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Original article

A comparison of double Endobutton and triple Endobutton techniques for acute acromioclavicular joint dislocation

D. Lu , T. Wang , H. Chen , L.-J. Sun *

Department of Orthopaedic Surgery, Second Affiliated Hospital of Wenzhou Medical College, 109 Xueyuanxi Road, 325000 Wenzhou, China

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ABSTRACT

Purpose of the study: The purpose of this study was to evaluate the results of patients treated with either double Endobutton device or triple Endobutton device for acute acromioclavicular joint dislocations.
Patients and methods: Eighty patients were randomized to operative stabilization either by double Endobutton device (group A, 40) or by triple Endobutton device (group B, 40). Preoperative variables included the patients' age, sex, the affected side, cause of injury, Rockwood classification and time from injury to surgery. Peri-operative variables were incision length, blood loss, the operative time and the radiation time, length of hospitalization and hospital costs. Postoperative variables were complications, the Constant and VAS scores and the ability to return to previous work. The coracoclavicular (CC) distance of the affected shoulder was assessed on a standard radiograph and compared with the contralateral normal one.
Results: The average follow-up time of group A was 26.5 ± 7.3 months and group B was 24.2 ± 6.6 months. The overall complication rate was similar in both groups (26/40 vs. 24/40, $P = 0.644$). There were no significant differences in the mean incision length, blood loss, the operative and radiation time, length of hospitalization, the Constant and VAS scores, and the ability to return to previous work between the two groups. However, the patients of group B had more hospital costs (3802.5 ± 258.5 vs. 2433.6 ± 182.5 USD, $P = 0.000$). The radiological assessment revealed no significant difference in the CC distance between the two groups ($P = 0.625$).
Discussions: Triple Endobutton technique did not show significant clinical advantages over double Endobutton technique.
Level of evidence: Level II prospective randomized study.

1. Introduction

There has been an understandable tendency toward anatomical coracoclavicular (CC) ligament reconstruction in the treatment of acute acromioclavicular (AC) joint dislocations [1–7]. The modern approach has been to reconstruct anatomic CC ligament with fixation or a loop at base of coracoid and a biological graft passing through clavicle either through a single drill hole or 2, to mimic the course of the conoid and trapezoid ligament [1,3–5,8,9]. The Endobutton device is one of them. Firstly described by Struhl et al. [1], anatomic ligament reconstruction using the Endobutton device has been proven to be an effective technique for the management of acute AC joint dislocations in both biomechanical and clinical studies [8,10–14]. However, using double Endobutton technique or triple Endobutton technique is still controversial [2,10,15–22]. Although the biomechanical strength of triple Endobutton device is superior to that of double Endobutton device [22], no study has confirmed its clinical advantages over double Endobutton device.

The purpose of this prospective comparative study was to evaluate the radiographic and clinical results of patients treated with either double Endobutton device or triple Endobutton device for acute AC joint dislocations. We hypothesized that triple Endobutton technique had lower rate of rupture, more durable time of coracoclavicular reduction and better radiological and functional outcomes compared with double Endobutton technique.

2. Materials and methods

2.1. Study population and study design

Eighty patients with Rockwood type III–V AC joint dislocation were treated with double Endobutton device (group A, 40) or with

* Corresponding author. Tel.: +86 577 88002810; fax: +86 577 88879123.
E-mail address: sunlj797110@163.com (L.-J. Sun).

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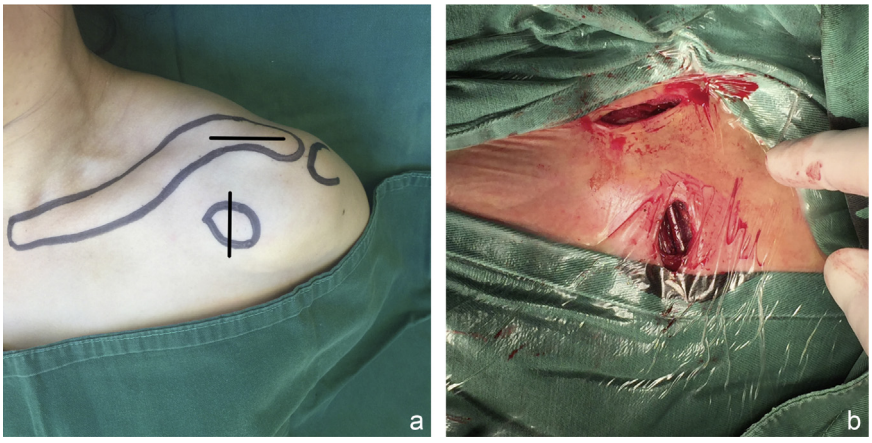

Fig. 1. a: one incision was 2–3 cm parallel to the clavicle and another incision was 2–3 cm perpendicular to the clavicle towards the coracoid process; b: the coracoid base was under direct visualization.

triple Endobutton device (group B, 40) between September 2010 and September 2013 at our hospital. Approval for the study was given by the Ethics Committee and informed consent was obtained from all patients before operation. The inclusion criteria were:

- age 18–50 years;
- acute dislocations (< 2 weeks after trauma);
- Rockwood type III patients with higher requirements for functional recovery such as manual laborers and athletes;
- Rockwood IV or V dislocations;
- no osteoporosis;
- all operations performed by the same group of surgeons;
- follow-up time of at least 12 months.

The following patients were excluded:

- open dislocations and old dislocations;
- previous shoulder complains or surgery;
- combined with nerve or vascular injury;
- associated with vital organs damage;
- associated with fractures and/or dislocation of other parts of the ipsilateral limb.

At admission, type of treatment was randomized by computer allocation and assigned to patients prospectively through sequentially numbered opaque envelopes. There was no significant difference in the preoperative variables between the two groups (Table 1).

2.2. Surgical procedures and rehabilitation

The surgical procedure of double Endobutton technique was similar to that described by Struh et al. [1]. Operations were performed by the same group of surgeons (S.L.J., L.D. and C.H.). An incision was made above the edge of the clavicle and a second incision perpendicular to the clavicle towards the coracoid process (Fig. 1). The clavicle was manually reduced and this reduction was identified under C-arm visualization. A guide wire was drilled into the top of the clavicle approximately 3 cm medial to the AC joint. After confirming that the tip of the wire was centred between the medial and lateral edges of the coracoid, drilling was continued to the base of the coracoid. A 4.0-mm drill was then used to ream over the guide wire. A second 2.5-mm drill hole was placed 1 cm lateral to the Endobutton drill hole. The appropriate size Endobutton closed loop (CL) was chosen, and five strands of #2 Ethibond suture were placed through the first and fourth holes of the Endobutton. The Endobutton and CL were inserted first through the clavicle and then the coracoid tunnel using a 3.2-mm smooth cylindrical plunger. The loop was pulled up, locking the Endobutton onto the underside of the coracoid. When tension was placed on the loop, the very tip of the CL was seen protruding from the top of the clavicular hole. A free Endobutton then slid into the protruding loop. The suture tails exiting through the top of the clavicle were passed through the Endobutton holes. The sutures were tied on top of the Endobutton. Three strands (six tails) of Ethibond sutures were brought out of the coracoclavicular space and passed through the lateral drill holes (Fig. 2). The trapezius and deltoid were repaired and the wound was closed with sutures.

The surgical procedure of triple Endobutton technique was similar to that of double Endobutton technique. The only difference

Table 1
Baseline characteristics between the two groups.

Characteristics	Group A	Group B	*P*
Age (years)	32.2 ± 12.5	35.6 ± 11.0	0.200
Sex (male: female, *n*)	30: 10	25: 15	0.228
The affected side (left: right, *n*)	16: 24	14: 26	0.644
Cause of injury (road accident: fall, *n*)	28: 12	22: 18	0.166
Rockwood type (III: IV: V, *n*)	31: 7:2	35: 4: 1	0.239
Injury to surgery time (days)	4.0 ± 3.0	4.5 ± 2.5	0.421
Follow-up time (months)	26.5 ± 7.3	24.2 ± 6.6	0.143

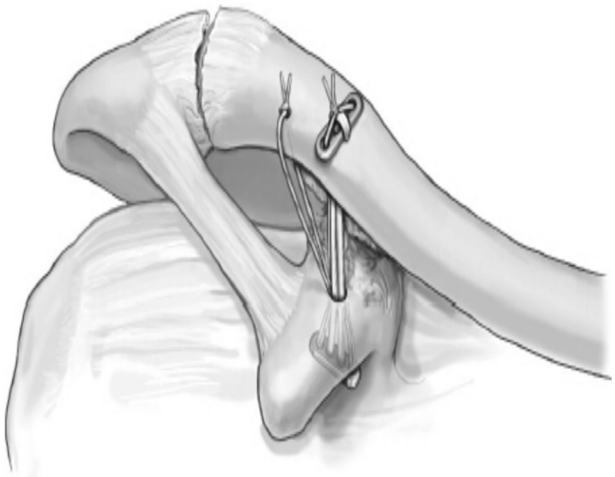

Fig. 2. Coracoclavicular ligament reconstruction with double Endobutton technique.

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