position with appropriate tension while the arm was in neutral position. Remembering that the tissue was initially at the 3 o’clock position (Fig. 1), the amount of capsular excursion (shift) was able to be measured in each patient.

Rehabilitation

Patients were instructed to use the sling for six weeks and to follow the same physiotherapy protocol. The protocol started with passive range of motion (ROM) for the first two weeks and then progressed to active assisted, followed by active ROM practices. Full ROM was expected to be achieved between the 6th and 8th weeks. Once achieving scapular control, shoulder strengthening, and proprioception were continued [17, 18].

Data collection

A database was created with the population demographics from their clinical charts including gender, age at the time of surgery, side of injury, and body mass index (BMI). Intra- or postoperative complications such as neurovascular injuries, infection, instability recurrence, and reoperation were investigated to identify the safety profile of the procedure as the primary outcome. As a secondary outcome, clinical outcomes were measured with the Western Ontario Shoulder Instability (WOSI) index performed before surgery and after surgery at 6 months, 1 year, and 2 years [19, 20].

Statistical analysis

The analysis was conducted using SPSS (Version 27). The preoperative and postoperative WOSI scores were compared using a paired sample t-test and Wilcoxon signed ranks test depending on the results of the normality test and Levene’s test. Effect sizes were reported using Cohen’s d. The most recent WOSI scores were used as postoperative scores in this study, which is defined as the outcome scores collected at the patient’s latest appointment after a minimum 1-year follow-up. The significance level was 0.05 in all analyses.

RESULTS

One hundred and thirty-nine patients underwent ACSIS surgery for shoulder instability between January 2015 and December 2021, thirty-six patients were included for the analysis after applying the exclusion
Demographic data of the study population. Table 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>N (%)</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean ± standard deviation</td>
<td>30.8 ± 11.4</td>
<td></td>
</tr>
<tr>
<td>Mean clinical follow-up, years, mean ± standard deviation</td>
<td>2.7 ± 1.2</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²), mean ± standard deviation</td>
<td>24.9 ± 4.6</td>
<td></td>
</tr>
<tr>
<td>Male, N (%)</td>
<td>31 (86.1%)</td>
<td></td>
</tr>
<tr>
<td>Right Side, N (%)</td>
<td>18 (50.0%)</td>
<td></td>
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</tbody>
</table>

Note: BMI = body mass index.

Summary of the preoperative CT glenoid and humeral bone loss measurements. Table 2

<table>
<thead>
<tr>
<th>Preoperative Baseline Variables</th>
<th>Mean ± standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glenoid A-P mm (mean ± standard deviation)</td>
<td>24.5 ± 2.5</td>
</tr>
<tr>
<td>HS depth mm (mean ± standard deviation)</td>
<td>3.6 ± 1.0</td>
</tr>
<tr>
<td>HS M-L mm (mean ± standard deviation)</td>
<td>20.1 ± 3.4</td>
</tr>
<tr>
<td>No bone loss, N (%)</td>
<td>9 (25.0%)</td>
</tr>
<tr>
<td>Both GBL and HS, N (%)</td>
<td>2 (5.6%)</td>
</tr>
<tr>
<td>HS only, N (%)</td>
<td>25 (69.4%)</td>
</tr>
<tr>
<td>GBL only, N (%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Note: A-P = anterior to posterior, HS = Hill-Sachs, M-L = medial to lateral, GBL = glenoid bone loss.

The mean WOSI improved from preoperatively (66.6 ± 13.10%) to postoperatively (57.2 ± 22%) with a mean improvement of 39.8 ± 23.0% and a large effect size (P < 0.001, d = 1.681). Ninety-three percent of patients met the minimal clinically important difference of WOSI.

DISCUSSION

The most important finding of this study is that ACSIS is a safe procedure, has good short term clinical outcomes, and low recurrence rate. This procedure allows for a measurable capsular shift from inferior to superior of the anterior capsule-labral complex.

The arthroscopic Bankart is a very reliable procedure, with low complications [23], and an average return to sport >90% [24]. K. Matsumi and H. Sougaya, published a paper highlighting the potential complications [23]. Main complications listed included: nerve injury (0.03%), infection (0.22%), implant related complications (0.3%), shoulder stiffness (anecdotal cases), and chondrolysis (anecdotal cases that may be related to infusion of articular local anesthetics), demonstrating the low incidence of complications after this procedure [23]. In this study, we showed that patients who underwent ACSIS procedure had no perioperative or early postoperative complications, comparable with what has been shown in the literature [23].

Even though the conventional Bankart is a safe procedure, a high recurrence rate is identified [7-9]. Murphy et al. found a 31.2% recurrence rate in their minimum 10-year follow-up systematic review [25]. ACSIS was designed to decrease this recurrence rate without the added complications [23].

Table 3

Compilation of patients who suffered a dislocation and/or apprehension in the follow-up.

<table>
<thead>
<tr>
<th>Dislocations</th>
<th>2/36 (6%)</th>
</tr>
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<tbody>
<tr>
<td>N (%)</td>
<td>Two patients had traumatic dislocation due to a fall and were corrected to an AAGR revision (around 1 yr postop.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Apprehension</th>
<th>1/36 (3%)</th>
</tr>
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<tbody>
<tr>
<td>N (%)</td>
<td>This patient had AAGR revision at 2yr time point.</td>
</tr>
</tbody>
</table>

Note: AAGR = arthroscopic anatomic glenoid reconstruction.
Capsular shift is part of the Bankart surgical technique [6]. Several studies have described variations of this capsular shift both arthroscopically and during an open procedure [26–32]. These shifts are non-precise, nonmeasurable and nonconsistent. The ACSIS procedure allows the surgeon to know the precise distance that the capsule-labral complex will be shifted.

This is the first study to analyze the safety profile of the ACSIS procedure. Strengths of this study include that we have a mean clinical follow-up of 2.7 ± 1.2 years, demonstrating the period where most of the concerning safety complications may arise. However, this study also has limitations. The nature of the study design is retrospective with its inherent limitations and the surgeries were performed by a single surgeon in a single center. In addition, we also have a small population with a minimum 1-year follow-up. The clinical relevance of this study’s findings is that ACSIS is demonstrated to be a safe procedure.

CONCLUSION

Patients treated with ACSIS for traumatic anterior shoulder instability show an excellent safety profile and good short-term clinical follow-up.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Ivan Wong reports a relationship with DePuy Mitek Inc that includes: consulting or advising and speaking and lecture fees. Ivan Wong reports a relationship with CONMED Corp that includes: consulting or advising and speaking and lecture fees. Ivan Wong reports a relationship with Serodus LLC that includes: speaking and lecture fees. Ivan Wong reports a relationship with Bioventus LLC that includes: speaking and lecture fees. Ivan Wong reports a relationship with ISAKOS that includes: board membership. Ivan Wong reports a relationship with AANA that includes: board membership. Ivan Wong reports a relationship with Arthroscopic and Related Surgery that includes: board membership. Ivan Wong reports a relationship with Smith and Nephew Inc. Anderson: includes: consulting or advising and speaking and lecture fees. Ivan Wong reports a relationship with American Journal of Sports Medicine that includes: includes: speaking and lecture fees. Ivan Wong reports a relationship with Lippincott Williams & Wilkins: includes: board membership.

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