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Original Article

Arthroscopic repair of Bankart lesion in traumatic anterior-inferior shoulder instability using the two-portal method: A preliminary report

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ABSTRACT

Background: In this report, we describe our preliminary clinical results of arthroscopic Bankart repair in traumatic anterior-inferior shoulder instability using the two-portal method.
Method: From August 2009 to December 2011, arthroscopic repair of Bankart lesion using this method was performed in 16 consecutive patients who were prospectively enrolled. Fifteen shoulders were treated with two-anchor sutures and one was treated with three-anchor sutures. Twelve patients received metallic anchor screws and four patients received bioanchor screws. The assessments were performed using the Rowe score, the University of California at Los Angeles shoulder rating scale, the American Shoulder and Elbow Surgeons score, and the shoulder range of motion (ROM) deficit.
Results: With an average follow-up period of 22.9 months, all shoulder scores improved after surgery ($p < 0.001$). The average ROM deficit of the operated shoulders was not significant as compared with the healthy side in forward elevation ($p > 0.05$), but was significant in external rotation ($p < 0.05$). All of the 16 shoulders remained stable (100%) after the arthroscopic repair surgery. All patients returned to their preinjury levels of daily activity without recurrent problems.
Conclusion: In patients with traumatic anterior glenohumeral instability, arthroscopic Bankart repair with the two portal method can provide good results. It can be an alternative method of treating patients with Bankart lesion without associated major glenoid defect or rotator cuff lesion in traumatic anterior-inferior instability.

1. Introduction

Arthroscopic Bankart lesion repair has become a popular method of treating patients with traumatic anterior-inferior shoulder instability.[1–5] It can achieve results comparable to those with traditional open repair of Bankart lesion if the procedure is selected on the basis of the pathological findings at the time of surgery.[6–15] Arthroscopic Bankart repair performed as same-day surgery is more cost effective than open repair.[16] According to a report by Tjoumakaris et al,[17] there was no difference between the arthroscopic and open Bankart repair groups using patient-assessed outcomes.[17]

One of the most important steps to master during shoulder arthroscopy is accurate portal placement. Improper portal position can frustrate the arthroscopist for the entire duration of the case. An additional working portal is usually necessary during the operation, especially for the repair of badly damaged capsular ligaments or labrum using various types of relay techniques. The most commonly used glenohumeral arthroscopy portals are the posterior portal, anterior portal, 5 o'clock portal, anteriosuperolateral portal, Port of Wilmington portal, and posteriolateral portal. The

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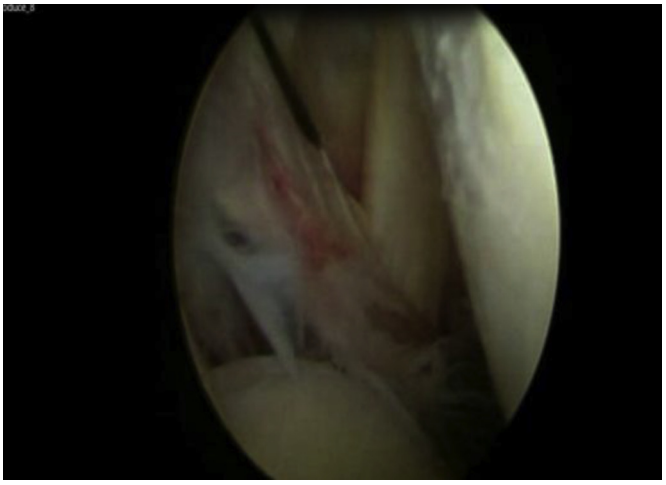

Fig. 1. Once the posterior portal was established, we created anterior portals with an outside-in technique using a spinal needle to determine the proper angle of approach prior to making the skin puncture.

three-portal method (one posterior portal with dual anterior portals) is the most popular and effective method to repair Bankart lesion arthroscopically.[18,19] Traditionally, one posterior portal or one anteriosuperolateral portal is used as a viewing portal and the other two portals are used as working portals. However, creation of the dual anterior portal can sometimes be difficult and time consuming in the limited space of the rotator interval, especially in shorter patients or patients with small muscle girdle of the shoulder joint.

Another important issue is the placement and size of cannulas after portals are selected. Generally, in the glenohumeral joint we often use cannulas in portals that will require repeated usage (e.g., posterior, anterior, and anteriosuperolateral portals). The reason is to ensure a clear and consistent path through the deltoid muscle and rotator cuff into the glenohumeral joint to prevent repeated damage of soft tissue such as the deltoid muscle or rotator cuff. When choosing a cannula, it is also important to have a clear understanding of what the cannula will be used for and which cannulas can accommodate certain suture-passing instruments.[18] Different sizes and various styles of cannulas are available. The diameter of cannulas ranges from 5.5 mm to 8.25 mm. Using a smaller cannula might seem advantageous because it limits the

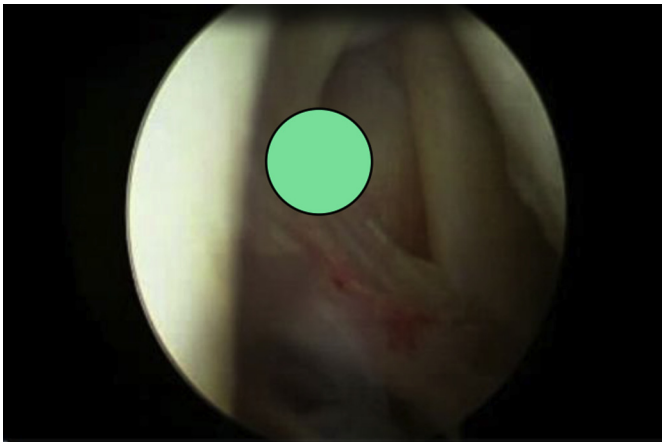

Fig. 2. An anterior portal was created at the junction of the upper rotator interval with the anterior border of the supraspinatus tendon.

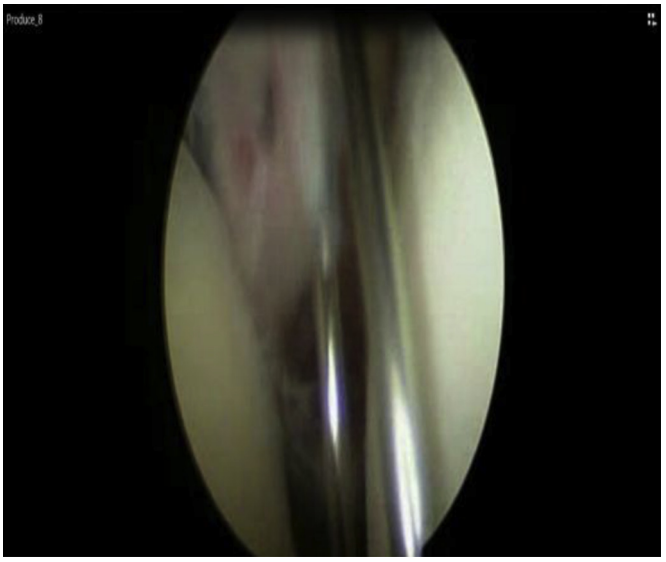

Fig. 3. A switching stick was walked down beside the needle and a cannula was placed over the switching stick.

disruption of soft tissues and potentially limits swelling. Not all instruments, however, can fit through all cannulas. The problem of collision of two cannulas in the anterior dual portals can occur in some cases such as in shorter patients with small muscle girdle of the shoulder joint.

These two problems can make arthroscopic Bankart repair more difficult. To avoid them, we tried to use the two-portal method (one anterior portal and one posterior portal) to treat patients with Bankart lesion in traumatic anterior-inferior instability. Sugaya et al[20] used a noncannula method to repair Bankart lesions. This method seems to prevent fluid extravasation, ensures easy access to the inferior portion of the glenoid, and facilitates intra-articular techniques. In 2005, Matsui and Omachi[21] were the first authors to propose a new secure suture relay technique for arthroscopic Bankart repair using suture anchors without creating an additional

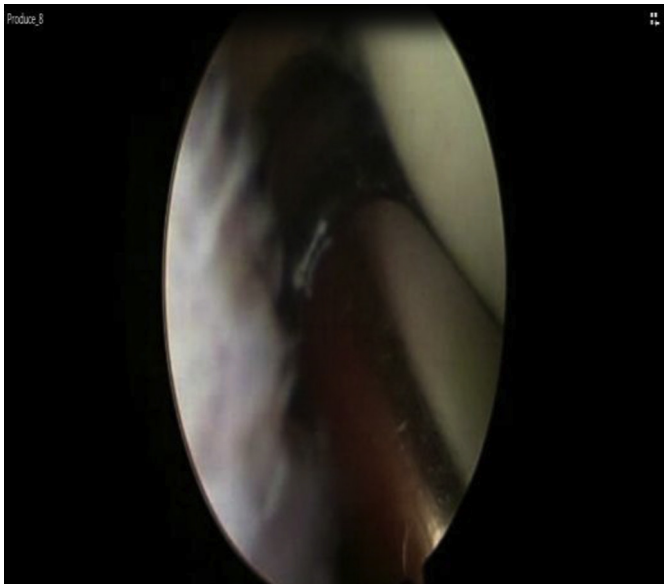

Fig. 4. An 8.25-mm semitransparent plastic cannula was inserted into the glenohumeral joint.

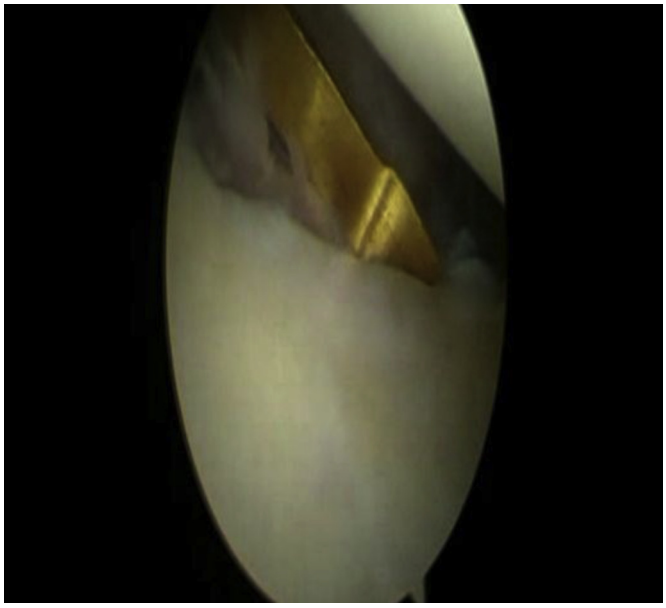

Fig. 5. The capsulolabral sleeve was dissected from the anterior glenoid neck with an arthroscopic chisel dissector through the anterior portal.

working portal. This technique is more cost effective and provides better cosmetic results because only a simple device is required. The purpose of this study is to report our preliminary results in arthroscopic Bankart repair of traumatic anterior-inferior shoulder instability with the two-portal method.

2. Materials and methods

2.1. Patients' demographic data

From August 2009 to December 2011, arthroscopic Bankart repair with the two-portal method was performed in 16 patients (15 males and 1 female) with traumatic anterior-inferior instability. All of the patients had Bankart lesions with Hill–Sachs lesions but no other associated lesions, such as superior labrum anterior and posterior lesion or rotator cuff lesion, and glenoid defect with less than 25% bone loss. Preoperative diagnosis was confirmed by documented history of traumatic anterior dislocation, physical examination, X-ray examination, and magnetic resonance arthrogram. The patients' mean age at the time of operation was 28.3 years (range: 17–49 years). Ten patients had right shoulder lesion and six patients had left shoulder lesion. The frequency of dislocation was more than two times. The duration of operation since the first dislocation was 3.5 years (range: from 6 months to 10 years) on average. The average follow-up period was 22.9 months (range: 12–35 months). The cause of dislocation was sport injury in

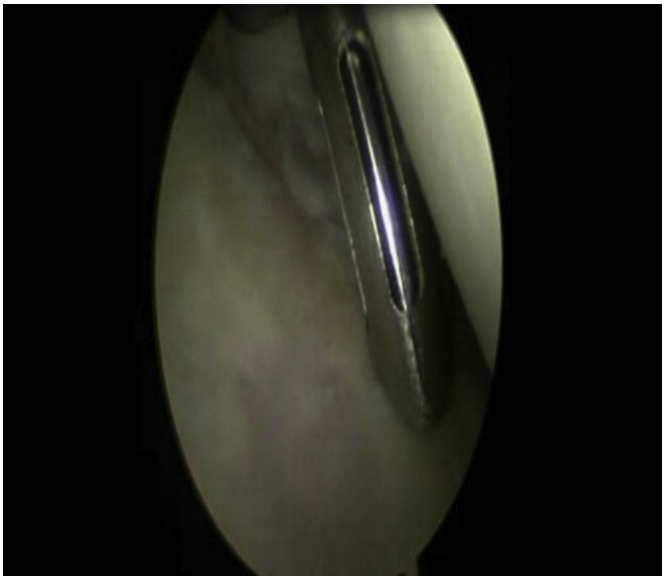

Fig. 7. A drill guide was introduced at the 3-o'clock to 5-o'clock position on the glenoid rim.

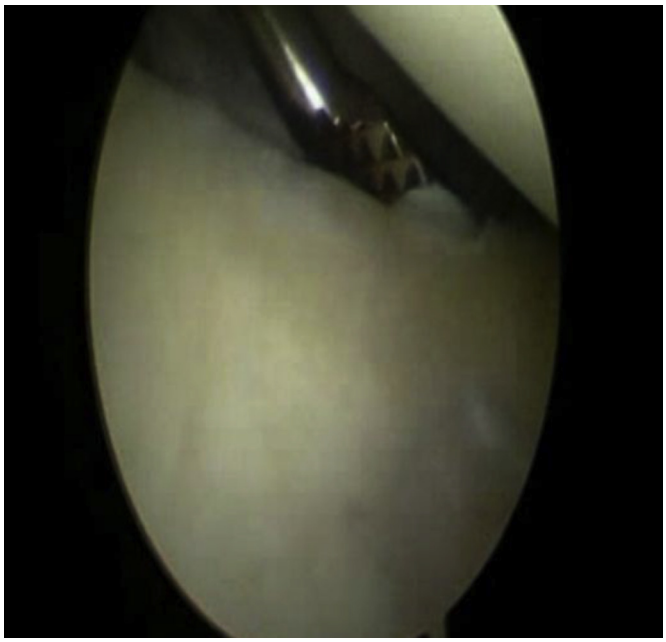

Fig. 6. The anterior glenoid was lightly dusted with a shaver or rasp to create a bleeding bone surface.

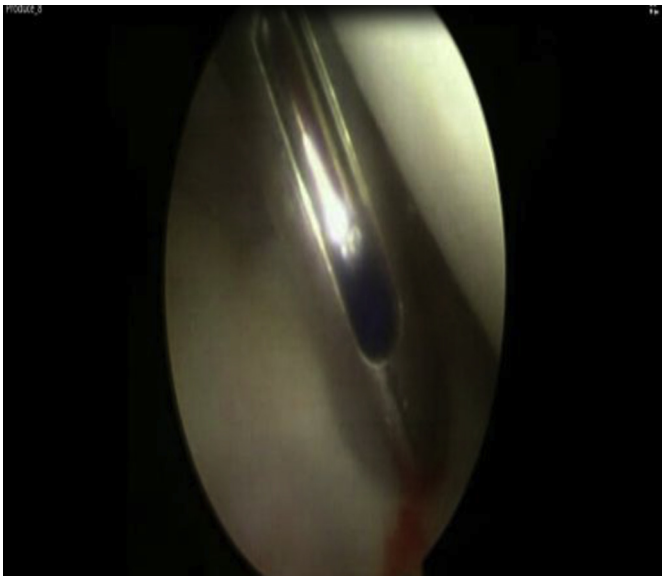

Fig. 8. The suture anchors (Bio Mini-Revo screws with number 2 Hi-Fi suture, 3.1 mm outer diameter ConMed/Linvatec; or FASTak suture anchor 2.8 mm Arthrex) were inserted on the glenoid rim.

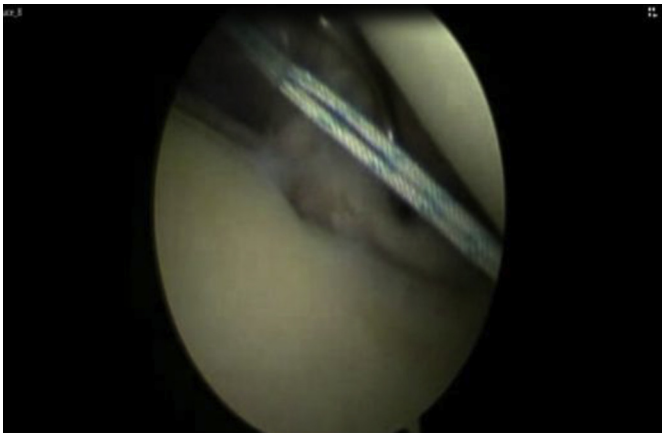

Fig. 9. Tissues (labrum, inferior glenohumeral ligament, or capsule) were pierced with suture hooks (Spectrum II/Linvatec).

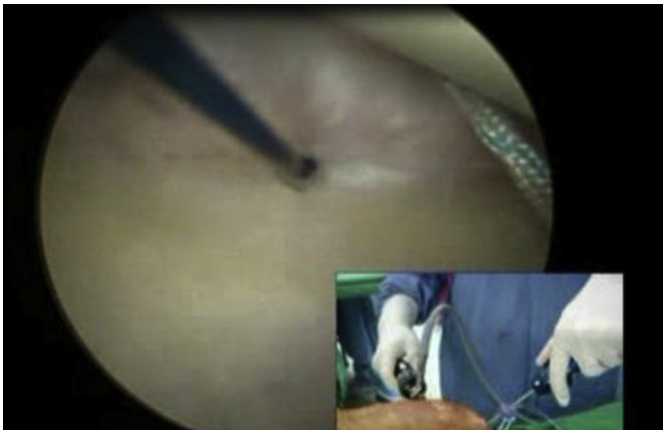

Fig. 11. The 2-0 PDS suture was driven as far into the glenohumeral joint as possible. PDS = polydioxanone.

seven patients and traffic accident or fall in nine patients. The arthroscopic Bankart repair with the two-portal method (posterior portal and anterior portal) was performed in all 16 patients by the same surgeon at Taichung Veterans General Hospital, a tertiary referral center in central Taiwan.

2.2. Surgical procedure

Under general anesthesia, the patient was placed in the lateral decubitus position. The arm was placed in a padded traction sleeve at 45° of abduction with approximately 4.5 kgm of traction. Initially, we started from a posterior viewing portal. Once the posterior portal was established, we created anterior portals with an outside-in technique using a spinal needle to determine the proper angle of approach prior to making the skin puncture (Fig. 1). An anterior portal was created at the junction of the upper rotator interval with the anterior border of the supraspinatus tendon (Fig. 2). Then a switching stick was walked down beside the needle, and a cannula was placed over the switching stick (Fig. 3). An 8.25-mm semitransparent plastic cannula (Arthrex, USA) was inserted into the glenohumeral joint (Fig. 4). Then we dissected the capsulolabral sleeve from the anterior glenoid neck with an arthroscopic chisel dissector through the anterior portal (Fig. 5). Next, we lightly dusted the anterior glenoid with a shaver or rasp to create a bleeding bone surface (Fig. 6). A drill guide was introduced at the 3-o'clock to 5-o'clock position on the glenoid rim (Fig. 7). The suture anchors [Bio Mini-Revo screws with number 2 Hi-Fi suture, 3.1 mm outer diameter ConMed Linvatec, Largo, FL, USA; or FASTak suture anchor (2.8 mm), Arthrex, Naples, FL, USA] were inserted on the

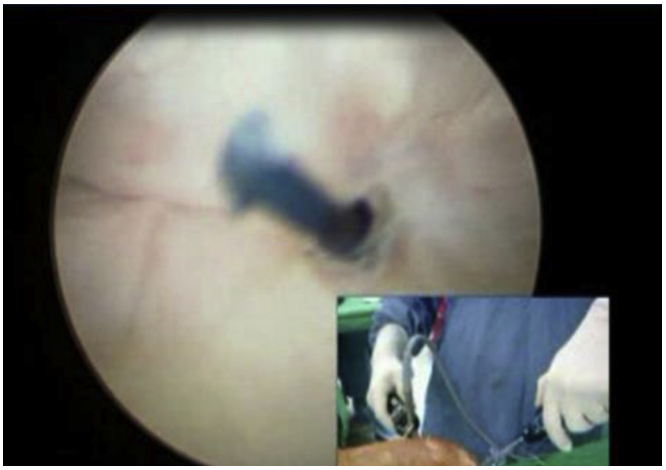

Fig. 10. Tissues (labrum, inferior glenohumeral ligament, or capsule) were pierced with suture hooks (Spectrum II/Linvatec); 2-0 PDS suture was used as a shuttle suture. PDS = polydioxanone.

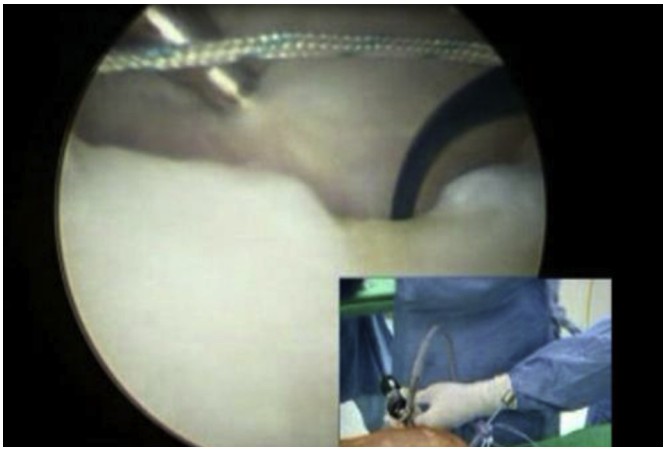

Fig. 12. Detachment of handle from the suture hook.

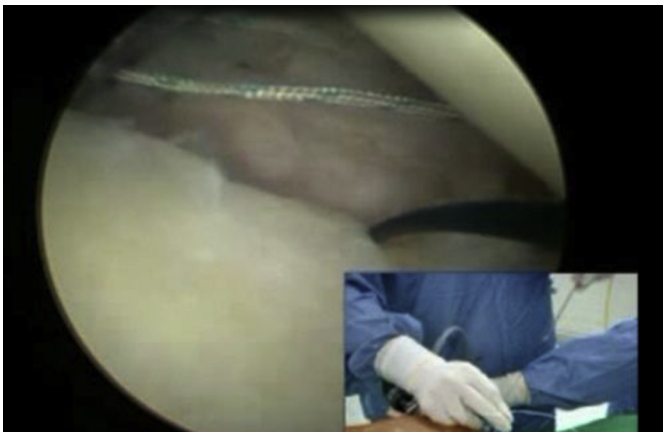

Fig. 13. The suture hook was withdrawn and the PDS suture was left in the glenohumeral joint. PDS = polydioxanone.

Fig. 14. The PDS and one side of the Hi-Fi suture were grasped with a suture retriever, which had been put into the same cannula. PDS = polydioxanone.

glenoid rim (Fig. 8). Tissues (labrum, inferior glenohumeral ligament, or capsule) were pierced with suture hooks (Spectrum II/Linvatec) (Fig. 9). A 2-0 polydioxanone (PDS) suture was used as a shuttle suture (Fig. 10). The 2-0 PDS suture was driven into the

Fig. 15. The PDS suture and one side of the Hi-Fi suture were retrieved with the aid of the suture retriever. PDS = polydioxanone.

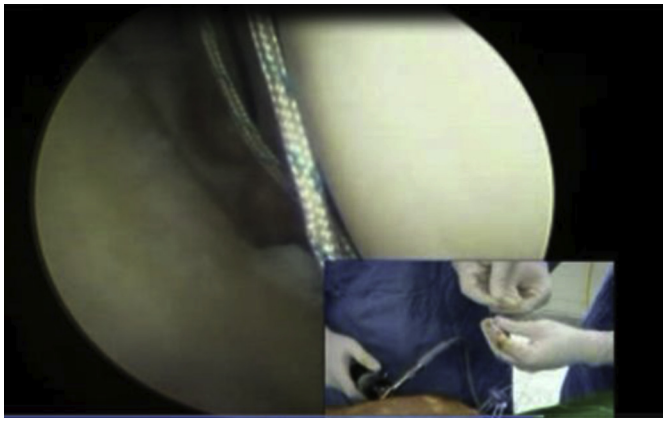

Fig. 16. A knot of PDS was tied on the Hi-Fi suture (retrieved by suture retriever) as a shuttle suture. PDS = polydioxanone.

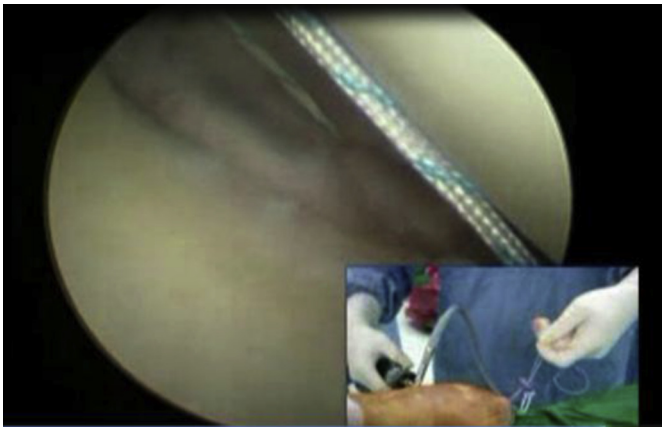

Fig. 17. The Hi-Fi suture was passed through the labrum and capsule with the aid of 2-0 PDS shuttle suture. PDS = polydioxanone.

glenohumeral joint as far as possible (Fig. 11). The handle was then detached from the suture hook (Fig. 12). We withdrew the suture hook and left the PDS suture within the glenohumeral joint (Fig. 13). The PDS and one side of the Hi-Fi suture were grasped using a suture retriever, which had been put into the same cannula (Fig. 14). The PDS suture and one side of the Hi-Fi suture were retrieved with the aid of a suture retriever (Fig. 15). A knot of the PDS was tied onto the Hi-Fi suture (retrieved by the suture retriever) as a shuttle suture (Fig. 16). The Hi-Fi suture was passed through the labrum and capsule with the aid of a 2-0 PDS shuttle suture (Fig. 17). The knot was then tied using a knot pusher (Fig. 18). The suture was cut with a suture cutter. Either two- or three-anchor sutures were fixed into the glenoid depending on the lesion size. Twelve patients were treated with metallic anchor screws and four patients were treated with bioanchor screws. Two-anchor screw fixation was done in 15 patients and three-anchor screw fixation was done in one patient.

2.3. Postoperative rehabilitation program and evaluation

The postoperative rehabilitation program included sling immobilization for 3 weeks, followed by gradual short range exercise from 3 weeks to 6 weeks, full range of motion (ROM) exercise from 6 weeks to 5 months, and hard throwing motion exercise after 5 months. The average follow-up period was 22.9 months (range: 12–35 months). The preoperative and postoperative results were

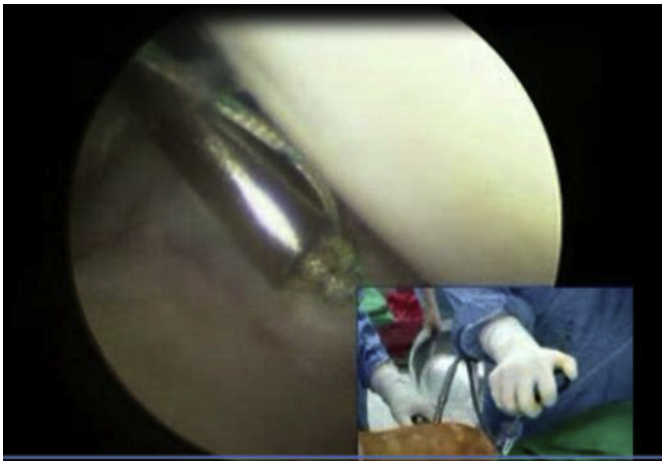

Fig. 18. The knot was then tied using a knot pusher.

Table 1
Comparison of preoperative and postoperative (3 months' postoperation) Rowe, ASES, and UCLA scores by paired *t* test (SPSS version 15).

	Preoperative score	Postoperative score	*p*
Rowe score	35.94 ± 3.75	92.19 ± 4.07	<0.001
ASES score	46.61 ± 2.14	95.06 ± 2.54	<0.001
UCLA score	20.36 ± 1.26	32.25 ± 1.73	<0.001

ASES = American Shoulder and Elbow Surgeons; UCLA = University of California at Los Angeles.

evaluated by the University of California at Los Angeles (UCLA) score, Rowe score, American Shoulder and Elbow Surgeons (ASES) score, and ROM deficit. Paired *t* tests were used to assess the difference between the shoulder scores and the preoperative and postoperative ROM deficits. All analyses were performed with paired sample *t* test using SPSS statistical software version 15 (SPSS Inc., Chicago, IL, USA).

3. Results

The average operation time was 40 minutes (range: 35–60 minutes). Blood loss amount was minimal. The preoperative and postoperative results were evaluated by the UCLA score, Rowe score, ASES score, and ROM deficit. The mean preoperative UCLA score was 20.36 ± 1.26 and the mean postoperative follow-up score was 32.25 ± 1.73. The mean preoperative Rowe score was 35.94 ± 3.75 and the mean postoperative follow-up score was 92.19 ± 4.07. The mean preoperative ASES score was 46.61 ± 2.14 and the mean postoperative follow-up score was 95.06 ± 2.54 (Table 1). Side-to-side ROM deficits (healthy side compared with the operated side) were 3.08° ± 0.85° preoperatively and 3.25° ± 1.06° postoperatively (3 months later) in forward elevation and 2.13° ± 0.81° preoperatively and 2.75° ± 0.77° postoperatively (3 months later) in external rotation (Table 2). With an average follow-up period of 27.9 months, all shoulder scores improved after the surgery ($p < 0.001$). The average ROM deficit of the operated shoulders was not significant when compared with the healthy side in forward elevation ($p > 0.05$) but was significant in external rotation ($p < 0.05$). A total of 16 shoulders remained stable and there were no recurrent dislocations or related complications such as wound infection or postoperative arthrofibrosis. All patients without recurrence returned to their preinjury levels of athletic activity.

Table 2
Comparison of preoperative and postoperative ROM deficits (3 months' postoperation) by paired *t* test (SPSS version 15).

	Forward elevation	External rotation
Preoperative ROM deficit	3.06 ± 0.85	2.13 ± 0.81
Postoperative ROM deficit	3.25 ± 1.06	2.75 ± 0.77
p	0.188 ($p > 0.05$)	0.046 ($p < 0.05$)

ROM = range of motion.

4. Discussion

We reported our experience with this two-portal technique to provide an effective alternative method for arthroscopic surgeons to treat patients with Bankart lesion. Randomized clinical studies comparing the two-portal and three-portal methods may be needed to confirm whether the two-portal method could be a better and more reliable method for treating Bankart lesions in patients with anterior-inferior instability.

The two-portal method offers several advantages for arthroscopic repair of Bankart lesions. First, creation of the dual anterior portal can be difficult and time consuming in the limited space of the rotator interval in shorter patients with small muscle girdle of the shoulder joint. The problem of collision of two anterior cannulas can also occur in these patients. In such cases, the two-portal method can reduce the occurrence of complications related to creating dual anterior working portals.[22,23] Second, cosmetic results are better and rehabilitation time is reduced after operation with the two-portal technique. Third, reduction of medical costs is an important consideration when we are planning to treat patients in the diagnosis-related group system in Taiwan. Reduction in the use of cannulas with the two-portal method also reduces the medical cost of the entire procedure. Fourth, soft-tissue damage can be minimized by reducing the number of portals that are created during an operation. Using two portals instead of three not only reduces possible risks and complications related to creating the portals, but also minimizes soft-tissue damage. It is important to create the ideal position of anterior portal because it is the only anterior portal that we can use with this two-portal method. Prior to the creation of the anterior portal, we recommend using the long K wire to find the ideal portal site, which can reach the point that we are going to place the anchor suture (Fig. 19). The only disadvantage of the two-portal method is the possibility of twisting, kinking, and locking of the sutures while doing the shuttle suture through the anterior portal.

As we know, surgeons who perform arthroscopic shoulder surgery go through a learning curve to master the procedure. Arthroscopic Bankart repair with the two-portal method can be performed by an arthroscopic surgeon without an experienced assistant. All of the procedures, including debridement of soft tissue, decortication

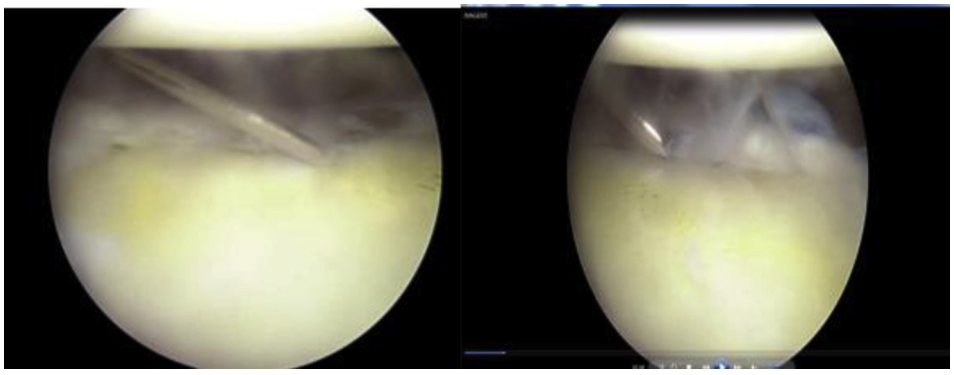

Fig. 19. Prior to the creation of the anterior portal, we recommend using the long K wire to find the ideal portal site that can reach the point that we are going use to place the anchor suture.

of the cortical bone and cartilage, repair of the torn labrum, placement of anchor screws, retrieval of the shuttle suture, and making the suture ties can be done through the anterior portal. Therefore, the operation can be performed smoothly and quickly by an experienced arthroscopic shoulder surgeon.

In conclusion, in patients with traumatic anterior glenohumeral instability, arthroscopic Bankart repair with the two-portal method can provide good results. It offers an alternative method for treating patients with Bankart lesion without associated major glenoid defect or rotator cuff lesion in traumatic anterior-inferior instability. The two-portal method has several advantages over the three-portal method such as the reduction of complications related to creation of another portal, a decrease of collision of cannulas in the anterior dual portals, better cosmetic appearance, lower cost, and minimization of postoperative soft-tissue damage and swelling.

Acknowledgments

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References

1. G.M. Gartsman, T.S. Roddey, S.M. Hammerman. Arthroscopic treatment of anterior-inferior glenohumeral instability. Two to five-year follow-up. J Bone Joint Surg Am 82-A (2000) 991–1003.
2. E.R. Chiang, J.P. Wang, S.T. Wang, S.C. Hung, H.L. Ma, C.L. Liu, T.H. Chen. Arthroscopic posteroinferior capsular plication and rotator interval closure after Bankart repair in patients with traumatic anterior glenohumeral instability—A minimum follow-up of 5 years. Injury 41 (2010) 1075–1078.
3. S.H. Kim, K.I. Ha, Y.B. Cho, B.D. Ryu, I. Oh. Arthroscopic anterior stabilization of the shoulder: two to six-year follow-up. J Bone Joint Surg Am 85-A (2003) 1511–1518.
4. D.K. Mishra, G.S. Fanton. Two-year outcome of arthroscopic Bankart repair and electrothermal-assisted capsulorrhaphy for recurrent traumatic anterior shoulder instability. Arthroscopy 17 (2001) 844–849.
5. G.W. Ee, S. Mohamed, A.H. Tan. Long term results of arthroscopic Bankart repair for traumatic anterior shoulder instability. J Orthop Surg Res 6 (2011) 28.
6. S.H. Kim, K.I. Ha, S.H. Kim. Bankart repair in traumatic anterior shoulder instability: open versus arthroscopic technique. Arthroscopy 18 (2002) 755–763.
7. J. Karlsson, L. Magnusson, L. Ejerhed, I. Hultenheim, O. Lundin, J. Kartus. Comparison of open and arthroscopic stabilization for recurrent shoulder dislocation in patients with a Bankart lesion. Am J Sports Med 29 (2001) 538–542.
8. C. Fabbriciani, G. Milano, A. Demontis, S. Fadda, F. Ziranu, P.D. Mulas. Arthroscopic versus open treatment of Bankart lesion of the shoulder: a prospective randomized study. Arthroscopy 20 (2004) 456–462.
9. C.R. Bottoni, E.L. Smith, M.J. Berkowitz, R.B. Towle, J.H. Moore. Arthroscopic versus open shoulder stabilization for recurrent anterior instability: a prospective randomized clinical trial. Am J Sports Med 34 (2006) 1730–1737.
10. J. Hobby, D. Griffin, M. Dunbar, P. Boileau. Is arthroscopic surgery for stabilization of chronic shoulder instability as effective as open surgery? J Bone Joint Surg Br 89 (2007) 1188–1196.
11. D.F. Geiger, J.A. Hurley, J.A. Tovey, J.P. Rao. Results of arthroscopic versus open Bankart suture repair. Clin Orthop Relat Res (1997) 111–117.
12. A. Sperber, P. Hamberg, J. Karlsson, L. Sward, T. Wredmark. Comparison of an arthroscopic and an open procedure for posttraumatic instability of the shoulder: a prospective, randomized multicenter study. J Shoulder Elbow Surg 10 (2001) 105–108.
13. T.R. Lenters, A.K. Franta, F.M. Wolf, S.S. Leopold, F.A Matsen 3rd. Arthroscopic compared with open repairs for recurrent anterior shoulder instability. A systematic review and meta-analysis of the literature. J Bone Joint Surg Am 89 (2007) 244–254.
14. N.G. Mohtadi, I.J. Bitar, T.M. Sasyniuk, R.M. Hollinshead, W.P. Harper. Arthroscopic versus open repair for traumatic anterior shoulder instability: a meta-analysis. Arthroscopy 21 (2005) 652–658.
15. B.J. Cole, J. L'Insalata, J. Irrgang, J.J. Warner. Comparison of arthroscopic and open anterior shoulder stabilization. A two to six-year follow-up study. J Bone Joint Surg Am 82-A (2000) 1108–1114.
16. C. Wang, N. Ghalambor, B. Zarins, J.J. Warner. Arthroscopic versus open Bankart repair: analysis of patient subjective outcome and cost. Arthroscopy 21 (2005) 1219–1222.
17. F.P. Tjoumakaris, J.A. Abboud, S.A. Hasan, M.L. Ramsey, G.R. Williams. Arthroscopic and open Bankart repairs provide similar outcomes. Clin Orthop Relat Res 446 (2006) 227–232.
18. S.S. Burkhart, K.Y. Lo, P.C. Brady. A Cowboy's Guide to Advanced Shoulder Arthroscopy. Lippincott, Williams & Wilkins, Philadelphia, PA; 2006. pp. 7–32.
19. I.K. Lo, C.C. Lind, S.S. Burkhart. Glenohumeral arthroscopy portals established using an outside-in technique: neurovascular anatomy at risk. Arthroscopy 20 (2004) 596–602.
20. H. Sugaya, Y. Kon, A. Tsuchiya. Arthroscopic Bankart repair in the beachchair position: a cannulaless method using an intra-articular suture relay technique. Arthroscopy 20 (2004) 116–120.
21. Y. Matsui, T. Omachi. New secure suture relay technique for arthroscopic Bankart repair without making an additional working portal. Arthroscopy 21 (2005) 113–118.
22. H.E. Segmüller, A.P. Alfred, G. Zilio, A.D. Saies, M.G. Hayes. Cutaneous nerve lesions of the shoulder and arm after arthroscopic shoulder surgery. J Shoulder Elbow Surg 4 (1995) 254–258.
23. M. Meyer, N. Graveleau, P. Hardy, P. Landreau. Anatomic risks of shoulder arthroscopy portals: anatomic cadaveric study of 12 portals. Arthroscopy 23 (2007) 529–536.