

Case Report

Superior approach for treating Ideberg III glenoid fractures with superior shoulder suspensory complex injury: A technical trick[☆]

JinLong Zheng^{a,1}, Nan Lu^{b,1}, ZhiMeng Shen^a, AiMin Chen^{b,*}

^a Orthopedic Department of The Cilin Hospital, No 599, Shiji Road, Guanhaiwei Town, Cixi City, Zhe Jiang Province 315300, People's Republic of China

^b Department of Orthopedic Surgery, Chang Zheng Hospital, The Second Military Medical University, No 415, Fengyang Road, Huangpu District, Shanghai 200003, People's Republic of China

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ABSTRACT

Ideberg III glenoid fractures are rare and difficult in treating among shoulder fractures. With the development of research, a series of surgical approaches and methods were performed, such as anterior approach, traditional Judet approach, modified Judet approach, combined approach, acromion approach and so on. While these approaches still have some limitations in treatment of Ideberg III glenoid fractures with superior shoulder suspensory complex(SSSC) injury, for extensive soft tissue dissection, unsatisfactory exposure, difficult surgical intervention. In our case with Ideberg III glenoid fracture with acromioclavicular dislocation, superior approach was adopted during treatment of the scapula glenoid fracture and coracoclavicular ligament rupture perfectly. The result was satisfactory in accordance with 92 points by Constant-Murley score. We believe that individualized therapy should depend on the injury types, and superior approach would be a new valuable method for Ideberg III glenoid fractures with SSSC injury.

Introduction

Scapula glenoid fractures are mostly associated with high-energy injuries, accounting for about 1.0% of total body fractures and 10% of shoulder fractures [1]. Some scholars still advocated conservative treatment for glenoid fractures [2,3], but more and more studies found that conservative treatment most probably resulted in various complications such as shoulder pain, instability, dysfunction and traumatic arthritis etc. Therefore, surgical treatments were accepted gradually, especially to the displaced Ideberg III glenoid fractures or with superior shoulder suspensory complex(SSSC) injury [4,5]. In consideration of the complexity of Ideberg III glenoid fractures, there were still controversial about surgical methods including surgical approach, fixed position and internal fixation device. We treated a Ideberg III glenoid fracture with SSSC injury by superior approach, which has not been reported in the literature. Hereby, this paper mainly introduces the characteristics of the superior approach and the technical trick, for providing a new valuable method for Ideberg III glenoid fracture with SSSC injury.

* No potential conflict of interest declared.

The patient gave informed consent and the Ethical Committee of the Second Military Medical University approved this study.

* Corresponding author.

E-mail address: aiminchen@aliyun.com (A. Chen).

¹ Contributed equally to this work.



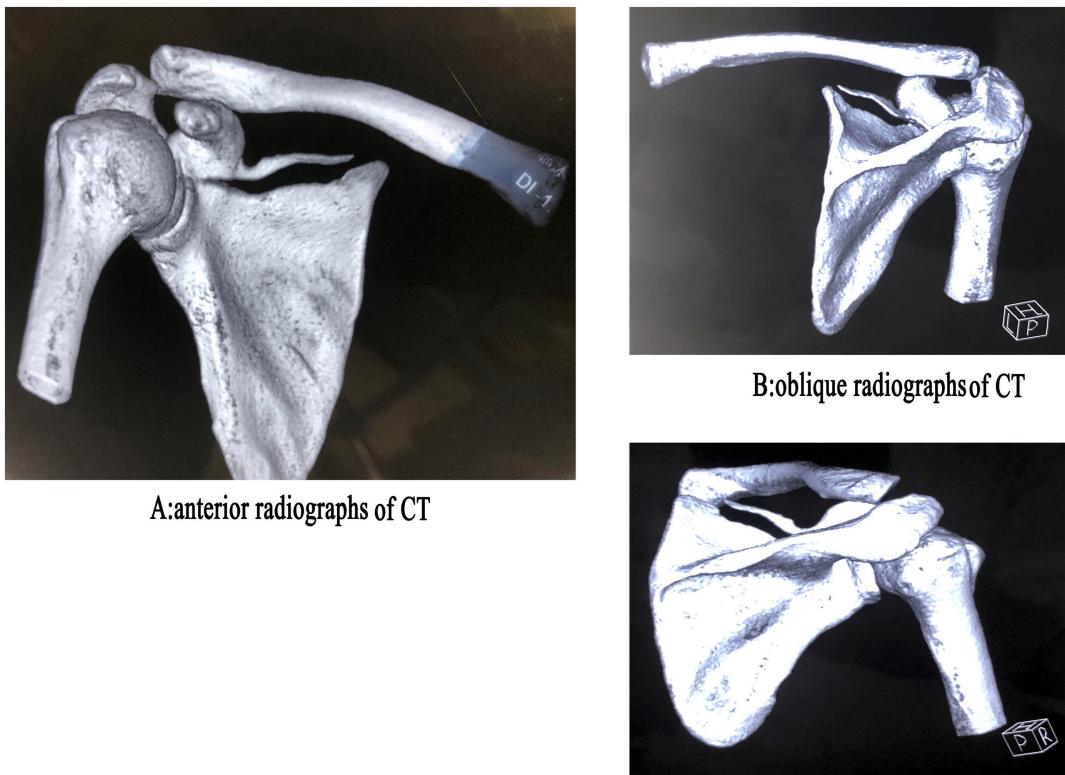
A:preoperative appearance

B:anteroposterior radiographs

Fig. 1. preoperative appearance and anteroposterior radiographs of the right shoulder joint. It showed obviously glenoid fracture, coracoid process displacement with acromioclavicular dislocation, and an ambiguous fracture line in upper scapula.

Case description

The patient, a middle-aged male, was admitted to the orthopedic department because of a motorcycle crash to his right shoulder. He complained of right shoulder pain (mainly in superior shoulder area), refusing to move the wounded shoulder. The injury consisted of features of the anterolateral skin scratch in right shoulder, the apophysis in distal clavicle higher than the acromion process with a step-shaped deformity and floating movement, perishoulder swelling, obvious tenderness, with additional limited shoulder movement. The orthopedic surgeon performed X-ray, CT examination and 3D reconstruction of the patient's shoulder.

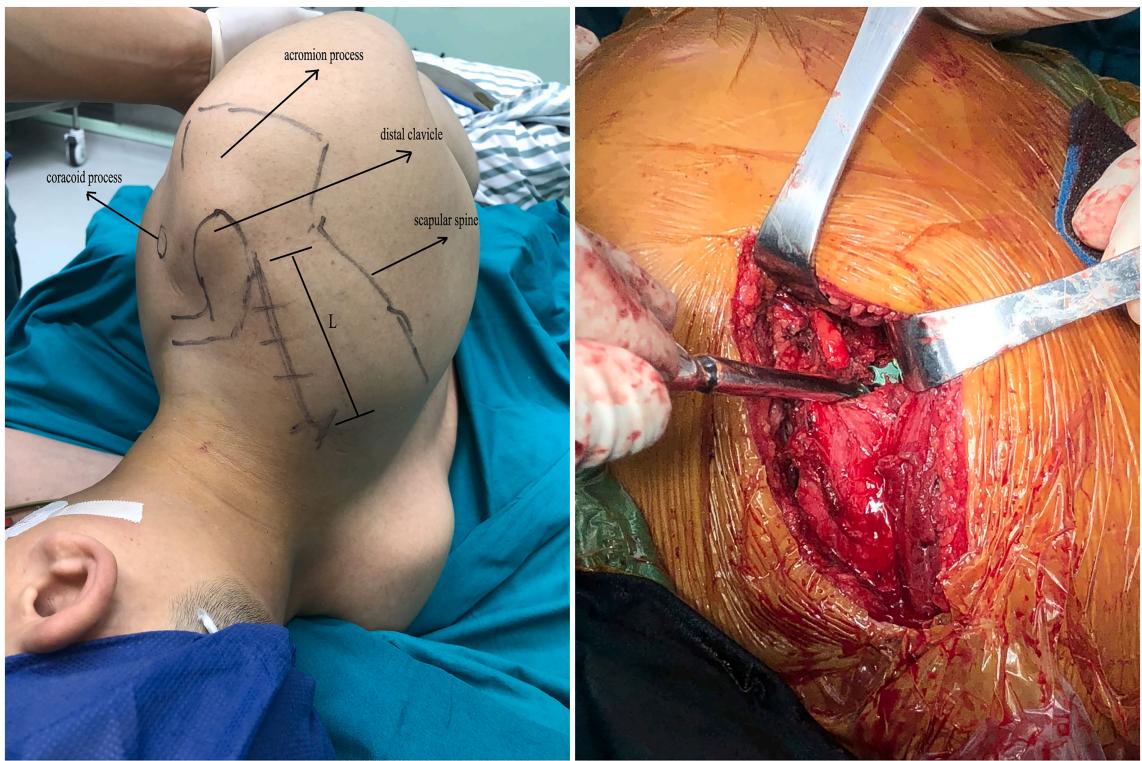


A:anterior radiographs of CT

B:oblique radiographs of CT

C:posterior radiographs of CT

Fig. 2. 3D CT reconstruction of the right shoulder joint. It clearly indicated that the fracture line of the glenoid process went through base of coracoid process to the upper scapula, with coracoid displacement and acromioclavicular dislocation.



A:incision design

B:Incision exposure

Fig. 3. “L” was interpreted as a surgical approach from the medial acromion, passing the superior margin of the scapula, to the medial angle of scapula, at about 8 cm in length.

Radiological images showed: the glenoid fracture, spreading to base of coracoid process and upper scapula, with acromioclavicular dislocation (Figs. 1, 2). Diagnosis is glenoid fracture (Ideberg III) with acromioclavicular dislocation (Rockwood III).

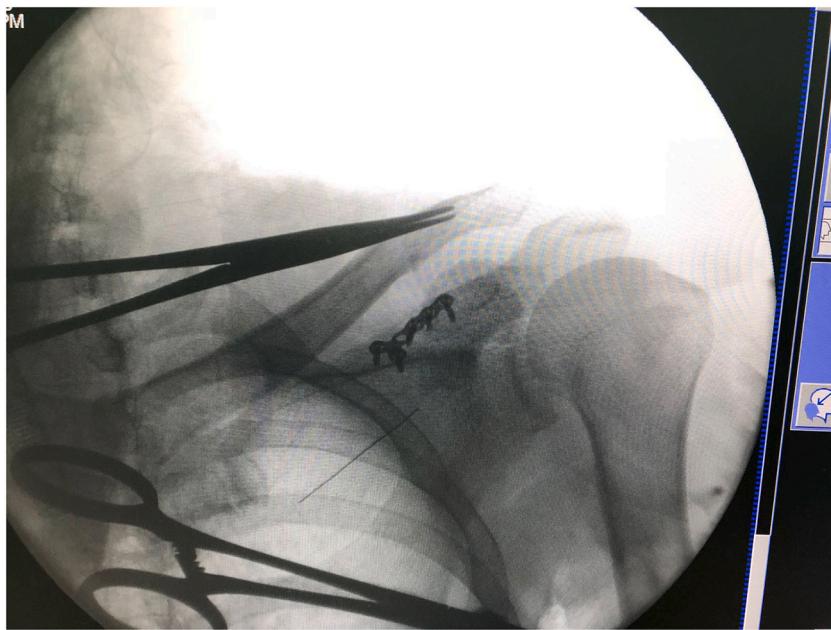
Surgical technique

The patient was placed in healthy lateral position by general anesthesia. The straight incision (superior approach) was taken in superior part of right shoulder (Fig. 3) from the medial acromion, passing the superior margin of the scapula, to the medial angle of scapula, at about 8 cm in length. By separating bluntly and retracting gently the trapezius muscle, supraspinatus, acromion and acromioclavicular joint were exposed. Then, we pulled the supraspinatus muscle forward to show superior glenoid, scapular notch and supraspinatus fossa (window 1), and pulled the supraspinatus muscle backward to show superior margin of scapula, posterior margin of distal clavicle, coracoid process and coracoclavicular ligament (window 2). Suprascapular vessel and suprascapular nerve should be paid attention and protected carefully in case of vascular rupture leading to massive hemorrhage and nerve injury resulting in postoperative neurological dysfunction. The acromioclavicular joint and the distal clavicle were exposed by extending the incision laterally.

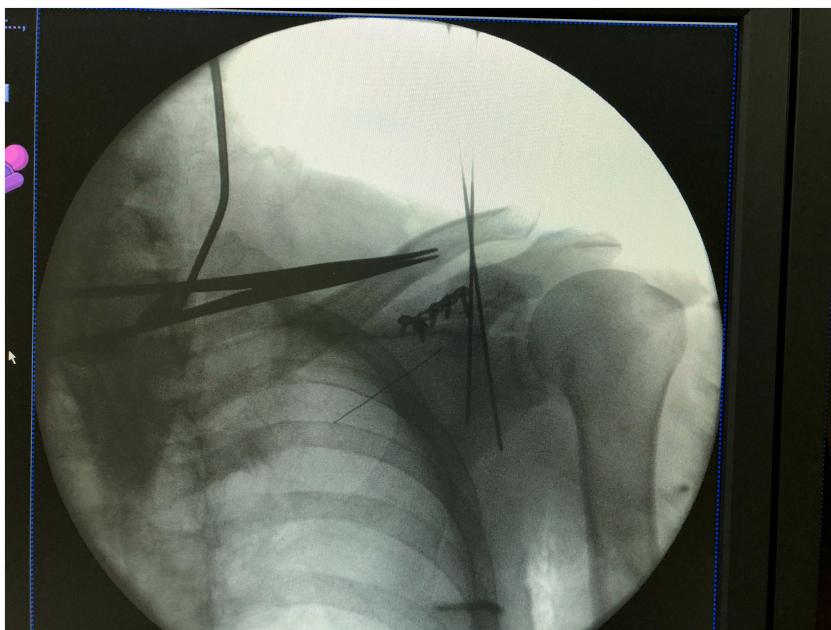
The fracture line was from the scapula glenoid slantingly upwards through the base of coracoid process to the upper scapula, with coracoclavicular ligament rupture at the origin of the coracoid process which was relatively fresh and mild contusion in the broken end. First upper scapula and coracoid basilar fracture were reduced anatomically, and fixed with a Y-shaped plate. After that, through intraoperative X-ray we found that the scapula glenoid was reduced satisfactorily, then fixed with kirschner wires temporarily. The glenoid fracture was fixed with a 3.5 mm cannulated screw through the base of the coracoid process slantingly downwards and backward into the scapular neck (Figs. 4, 5, 6). At last, the broken end of coracoclavicular ligament was repaired with tendon suture by mattress suture, with additional reinforced suturing fixation by knitting suture by drilling in the coracoid process and penetrating a tendon suture through the bone tunnel.

Outcome

A neutral suspension immobilization of right shoulder had been carried out for 2 weeks since operation, whereafter, continuous passive motion (CPM) was performed. Then the patient received rehabilitative guidance at 6 weeks after operation, including psychological intervention and active exercises such as stretching exercises and climbing the wall to improve muscle strength and

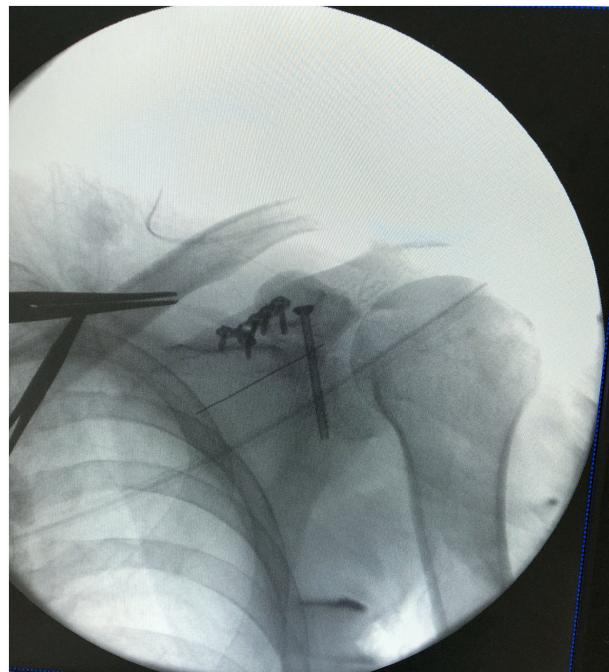


Figs. 4/5/6. The intraoperative anteroposterior X-ray images of the right shoulder joint. It showed: process of reduction and fixation. Anatomic reduction of upper scapula, the base of coracoid process, glenoid process and satisfactory position of the plate and screw. The acromioclavicular joint was basically reduced, however coracoclavicular interval still was larger than the healthy side.



Figs. 4/5/6. (continued)

durability of the joint. He returned gradually to his normal activities at 8 weeks after operation (Fig. 7). Intraoperative radiographs were taken, and followed by reexamination by X-ray at 1 day, 6 weeks, 8 weeks, 3 months, 4 months and 6 months after operation. With follow-up for 4 months (Figs. 8, 9, 10, 11), shoulder functions were evaluated by the Constant-Murley scoring system [6] at last. In this case, the activity range of wound shoulder was almost normal without obvious pain. The outcome of surgical treatment was satisfactory in accordance with 92 points in total score. Right shoulder abduction, forward flexion and horizontal external rotation were 145°, 150° and 55°, which were 20°, 10° and 15° less than the corresponding activity ranges in the contralateral shoulder respectively.



Figs. 4/5/6. (continued)



A:functional exercise a, at 6 weeks
after surgery

B:functional exercise b, at 6 weeks
after surgery

Fig. 7. Rehabilitative guidance at 6 weeks after operation, including psychological intervention and active exercises such as stretching exercise and climbing the wall.

Discussion

There are many classification methods for scapula glenoid fractures, in which Ideberg classification [7] is most commonly used. Ideberg et al. classified glenoid fractures into 6 types. Among them, Ideberg III glenoid fractures are characterized by a transverse

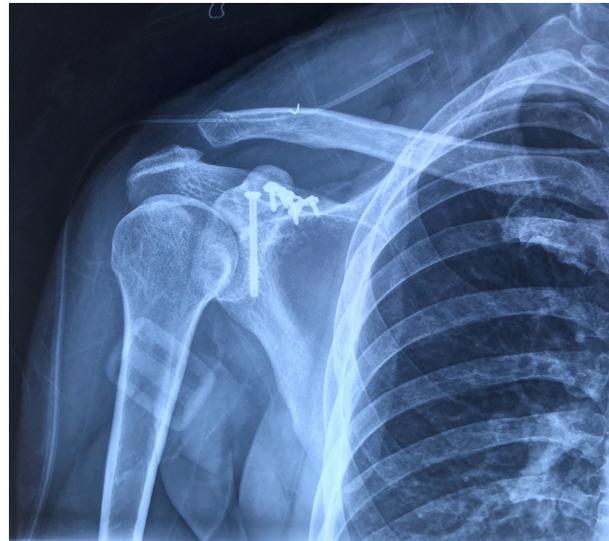
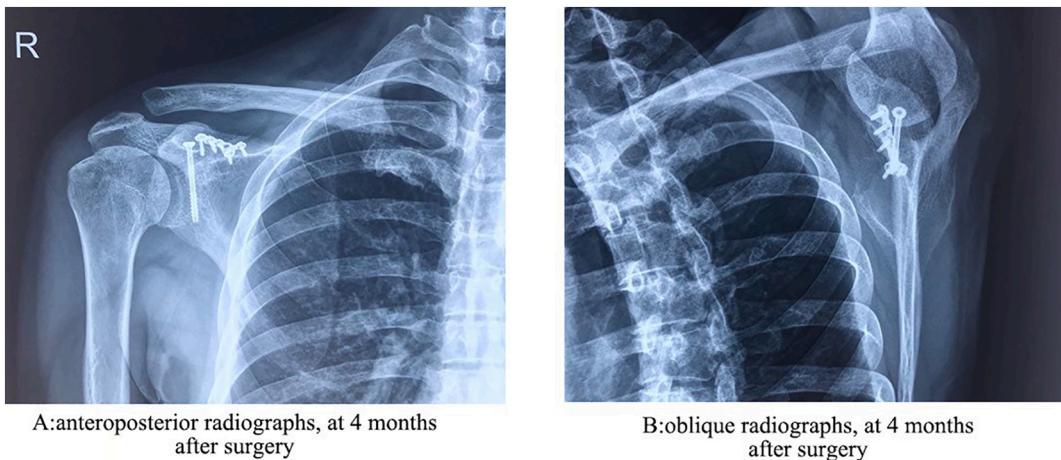


Fig. 8. X-ray anteroposterior radiographs of the right shoulder joint on the first day after surgery showed satisfactory reduction of fractures and positions of the plate and screw, and no significant change in the position of acromioclavicular joint compared with the previous one.



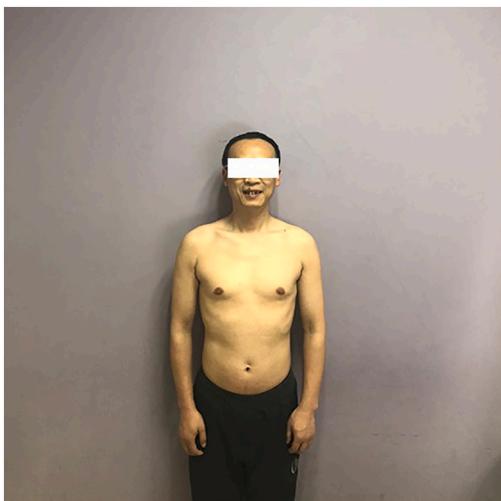
A:anteroposterior radiographs, at 4 months
after surgery

B:oblique radiographs, at 4 months
after surgery

Fig. 9. X-ray anteroposterior and oblique radiographs of the right shoulder joint at 4 months after surgery showed satisfactory reduction and positions of the plate and screw, fracture healing.

fracture line that separates the superior glenoid process, the base of coracoid process and the upper scapula, often accompanied with SSSC injuries. Research has shown that displaced Ideberg III glenoid fractures or with SSSC injury should require surgical treatment [4,5].

It is particularly important to choose an appropriate surgical approach because of the complexity of Ideberg III glenoid fractures. Currently, there are several known surgical approaches as follows: anterior approach [5,8,9], posterior approach (traditional Judet approach and modified Judet approach) [10–12], combined approach [13] and acromion approach [14]. A posterior superior approach, posterior vertical approach and posterior minimally invasive approach [15] mentioned by a few literatures, actually, all should belong to the category of modified Judet approach. The anterior approach is the most common method for the Ideberg III fracture due to the satisfactory exposure to the intra and extra articular components, incision of which starts from the midpoint between coracoid tip and acromioclavicular joint, and goes down along the anterior edge of axillary furrow. However, the disadvantages of this approach are the extensive soft tissue dissection and unsatisfactory exposure to fractures around the scapular notch [16]. The incision of traditional Judet approach starts from posterior acromion and arcuates to inferior angle of the scapula along scapular spine and medial margin of the scapula, and incision of modified Judet approach is based on the traditional Judet approach for more accurate and targeted operation. The incision of posterior superior approach starts from posterior acromion and extends along scapular spine to expose superior glenoid process and coracoid process base. The posterior vertical approach applies a vertical incision from the posterior angle of acromion process to subscapular angle to expose the glenoid neck, glenoid process and the surroundings of the shoulder joint. The posterior minimally invasive approach performs tiny incisions along the anatomical margin of



A:appearance at 4 months after surgery while drooping the arms



B:appearance at 4 months after surgery when abducting the arms

Fig. 10. The appearance of the right shoulder joint at 4 months after surgery. The appearance was normal while drooping the arms, and the abduction range of the wounded shoulder approximately returned to the normal level.



A:appearance at 4 months after surgery when elevating the arms



B:appearance at 4 months after surgery when back-extending the arms

Fig. 11. The appearance of the right shoulder joint at 4 months after surgery. The appearance was normal while elevating or back-extending the arms.

the scapula, centering on fracture sites, which has the advantages in less muscle dissection and trauma, and disadvantages in limited exposure and difficult reduction and fixation of complex fracture. Combined approach, as the name implies, is made up of the anterior approach and posterior approach, which has the advantage in easy exposure and disadvantages in large incision and extensive soft tissue dissection and damage. The incision of acromion approach is performed from the posterior acromion along the middle or entire length of the scapular spine, which is suitable for treating fractures around the scapular notch or Ideberg III fractures related to acromion fracture, but is still difficult to repair SSSC.

In this case, the superior approach was adopted, mainly considering the special fracture type—Ideberg III glenoid fracture with

acromioclavicular dislocation. The purpose was to offer convenient and necessary conditions in surgical therapy of glenoid fracture, coracoid basilar fracture, upper scapula fracture and coracoclavicular dislocation. There exist two windows with the supraspinatus muscle as center, and windows 1 can be exposed by pulling the muscle forward, while windows 2 can be exposed by pulling it backward. Although the presence of acromion brings some difficulties to the operation, its influence is limited.

Upper scapula fracture and coracoid basilar fracture were surgically treated to create a good bony base for the repairment of coracoclavicular ligament. Meanwhile, the glenoid fracture was fixed because the glenoid fractures had caused damage to the articular surface. As long as the glenoid fracture lead to the destruction of joint stability, surgical treatment should be actively carried out to achieve good functional recovery [17]. In addition, because of the importance of soft-tissue ring in SSSC, the principle of paying equal attention to the bone structure and ligament tissue should be adhered to in Ideberg III glenoid fractures. In consideration of being relatively fresh and mild contusion in the broken end of coracoclavicular ligament, it was enough to repair the rupture with tendon suture directly in this case. In recent years, the cognitions about treatment method of acromioclavicular dislocation have changed from the original rigid fixation (e.g., clavicular hook plate) to the elastic fixation retaining some motion of the acromioclavicular joint, because elastic fixation is more suitable for physiological reconstruction than rigid fixation with clavicular hook plate. Furthermore, complications such as acromion impingement syndrome, joint pain may occur in rigid fixation with clavicular hook plate [18]. Of course, the follow-up at 3 months after surgery revealed that there was still asymmetry in the shoulders, which might be related to muscle weakness, and expected to be gradually improved through later functional exercises.

Conclusion

To the best of our knowledge, there are all kinds of approaches and treatment methods about Ideberg III glenoid fractures. Nevertheless, we believe that individualized therapy should depend on the different injury types, and superior approach should be a new valuable method for Ideberg III glenoid fractures with SSSC injury.

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