Journal of Orthopaedics, Trauma and Rehabilitation 19 (2015) 78–82

Contents lists available at ScienceDirect

Journal of Orthopaedics, Trauma and Rehabilitation

Journal homepages: www.e-jotr.com & www.ejotr.org

Original Article

A Comparison of Biceps Labrum Complex Findings in Patients With and Without Superior Migration of the Humeral Head in Large or Massive Rotator Cuff Tears

比較在患有旋轉袖肌巨大破裂的病人中有和沒有肱骨頭向上遷移對於肱二頭肌盂唇複合體的影響

Nariyuki Mura [a, b, *], Mikio Harada [a, b], Daisaku Tsuruta [b], Toshihiko Ogino [c], Michiaki Takagi [b]

[a] Department of Orthopaedic Surgery, Yoshioka Hospital, Higashihoncho, Tendo, Yamagata, Japan
[b] Department of Orthopaedic Surgery, Yamagata University Faculty of Medicine, Yamagata, Japan
[c] Department of Orthopaedic Surgery, Hokushin Higashi Hospital, Higashiku, Sapporo, Japan

ARTICLE INFO

Article history:
Received 20 March 2014
Received in revised form
15 May 2014
Accepted 31 May 2014

Keywords:
arthroscopic findings
biceps labrum complex
rotator cuff tear
superior migration of humeral head

ABSTRACT

Background: The purpose of this study was to clarify the relationship between superior migration of the humeral head and findings of biceps labrum complex (BLC) in large or massive rotator cuff tears.
Methods: Forty-nine shoulders that underwent surgery for torn supraspinatus and infraspinatus tendons were included. Patients were divided into two groups according to the acromio–humeral interval (AHI). Arthroscopic findings of BLC were classified into five types; Type 0; normal shape, Type 1: fraying; Type 2: detachment; Type 3: attrition of BLC and superior glenoid; and Type 4: defect.
Results: The group without migration (AHI ≥ 7 mm) consisted of 21 shoulders and that with migration (AHI < 7 mm) was 28 shoulders. There were significantly more patients with Types 2, 3, and 4 in the group with migration than without migration.
Conclusion: This study indicates a potential relationship between BLC injury and superior humeral head migration accompanied by a rotator cuff tear.

中 文 摘 要

背景: 一個大的肩袖撕裂的患者往往被確定有肱骨頭的向上遷移。這項研究的目的是澄清在大型或巨型肩袖撕裂的患者中，肱骨頭向上遷移和關節鏡下的肱二頭肌盂唇複合體（biceps labrum complex; BLC）之間的關係。
方法: 研究包括49個因撕裂岡上肌和岡下肌腱而接受關節鏡手術的病人。患者根據肩峰間隔（acromio-humeral interval; AHI）分成兩組。沒有向上的遷移的一組定義為患者的AHI是或多於7毫米。有向上遷移的一組定義為患者的AHI少於7毫米。研究調查患者的臨床特徵，關節鏡下的肱二頭肌長頭（long head of biceps; LHB）特徵，肩胛下肌腱和BLC。 BLC損傷分為5種類型，類型0:正常形狀，類型1:磨損，2型:分離，3型: BLC和上盂唇的磨損，類型4:缺陷。
結果: 肱骨頭沒有向上遷移的組別包括了21個肩膀，癥狀發作期為7.5個月。肱骨頭向上遷移的組別包括了28的肩膀，癥狀發作期為23.0個月。LHB和肩胛下肌腱狀態兩組沒有顯著差異。兩組中BLC受傷的發現分別是[類型:有遷移;沒有遷移] – 0型: 4個;1個，1型: 7個;1個，2型: 4個;12個，3型: 6個;13個，和4型: 0個;1個。在肱骨頭向上遷移的組別中，BLC受傷類型為2，3，4型的患者顯著高於沒有遷移的組別。
結論: 這項研究表明在肩袖撕裂的患者中，BLC傷害和肱骨頭向上遷移有潛在的關係。

* Corresponding author. *E-mail:* muran@yoshioka-hp.or.jp.

http://dx.doi.org/10.1016/j.jotr.2014.05.002

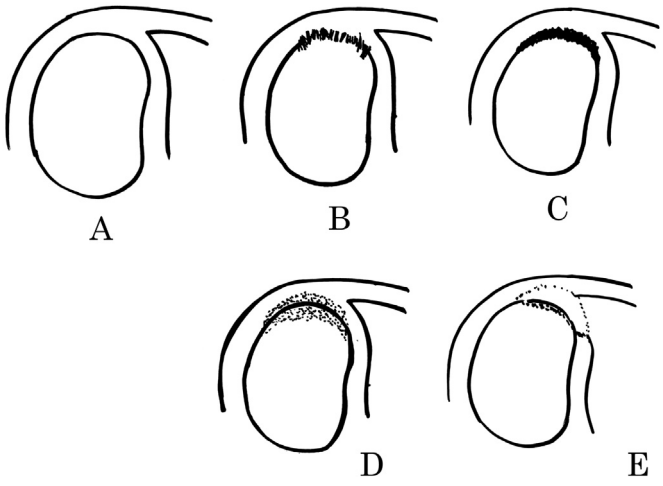

Figure 1. Classification of arthroscopic findings of superior labrum (BLC). (A) Type 0: no abnormal findings; (B) Type 1: fraying; (C) Type 2: labral detachment; (D) Type 3: attrition of cartilage and labrum; and (E) Type 4: labral defect.

Introduction

Superior migration of the humeral head is often seen in large or massive rotator cuff tears.[1] The main cause of superior humeral head migration is considered to be infraspinatus tendon tear.[2] However, superior migration is not observed in massive tears in some cases. It has been reported that the long head of the biceps tendon (LHB) has a depressor function on the humeral head to escape from superior migration,[3,4] and that the articular labrum contributes to joint stability.[5] Rotator cuff tears have been reported to occur frequently with superior labral injuries based on magnetic resonance imaging findings.[6] However, the relationship is not yet clear between superior labral injuries and superior humeral head migration in rotator cuff tears. This study aimed to elucidate the relationship between superior humeral head migration and injuries to the biceps tendon–labrum complex (BLC).

Methods and materials

The patients had large or massive rotator cuff tears with both supraspinatus and infraspinatus tendon tears. Mini-open or arthroscopic rotator cuff repair was performed on a total of 49 shoulders. Regarding intra-articular structures in the glenohumeral joint, all cases were examined and probed in arthroscopy. Preoperative plain radiographs (frontal anterior–posterior views) were used to measure the acromio–humeral intervals (AHI) in the neutral position in standing. Normal AHI was ≥7 mm based on the criteria of Weiner and Macnab.[1] Therefore, in our series, patients with AHI of <7 mm were classified into the group with superior migration of the humeral head and those with ≥7 mm AHI into that without superior migration. Between these two groups, the age at surgery, symptomatic period between onset and surgery, absence or presence of trauma at onset, preoperative and postoperative Japanese Orthopaedic Association (JOA) score (shoulder surgery classification system), and arthroscopic findings were compared. The arthroscopy was used to examine and probe the BLC itself and the absence or presence of LHB tear, LHB dislocation, and subscapularis tendon tear. The arthroscopic findings of BLC were classified into five types: Type 0 for no finding of abnormality; Type 1 for fraying; Type 2 for detachment of the BLC from the glenoid; Type 3 for attrition of the BLC and cartilage of the superior glenoid; and Type 4 for defect, including partial loss of BLC (Figure 1). Arthroscopic findings of subscapularis tear were divided by Lafosse's classification system.[7] Statistical analysis was performed using the Mann–Whitney *U* test and Fisher's exact test. Statistical significance was set at 0.05.

Results

The mean age at surgery was 64 years (range 49–76 years) in a group without superior migration (21 shoulders) and 64 years (42–78 years) in a group with superior migration (28 shoulders; Table 1). The group without superior migration and the group with superior migration had, respectively: a symptomatic period of 7.5 months and 23.0 months; a history of trauma in eight shoulders and 14 shoulders; preoperative JOA score of 63.5 points and 60.0 points; postoperative JOA score of 88.9 points and 90.3 points; LHB tear in six shoulders and nine shoulders; LHB dislocation in three shoulders and six shoulders; superior one-third of subscapularis tendon tear in four shoulders and five shoulders; and superior two-thirds or complete of subscapularis tendon tear in four shoulders and eight shoulders. The symptomatic period was significantly longer in the group with superior migration than in that without migration ($p < 0.05$). The group without superior migration and the group with superior migration had, respectively: BLC injury of type 0 (Figure 2) in four shoulders and one shoulder; Type 1 (Figure 3) in seven shoulders and one shoulder; Type 2 (Figure 4) in four shoulders and 12 shoulders; Type 3 (Figure 5) in six shoulders and 13 shoulders; and Type 4 (Figure 6) in zero shoulders and one shoulder. If Types 0 and 1 were defined as without injury of BLC and Types 2 or more as with injury, BLC injuries were seen more frequently in the group with superior migration than in the group without ($p < 0.05$; Table 2). There was a significant negative correlation between AHI and the type of BLC injury ($p = 0.0123$, $r = -0.368$).

Table 1
Comparison of two groups without and with superior migration.

	Group without superior migration	Group with superior migration
No. of shoulders	21	28
Age at surgery (y)	64 (49–76)	64 (42–78)
Symptomatic period (mo)*	7.5	23.0
History of trauma	8	14
Preoperative JOA score (points)	63.5	60.0
Postoperative JOA score (points)	88.9	90.3
LHB tear	6	9
LHB dislocation	3	6
Subscapularis tendon tear (superior one-third)	4	5
Subscapularis tendon tear (superior two-thirds or complete)	4	8

JOA = Japanese Orthopaedic Association; LHB = long head of the biceps tendon.
* $p < 0.05$.

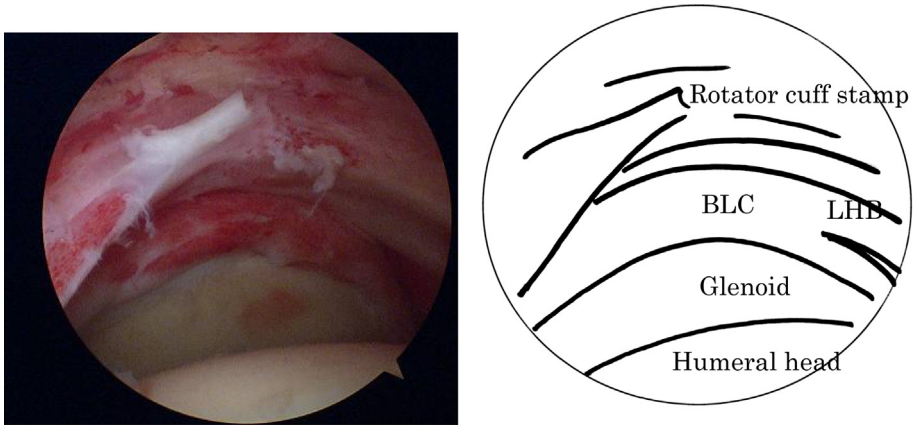

Figure 2. Type 0: normal shape.

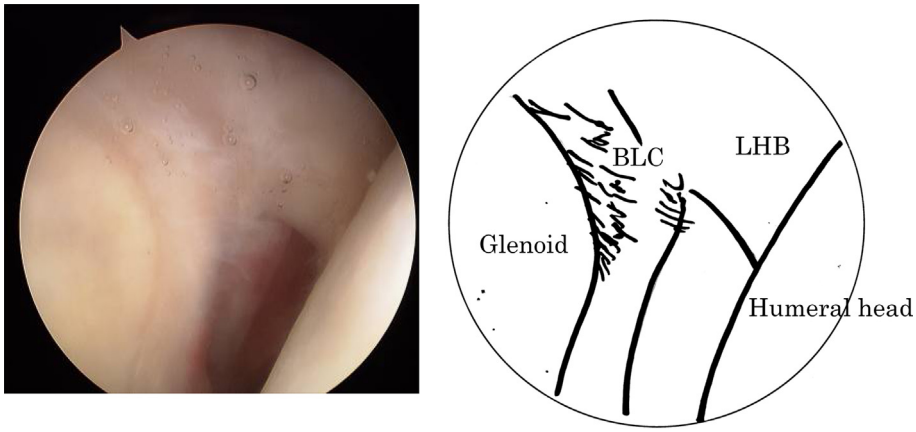

Figure 3. Type 1: fraying.

Discussion

Superior migration of the humeral head is seen in some cases of rotator cuff tears. Its pathogenesis is thought to involve upward traction force applied by deltoid muscles.[1] It is accompanied by a decreased compression of the humeral head into the glenoid by the rotator cuff muscles and a loss of sealing effect of the rotator cuff. There have been studies to examine the cause of superior humeral head migration. Nové-Josserand et al[2] reported that infraspinatus muscles were the most important factor of superior humeral head migration. Namura et al[8] reported that superior migration occurs due to infraspinatus and subscapularis tendon tears. Mura et al[9] created rotator cuff tears in cadavers and examined superior humeral head migration. They observed significant superior humeral head migration when there were supraspinatus and infraspinatus tendon tears. However, some cadavers had only supraspinatus tear, but developed superior migration. Other cadavers had both types of tears and no superior migration. These results suggest that there

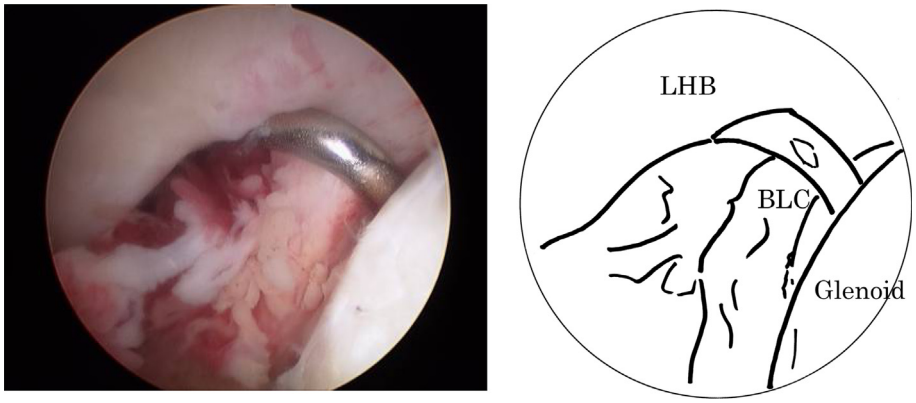

Figure 4. Type 2: labral detachment.

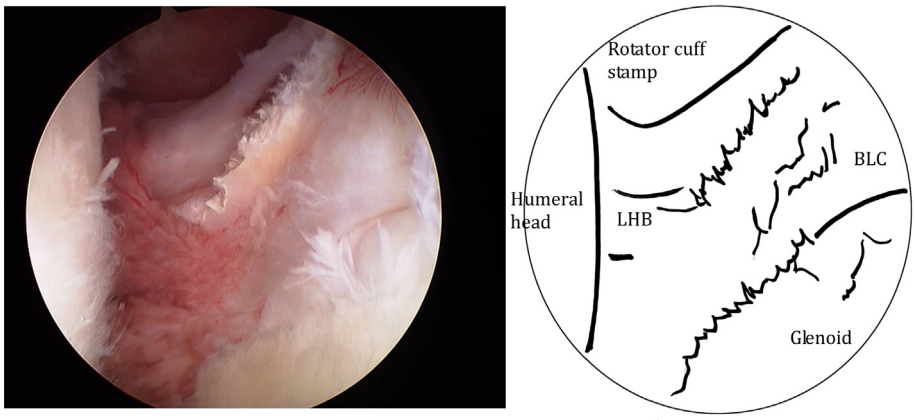

Figure 5. Type 3: attrition of cartilage and labrum.

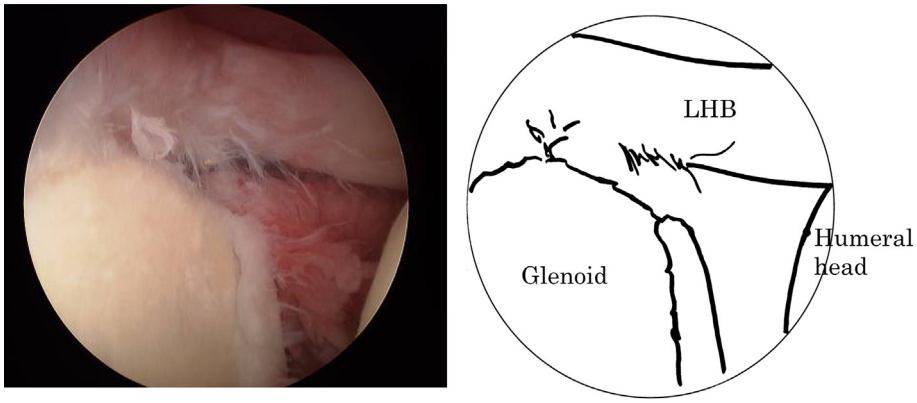

Figure 6. Type 4: labral defect.

are factors besides rotator cuff tear involved in superior humeral head migration.

Kido et al[3] reported that the biceps have a depressor function on the humeral head to inhibit its superior migration. Lippitt et al[5] reported that the labrum contributed to the stability of the humeral head and resection of the superior labrum decreased the stability by 12%. These results led to speculation that the humeral head would be susceptible to superior migration in rotator cuff tears when a superior labral injury was combined. In this study, arthroscopic findings of patients with large or massive rotator cuff tears were examined. Superior labral detachment, attrition, and defect were observed significantly more frequently observed in the group with superior humeral head migration than that in the group without. The results suggest the potential relationship between BLC injury and superior humeral head migration in large or massive rotator cuff tears.

There was a question of whether a BLC injury was the cause or result of superior migration. Since the group with superior migration had a significantly longer symptomatic period than the group without, superior migration has been considered to occur in a decubitus position after rotator cuff tears develop and to be corrected in a standing position.[10] This instability can lead to gradual development of BLC injury, further promoting the superior migration. Therefore, the remaining rotator cuff muscles became atrophic over time, resulting in decreased compression of the humeral head into the glenoid.

The limitations of this study are that the number of patients was small at 49 and that radiographs were taken in a standing position only. In addition, a study on reliability is needed regarding the progression of BLC injury and other arthroscopic findings.

Conclusion

This study examined BLC injuries in 49 shoulders of patients who had undergone arthroscopic surgery for large or massive rotator cuff tears. Compared with the group without superior

Table 2
Arthroscopic findings of biceps labrum complex (BLC).

	Type 0: No abnormal findings	Type 1: Fraying	Type 2: Labral detachment	Type 3: Attrition	Type 4: Labral defect
Group without superior migration	4	7	4	6	0
Group with superior migration	1	1	12	13	1
	BLC injury absent (Types 0–1)		BLC injury present (Types 2–4)		
Group without superior migration	11		10		
Group with superior migration	2		26		

*$p < 0.05$.

humeral head migration, the group with superior migration had a significantly longer symptomatic period and higher incidence of BLC injuries. The data indicate a potential relationship between BLC injury and superior humeral head migration.

Conflicts of interest

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

References

1. Weiner DS, Macnab I. Superior migration of the humeral head. *J Bone Joint Surg Br* 1970;**52**:524–7.
2. Nové-Josserand L, Lévigne C, Noël E, et al. The acromio–humeral interval. A study of the factors influencing its height. *Rev Chir Orthop Reparatrice Appar Mot* 1996;**82**:379–85. Article in French, English abstract].
3. Kido T, Itoi E, Konno N, et al. The depressor function of biceps on the head of the humerus in shoulders with tears of the rotator cuff. *J Bone Joint Surg Br* 2000;**82**:416–9.
4. Kumar VP, Satoku K, Balasubramaniam P. The role of the long head of biceps brachii in the stabilization of the head of the humerus. *Clin Orthop* 1989;**244**:172–5.
5. Lippitt SB, Vanderhooft JE, Harris SL, et al. Glenohumeral stability from concavity-compression: a quantitative analysis. *J Shoulder Elbow Surg* 1993;**2**:27–35.
6. Tung GA, Entzian D, Green A, et al. High-field and low-field MR imaging of superior glenoid labral tears and associated tendon injuries. *AJR Am J Roentgenol* 2000;**174**:1107–14.
7. Lafosse L, Jost B, Reiland Y, et al. Structual integrity and clinical outcomes after arthroscopic repair of isolated subscapularis tears. *J Bone Joint Surg Am* 2007;**89**:1184–93.
8. Namura T, Morihara T, Takubo Y, et al. Relationship between superior migration of the humeral head and the size of torn tendons on massive rotator cuff tear. *Shoulder Joint* 2008;**32**:605–8 [Article in Japanese].
9. Mura N, O'Driscoll SW, Zobits ME, et al. The effect of infraspinatus disruption on glenohumeral torque and superior migration of the humeral head: a biomechanical study. *J Shoulder Elbow Surg* 2003;**12**:179–84.
10. Namura T, Morihara T, Takubo Y, et al. Relationship between superior migration of the humeral head on X-rays in the supine and standing position and the size of torn tendons on rotator cuff tear. *Shoulder Joint* 2009;**33**:757–60 [Article in Japanese].