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Original Article

Hybrid suture technique vs simple suture technique for antero-inferior labral tears: Two years' clinical outcomes

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ABSTRACT

Background: We previously reported a hybrid suture technique, wherein mattress and simple suturing are used to create Mason-Allen configuration, with low recurrence rates. This comparative study looking at the two years' clinical outcomes of arthroscopic anterior labral repair using the hybrid suture technique versus simple suture technique.

Methods: We identified 103 patients who underwent arthroscopic anterior labral repair from 2010 to 2015 with 2-year follow-up. The patients were categorized into two groups: hybrid suture technique (65 patients) and simple suture technique (38 patients). Clinical outcomes measures included UCLA shoulder score, Constant Shoulder Score, Numerical Pain Rating Scale, and Oxford Instability score.

Results: Mean age of the patients was 27.02 ± 9.76 years (17–63), with 91 males and 12 females. At 24 months, both groups showed significant improvement in post-operative clinical scores compared to pre-operation. The patients in hybrid sutures technique demonstrated significant improvement in Constant Shoulder Score, UCLA shoulder score and Oxford Instability score compared to simple suture group at 3 months follow up. (121.98 ± 21.05 vs 109.32 ± 21.15, $p < 0.05$; 65.5 ± 19 vs 57.4 ± 17.6, $p < 0.05$; 27.3 ± 5.7 vs 23.7 ± 5.0, $p < 0.05$; 29.3 ± 8.9 vs 33.4 ± 8.2, $p < 0.05$). The postoperative recurrence rate was comparable between both groups (hybrid suture group 7.81% vs simple suture group 7.84%).

Conclusions: Arthroscopic anterior labral repair with hybrid suture technique offers significant early improvements in clinical scores and low recurrence rate compared to simple suture technique at 2-year follow-up.

Level of evidence: Level III; Retrospective Cohort Design; Treatment study.

Introduction

Shoulder dislocation is a common condition encountered by orthopedic surgeon. The reported incidence for first time-time shoulder dislocation is about 8.0–8.2 per 100,000 people per year and the prevalence is around 2%. Anterior shoulder dislocations make up 96–98% of all shoulder dislocations.[1] The recurrence episode depends on the patient's age during the first episode and the reported risk of redislocation is approximately 80%, especially in male patient younger than 20 years. Therefore, surgical treatment is usually recommended compare to conservative management, in view of the high recurrence rate.[2,3]

The surgical management can be performed either open method or arthroscopic surgery. Perthes et al. first described the open repair method in 1906[4] and Bankart reported excellent clinical outcomes of this technique in patients with anterior shoulder instability.[5] Since then, the open Bankart repair was considered as the gold standard in view of good clinical result and low recurrence rate of less than 5%.[6,7] However, the open surgery also associated with disadvantages such as prolong hospitalization, greater blood loss, longer rehabilitation period, and restriction in range of motion particularly external rotation due to overtightening.[3]

With recent technical advancement and improved implant choices, arthroscopic Bankart repair has slowly become an interesting alternative surgical technique for traumatic shoulder dislocations. Furthermore, arthroscopic Bankart repair is also associated

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with lower complications rate, faster rehabilitation and similar clinical outcomes compare to their open counterpart.[6,7] However, the early arthroscopic techniques which utilized staples, transglenoid sutures and removable metallic devices were associated with high recurrence rate.[8,9] The introduction of anchor suture in arthroscopic Bankart repair has revolutionized the treatment for shoulder dislocation. The advantages of anchor suture are namely multiple points of fixation, no posterior glenoid penetration and pull-out strength similar to transosseous sutures of suture anchors. Previously, our center has published a study regard hybrid suture technique, where mattress and simple suturing are used to create Mason-Allen configuration, with low recurrence rates. However, the study was mainly case series without a control group. In addition, only UCLA score was used for clinical evaluation in the study. Thus, the interpretation of this novel technique might be limited.[10]

This present study aims to compare the clinical outcomes and the recurrence rate of hybrid suture technique versus simple suture technique at 2-year follow-up. We hypothesize the clinical outcomes and recurrence rate are comparable between these two techniques at final follow-up.

Material and methods

We reviewed 103 patients who underwent arthroscopic Bankart repair for anterior glenohumural instability by 2 senior surgeons from May 2010 to May 2015 in our center. One senior surgeon performed the hybrid suture repair ($n = 65$), while the other senior surgeon performed simple suture repair ($n = 38$). The inclusion criteria were patients with anterior shoulder dislocations who underwent arthroscopic bankart repair and who were available for follow-up at a minimum 2 years post-operatively. The exclusion criteria were voluntary or multidirectional instability, pure posterior instability, bony Bankart lesion or anterior glenoid defect more than 25%, concomitant rotator cuff tear, and Hill-Sachs lesion involving more than 25% of the humeral head.

Preoperatively, the patients were evaluated by the senior authors for the range of motion and the stability of the shoulder. The apprehension and load and shift test were used to diagnose anterior instability. All patients were assessed by an independent physiotherapist preoperatively, at 6 and 24 months postoperatively. The demographics of the patients including age, gender, body mass index (BMI) were collected preoperatively. Clinical outcomes measures included University of California Los Angeles (UCLA) shoulder score, Constant Shoulder Score, Numerical Pain Rating Scale, and Oxford Instability score at preoperative and 6 and 24 months postoperatively. All patients underwent preoperative radiographs which include anteroposterior, lateral, axillary and T-scapular views taken, as well as magnetic resonance imaging of the affected shoulder. Ethical approval for the study was granted by the Institutional Review Board of Singapore Health Services (SingHealth, CIRB 2017/ 2443).

Surgical technique

Hybrid suture technique

All patients were operated by the same senior surgeon and thus the surgical technique was consistent. The operative technique and postoperative rehabilitation were performed according to the previous published technique using the hybrid suture technique.[10] The arthroscopic procedure was performed in beach chair position after patient underwent general anesthesia. Subsequently, the senior surgeon performed clinical examination to assess the direction of instability. After preparing the shoulder under sterile manner and the bony landmarks identified, diagnostic arthroscopy was performed through a standard posterior portal. The posterior was created 2 cm inferior and 1 cm medial to tip of the acromion. Another 2 anterior portals created with spinal needle. 2 cannulas were inserted into the 2-anterior portal respectively. The anterosuperior portal was made through the rotator interval while the second portal is above the superior border of the subscapularis. A 30-degree arthroscope was introduced through the posterior portal and a periosteal elevator was introduced through the anteroinferior portal to assess and debride the detached labrum.

The senior surgeon routinely used 3 bioabsorbable anchor suture (DePuy Mitek Inc, NJ, USA) for the Bankart repair. The anchors were usually place at the 5:30, 4 and 3 o'clock position for the right shoulder while 6:30, 8 and 9 o'clock for the left shoulder. Drill holes were made along the detach labrum with the help of a drill guide. The hybrid suture technique consists of 2 parts, 1) the first anchor placed at the 5:30/6:30 o'clock on the glenoid surface, aim to create the bumper effect by pulling the anterior band of IGHL via horizontal mattress suturing and tied together with the most inferior suture. 2) the second and third anchor were placed at the 4/8 and 3/9 o'clock position and secured with simple vertical sutures.

If concomitant SLAP lesion was also discovered in the same surgical setting, a SLAP repair procedure will be performed in same setting.

Simple suture repair

The initial steps were similar to the hybrid technique, with similar anchor numbers and placements, however, the surgeon only captured the labrum without the anterior band of IGHL, and secured onto glenoid rim using simple suture technique.

Post-operative rehabilitation

After the arthroscopic Bankart repair, both groups routinely will be on arm sling for 6 weeks. The post-operative rehabilitation began on day 1 with guidance of a trained physiotherapist. The immediate rehabilitation exercise included pendular exercise for the first three weeks and active forward flexion to 90° for the next three weeks. Full shoulder mobilization can be started after six weeks. Free movement of the elbow and wrist were encouraged. The rehabilitation program usually continued for 3–6 months.

Data analysis

Standard statistical software (SPSS, Chicago, Illinois) was used to analyze the data. Sample Mann-Whitney U Test for non-parametric continuous variables, and Independent Sample T Test was used for parametric continuous variables. Chi-square test was used to analyze categorical variables. Significance was defined as $P \leq 0.05$.

Results

Between May 2010 to May 2015, 103 patients who underwent arthroscopic Bankart repair with both hybrid and simple suture techniques were included in this study. The majority of the patients were males (91/103). The mean age at the time of procedures was 27.0 ± 9.8 years (17–63). The mean time between the first dislocation and the surgical procedure was approximately 5 months.

Both groups showed significant improvement in the post-operative clinical outcomes scores and range of motion compared to pre-operative. At 24 months follow up, the patients in the hybrid suture group demonstrated comparable improvement in the Constance shoulder score, UCLA score, Oxford instability score, NPRI score and range of motion compare to the simple suture repair

(Table 1). However, we observed the hybrid suture group patients demonstrated significant improvement in the Constant Shoulder Score, UCLA scores and Oxford Instability Score at 3 and 6 months follow up when compared with the simple suture group. All range of motion between both groups were comparable at 12 and 24 months follow up. In our study, we also observed both groups of the patients reported good satisfactions at all time, hybrid suture group at 93.4% and simple suture group at 94.6% respectively (Table 2).

The overall recurrence rate was 7.76% (8/103). The recurrence rate in hybrid suture group was 7.69% (5/65) while the recurrence rate in simple suture group was 7.89% (3/38). Three out of the five dislocated shoulders in hybrid suture group underwent revision, two out of the three dislocated shoulders underwent revision in the simple suture group.

Table 2
Patient satisfaction rate.

Time Frame	Hybrid	Simple	P- Value
3 months	84.7%	89.2%	0.536
6 months	95.2%	88.6%	0.244
12 months	95.1%	94.4%	1.000
24 months	93.4%	94.6%	1.000

Discussion

Our study has demonstrated two major findings. The clinical outcomes of the hybrid suture are comparable with the simple suture repair at the 24 months follow up. However, patient in the hybrid suture group demonstrated significant improvement in Constance shoulder score, UCLA score, Oxford instability score in early post-operative period (as early as 3 months) when compare with the simple suture group. Secondly, the recurrence rate between both groups are comparable at 24 months follow up.

Traumatic anterior disability of the shoulder can be disabling and associated with high recurrence rate, especially in the younger patients.[2,11] Despite the early arthroscopic instability repairs were associated with high recurrence rate, with the introduction of suture anchor and capsular plication, the results are comparable with the open bankart repair.[6,7]

Inferior glenohumeral ligament plays a crucial role in glenohumeral instability and failure to address might lead to surgical failure.[12] O'Brien et al. showed that the inferior glenohumeral ligament is a complex structure consist of an anterior band, a posterior band and an interposed axillary pouch. Histologically, the anterior and posterior band of inferior glenohumural ligament are composed of thickened band of collagen structures.[12] Turkel et al. conducted an anatomical study which found that at zero degree of abduction, subscapularis is the main stabilizer of the glenohumeral joint. At 45-degree abduction, the subscapularis, middle glenohumeral ligament and anterosuperior fibers of the inferior glenohumeral ligaments provide stability. At 90° of abduction, the inferior glenohumeral ligament prevent dislocation during external rotation.[13] The inferior glenohumeral complex plays an essential role in shoulder stabilization and failure to repair it might contribute to surgical failure. Biomechanical studies have shown that Bankart lesion alone was not able to create shoulder dislocation.[14] In fact, further capsular damage needs to be address during

Table 1
Clinical outcomes.

	Time Frame	Hybrid	Simple	P-value
Shoulder Flexion Range (°)	Preoperative	124.5 ± 31.6	126.7 ± 23.4	0.761
	3 months	122.0 ± 21.1	109.3 ± 21.1	0.005
	6 months	134.1 ± 15.7	126.5 ± 17.7	0.104
	12 months	139.3 ± 25.0	135.9 ± 16.5	0.115
	24 months	139.8 ± 24.2	142.0 ± 15.8	0.952
Shoulder Abduction Range (°)	Preoperative	118.9 ± 33.5	117.7 ± 29.0	0.712
	3 months	111.0 ± 27.9	99.6 ± 26.9	0.051
	6 months	127.4 ± 23.0	124.9 ± 18.8	0.596
	12 months	136.1 ± 25.8	135.6 ± 15.4	0.273
	24 months	140.0 ± 25.8	140.1 ± 16.8	0.658
Shoulder Abduction Strength (lbs)	Preoperative	13.0 ± 8.2	12.9 ± 7.1	0.940
	3 months	12.0 ± 8.5	9.0 ± 6.8	0.069
	6 months	15.7 ± 7.0	14.9 ± 7.0	0.581
	12 months	17.7 ± 7.5	17.9 ± 7.2	0.946
	24 months	18.0 ± 7.7	19.1 ± 6.6	0.546
Numerical Pain Rating Scale	Preoperative	3.8 ± 3.4	3.3 ± 3.4	0.543
	3 months	1.4 ± 2.0	2.2 ± 2.6	0.095
	6 months	0.9 ± 1.7	1.9 ± 2.6	0.051
	12 months	0.8 ± 1.6	0.9 ± 1.6	0.675
	24 months	0.8 ± 1.7	0.6 ± 1.4	0.610
Constant Shoulder Score	Preoperative	66.5 ± 20.1	67.5 ± 16.3	0.967
	3 months	65.5 ± 19.0	57.4 ± 17.6	0.039
	6 months	78.2 ± 14.9	74.0 ± 14.1	0.102
	12 months	84.9 ± 11.2	83.6 ± 10.3	0.518
	24 months	84.6 ± 12.5	86.9 ± 8.8	0.599
UCLA Shoulder Rating Scale	Preoperative	22.2 ± 5.3	21.7 ± 4.6	0.390
	3 months	27.3 ± 5.7	23.7 ± 5.0	0.002
	6 months	30.3 ± 4.5	27.7 ± 4.4	0.002
	12 months	31.9 ± 3.5	30.1 ± 3.8	0.013
	24 months	31.3 ± 4.3	31.2 ± 3.6	0.697
Oxford Shoulder Instability Score	Preoperative	33.1 ± 9.2	33.4 ± 10.6	0.891
	3 months	29.3 ± 8.9	33.4 ± 8.2	0.027
	6 months	22.3 ± 9.1	26.5 ± 9.4	0.029
	12 months	18.5 ± 6.9	21.1 ± 8.1	0.179
	24 months	18.0 ± 7.3	19.2 ± 7.7	0.350

lbs, pound; UCLA, University of California Los Angeles.
*P values < .05 are statistically significant.

an arthroscopic repair.

Nho et al. conducted a biomechanical study which studied four different suture techniques namely: a simple stitch, a knotless suture anchor, a horizontal mattress suture pattern, and an additional simple suture pattern using a double-loaded anchor. The author found the in vitro results of these four repair techniques were similar.[15] However, a biomechanical study which compare the restoration of labral height between simple suture and horizontal mattress sutures showed that in vitro horizontal mattress suture technique achieved better labral anatomy restoration.[16] Furthermore, a cadaveric study by Lazarus further supported the importance of intact labral in shoulder stability.[17] This study showed the chondral-labral defect created in cadavers leads to a reduction of glenoid height by approximately 80% and stability ration by approximately 65%.[17] Based on the findings of these studies, we developed the hybrid suture technique with the aim to improve the clinical outcomes of the current gold standard treatment.

In our study, we observed both groups demonstrated significant improvement in clinical outcomes compared to pre-operation. Satisfactory ranges of motions are crucial for the patients in order to return to their premorbid daily and sports activities. A study by Fabbriciani et al. reported good range of motion after arthroscopic repair.[18] The result is similar to other studies which reports on arthroscopic Bankart repair using simple suture repair. Seedek et al.[19] and Ee et al.[20] reported 75–85% of the patient were able to return to sport activities at final follow up.

There was concern that the shoulder range of motions would be limited to achieve greater shoulder stability. Our first study demonstrated the mean range of motion of the operated shoulder was not affected at 6- and 24-months post operation.[10] In fact, this comparative study further demonstrated improvement in early range of motion when compared to the simple suture group. Biomechanical studies demonstrated that labral repair with plication of IGHL showed the repair was stable without limitation in post-operative range of motion.[21,22] Previous studies showed extensive capsulorrhaphy might lead result in loss of range of motion. Westerheide et al. presented a case series included 71 cases of anterior glenohumeral instability treated with arthroscopic anterior stabilization and posterior capsular plication, reported loss of motion in 40% of the patients despite a low recurrence rate.[23] We postulate that as our technique involve only plication of the IGHL without posterior capsular plication, and probably improved proprioception and better sense of stability, thus the hybrid suture groups patient was able to achieved good clinical outcomes without loss of motion.

The recurrence rate between both groups were comparable between two groups at 24 months follow up. (hybrid suture group 7.69% vs simple suture group 7.84%). Recent studies reported on the recurrence rate after arthroscopic bankart repair range from 7.5% to 15%. Gartsman et al. reported a recurrence rate of 7.5% with the use of knot-tying anchors for bankart repair.[24] Mishra et al. reported a recurrence rate of 7% with arthroscopic bankart repair augmented with thermal capsulorrhaphy.[25] Our study showed that the recurrence rate of the hybrid suture technique is consistent with the result of other studies.

The strength of this study is the first to describe arthroscopic Bankart repair which utilize hybrid suture technique with plication of IGHL, producing comparable clinical outcomes and low recurrence rate when compare to simple suture technique. Second, the patients were follow-up by independent assessors who are not the performing surgeons, thus reduce any potential bias.

This study is not without the limitations. Firstly, it is an observational cohort comparison study and not a randomized controlled trial, thus to further validate the efficacy of hybrid suture technique, future randomized controlled studies may be warranted. Second, the operated patients did not receive routine post operation imaging studies to evaluate the integrity of the repair. Lastly, a two year follow up may be suboptimal to evaluate re-dislocation as an endpoint of failure. Although the Constant and UCLA score, we agree are not instability specific scores, we have included the Oxford shoulder Instability score.

Conclusion

Arthroscopic anterior labral repair with hybrid suture technique offers significant early improvements in clinical scores and comparable low recurrence rate compared to simple suture technique at 24 months follow-up.

Conflicts of interest

There are no known conflicts of interest associated with this publication and there has been no financial support for this work that could have influenced its outcome.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.asmart.2019.08.002.

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