

Chang Wug Oh · In Ho Jeon · Hee Soo Kyung
Bung Chul Park · Poong Taek Kim · Joo Chul Ihn

The treatment of double disruption of the superior shoulder suspensory complex

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Abstract Between January 1997 and March 2000, we treated 13 patients with double disruption of the superior shoulder suspensory complex (SSSC). The mean age of the patients was 42 (20–63) years. All patients had associated chest injuries, but there were no injuries of the brachial plexus or the peripheral nerves. Three patients, whose general condition was poor, were treated conservatively. Five underwent internal fixation of both the clavicular and scapular fractures and five of the clavicle only. We evaluated the clinical results using the Rowe Score after a minimum follow-up of 1 year. All fractures united. The average time to union was 14 weeks for clavicular and 11 for scapular fractures. There was malunion in four of five scapular fractures treated conservatively. A functionally better result was obtained in the surgical group with a mean Rowe Score of 88, compared with the conservative group whose mean score was 77. Surgical treatment for double disruption of the SSSC is a good option, allowing early rehabilitation and giving good functional results.

Résumé Entre janvier 1997 et mars 2000, nous avons traité 13 malades avec une double interruption de la ceinture scapulaire. L'âge moyen des malades était de 42 (20–63) ans. Tous les malades avaient des atteintes concomitantes de la cage thoracique. Aucune lésion du plexus brachial ou des nerfs périphériques n'a été observée. Trois malades ont eu un traitement conservateur en raison de leur état général. Cinq malades ont eu une fixation interne des fractures claviculaires et scapulaires, et cinq n'ont eu qu'une fixation de la fracture claviculaire. Après un suivi minimum d'une année nous avons évalué les résultats cliniques en utilisant le score de Rowe. Toutes les fractures ont consolidé dans un temps moyen de

quatorze semaines pour les fractures claviculaires et onze semaines pour les fractures scapulaires. Pour cinq fractures scapulaires traitées sans fixation interne, il y avait quatre calcs vicieux. D'après le score de Rowe un résultat fonctionnellement meilleur a été rapporté dans le groupe chirurgical (88) plutôt que dans le groupe conservateur (77). Le traitement chirurgical de la double du complexe suspenseur supérieur de l'épaule est une bonne option pour obtenir des résultats fonctionnelle ment bons.

Introduction

The superior shoulder suspensory complex (SSSC) is a bony and soft tissue ring comprising the glenoid process, the coracoid process, the coracoclavicular ligaments, the distal clavicle, the acromioclavicular joint, and the acromion [5]. Its integrity is essential to the normal relationship between the upper extremity and the trunk. Single disruptions of the SSSC, such as distal clavicular fractures, are common and do not violate its integrity. However, double disruption, such as occurs with a floating shoulder, creates an unstable situation that may be slow to heal and have a poor functional outcome [5]. The management remains controversial. There are few clinical studies dealing with this injury in the orthopaedic literature. The purpose of this study was to compare the outcome after operative and conservative treatment in 13 patients with an SSSC injury.

Patients and methods

Thirteen adult patients with a double disruption of SSSC presented between January 1997 and March 2000. They were managed by one surgeon, and no standard treatment protocols were used. Ten patients were injured in road traffic accidents and three in falls from a height of at least 10 m. There were 11 men and two women with a mean age of 42 (20–63) years. All patients had a scapular neck fracture and four had a fracture of the body of the scapula also. Six had associated fractures of the midshaft of the clavicle, four of the distal aspect of the clavicle, one a lateral clavicular

C.W. Oh · I.H. Jeon (✉) · H.S. Kyung · B.C. Park · P.T. Kim
J.C. Ihn

Department of Orthopedic Surgery, College of Medicine,
Kyungpook National University Hospital, Taegu, 50, 2-Ga,
SamDuk Dong, Chung-Gu, South Korea
e-mail: jeonchoi@chollian.net
Tel.: +82-534205637, Fax: +82-534226605

Table 1 Details of fractures and injuries. *MRF* multiple rib fractures

Case	Age/Sex	Cause of injury	Clavicle fracture	Scapular fracture	Combined injuries	Treatment	Rowe score
1	81/M	Motorcycle accident	Lateral 1/3	Neck fx.	MRF (3–5) + hemothorax-scanty	Conservative	90
2	40/F	Fall down	Middle 1/3	Neck fx.	MRF (2–8) + pneumothorax + cerebral contusion	Clavicle fixation only	80
3	18/M	Motorcycle accident	Middle 1/3	Neck + spine fx	MRF (3, 4) + hemothorax-scanty	Clavicle fixation only	90
4	57/M	Bike accident	Lateral 1/3	Neck + body fx	Lung contusion + cerebral contusion	Clavicle + scapular fixation	80
5	51/M	Fall down	Middle 1/3	Glenoid intraarticular + acromial fx	MRF (2–10, 5–7) + pneumothorax	Clavicle+scapular fixation	95
6	43/M	Car accident	Middle 1/3	Neck + spine fx	MRF (2–5) + hemothorax-scanty	Clavicle + scapular fixation	100
7	21/F	Pedestrian accident	Middle 1/3	Neck fx.	MRF (3–4) + hemothorax + ankle fx + mandible fx	Clavicle fixation only	90
8	34/M	Car accident	Middle 1/3	Neck + body fx	Hemothorax-scanty + hemoperitoneum-spleen rupture + tibia & femur open fx + contralateral clavicle, humerus fx.	Clavicle fixation only	90
9	34/M	Fall down	Lateral 1/3	Neck + body fx.	MRF (2–5, 2–4) + hemothorax	Conservative	85
10	35/M	Pedestrian accident	Middle 1/3	Neck fx.	Hemopneumothorax + cerebral contusion	Clavicle fixation only	90
11	50/M	Motorcycle accident	Lateral 1/3	Neck	MRF (3–6, 2–4) + hemothorax (both) + contralateral humerus fx + femur fx + pelvic bone fx	Clavicle + scapular fixation	90
12	31/M	Motorcycle accident	AC separation	Neck + coracoid + acromial fx.	MRF (4–9) + hemothorax-scanty	Clavicle + scapular fixation	80
13	55/M	Car accident	Middle 1/3	Neck fx	MRF(3–5) hemothorax + lung contusion + tripod fx	Conservative	55

fracture, and two had fractures of the coracoid process. All fractures were closed. All patients had an associated chest injury, ten had a haemothorax, and three a pneumothorax. Details of the fractures and injuries are shown in Table 1. There were no associated brachial plexus or peripheral nerve injuries.

Three patients whose general condition was poor were treated conservatively with a simple sling. Ten patients underwent operative management at a mean of 12 (3–24) days after injury. In two patients who required ventilation for the management of a haemopneumothorax, surgery was delayed for 21 and 24 days.

Surgery was undertaken with the patient in a “beach chair” position. Osteosynthesis of the clavicle was undertaken using a 3.5 mm reconstruction plate (AO Synthes-Switzerland). The fracture of the acromion was fixed with a cannulated screw. An intraoperative X-ray of the clavicular fixation determined the treatment of the scapular fracture. If the scapular fracture remained unreduced the patient was placed in the lateral position with the affected arm free and the fracture fixed with a reconstruction plate through a posterior approach between infraspinatus and teres minor. The mean time for anaesthesia was 165 (120–180) min.

The five patients who had osteosynthesis of the clavicle only and the five who had osteosynthesis of both the clavicular and scapular fractures started an active exercise programme 6 weeks after operation. The patients were followed regularly and the mean

follow-up was 20 (12–40) months. Evaluation was undertaken using the Rowe scoring system, which includes 50 points for stability, 20 for movement, and 30 for function of the glenohumeral joint.

Results

All the fractures united; the mean time to union was 14 weeks for clavicular fractures and 11 for scapular fractures. Seven patients had an excellent functional result, five a good result, and one a fair result. The mean score for the 13 patients was 85.7 points. The ten patients who underwent surgery had a better functional score (88) than the three who were treated conservatively (77). Four patients with fractures of the scapular neck, which were displaced by more than 1 cm, had unsatisfactory results (76.8 points) when compared with those with undisplaced fractures (89 points). There was no difference in the results between patients in whom different fixation methods were used (Figs. 1, 2).

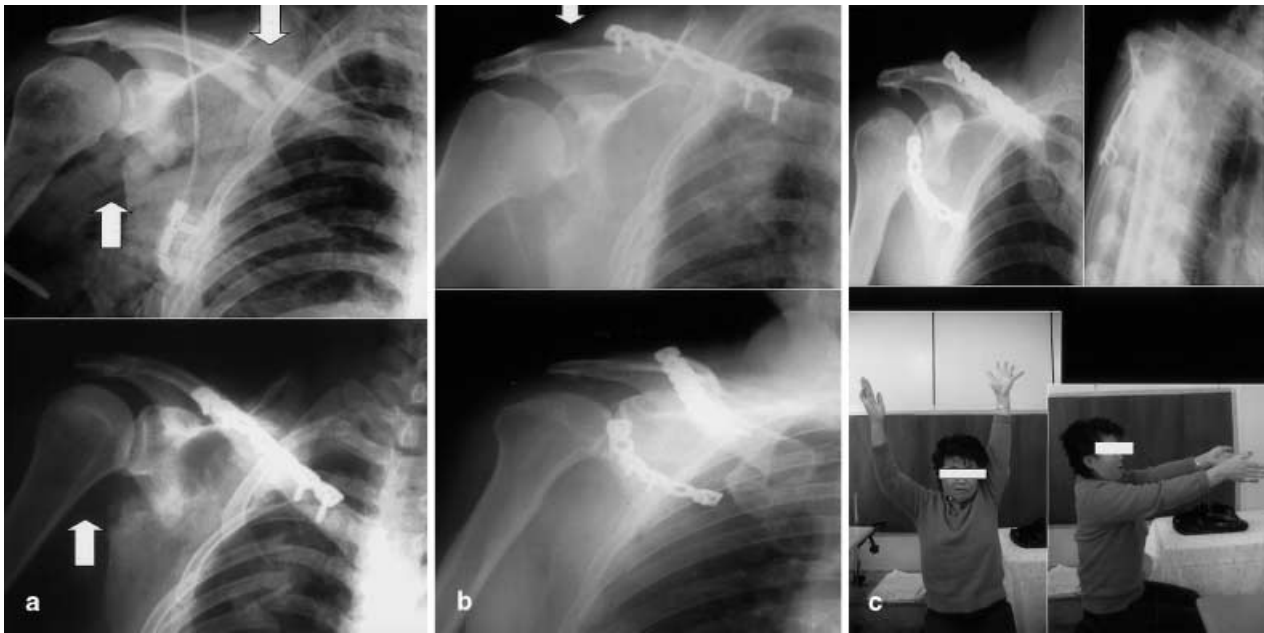


Fig. 1a–c A 40-year-old woman after traffic accident. **a** Initial film shows ipsilateral displaced fractures of the clavicle and the scapular neck (*above*). After internal fixation of the clavicle there was no improvement in the position of the scapular neck fracture (*below*). **b** Four weeks after surgery loosening of the recon-

struction plate of the clavicle was seen (*above*), and internal fixation of both the clavicle and the scapula fracture was done (*below*). **c** At 3-year follow-up the fractures had united and the patient had a good function with mild limitation of abduction

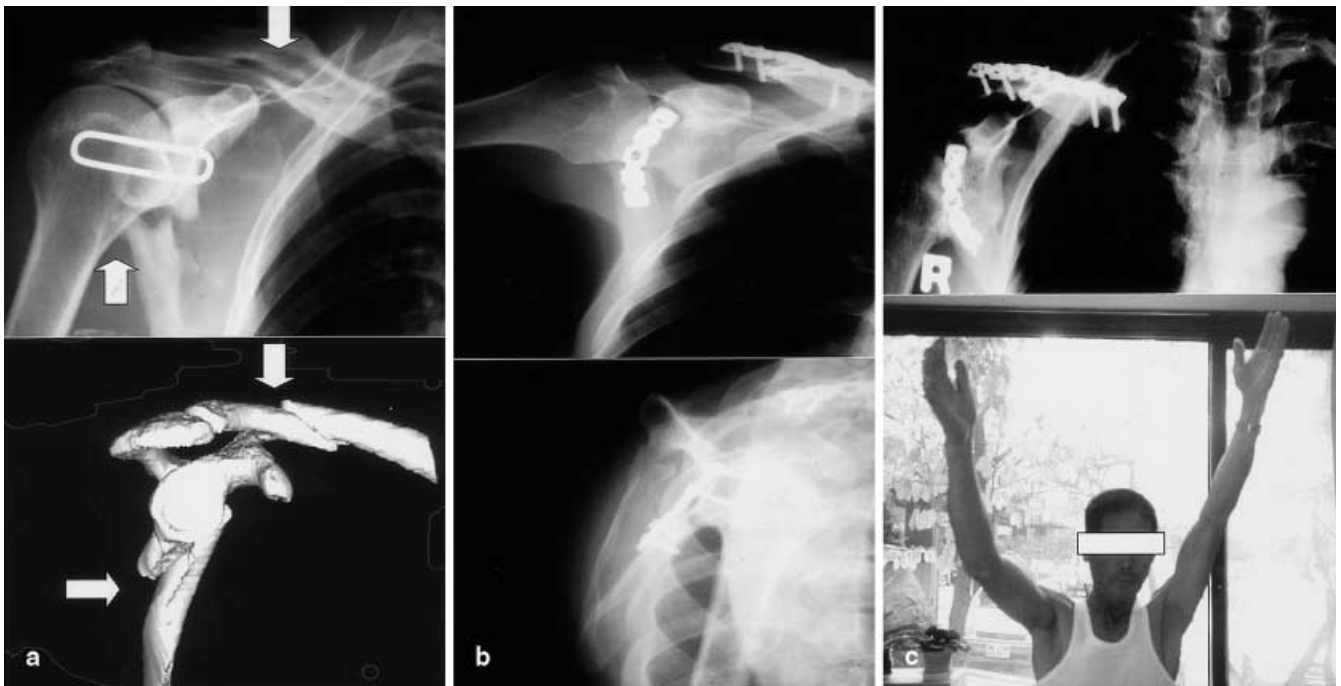


Fig. 2a–c A 51-year-old man after fall. **a** Ipsilateral displaced fractures of the clavicle and the scapular neck. **b** Internal fixation of both fractures was performed. **c** At final follow-up of 2 years the fractures had united and the patient had a good shoulder function

Complications

There were no superficial or deep infections. Two patients with implant failure required further fixation of both the clavicular and scapular fractures, and the fractures thereafter healed satisfactorily. Four patients had malunion of the scapular fracture. The patient with a fair shoulder score had moderate pain and limitation of elevation of the shoulder to about 60°.

Case 1

A 43-year-old woman who was involved in a road traffic accident sustained fractures of the outer third of the right clavicle and a scapular neck fracture. There were associated multiple rib fractures and a haemothorax. After 2 weeks of treatment in the intensive care unit internal fixation of the clavicular fracture alone was performed using a reconstruction plate; however, the scapular fracture remained reduced. Active assisted shoulder exercises began 3 weeks after surgery and the plate became loose 4 weeks after operation. Further plate fixation of the clavicular fracture was performed with added bone graft; the scapular fracture was fixed with a reconstruction plate through the posterior approach. She was followed for 3 years and had union of the fractures and an excellent result, with a Rowe Score of 95 out of 100.

Case 2

A 63-year-old man sustained a displaced clavicular shaft and a scapular neck fracture when he fell from a height. Open reduction and plate fixation was performed 5 days later. Twenty-four months after the procedure he had normal shoulder function with a score of 90.

Discussion

There is an increasing incidence of scapular fractures in patients who sustain multiple injuries [1]. Most can be treated conservatively with early mobilisation of the shoulder [3, 12]. Although good results following this functional treatment have been reported, in patients who have a clavicular fracture combined with a scapular neck fracture or an injury to the coracoclavicular ligament, conservative treatment may give poor results, as these combined injuries are unstable due to loss of the suspensory function of the clavicle [2, 4, 11].

When there is a fracture of both the clavicle and the neck of the scapula, the scapular fracture is unstable. The weight of the arm and the muscles acting on the humerus displace the glenoid fragment distally and anteromedially [7, 8]. Although combinations of clavicular fracture with a scapular fracture or coracoclavicular disruption are rare, these injuries require particular attention. Ada and Miller reported a high incidence of rotator cuff dysfunction in patients with displaced clavicular and scapular fractures resulting in loss of the normal lever arm of the rotator cuff, and they recommended that the fractures be treated by open reduction [1]. Romeo et al. reported a poor outcome after scapular neck fractures with malalignment; they measured the glenopolar angle to assess the rotational malalignment of fractures involving the glenoid [14]. In our series patients with scapular fractures, which were displaced by more than 1 cm, had poorer results than those with undisplaced fractures, and

patients who underwent surgery had a better functional outcome than those treated conservatively.

Herscovici et al. and Low recommended osteosynthesis of the clavicle to prevent malunion of the scapular neck fracture [8, 10], and Rikli et al. reported that an associated fracture of the clavicle or a disruption of the AC or the SC joint resulted in an unstable shoulder. Surgical stabilisation of the clavicle alone could reduce the scapular fracture indirectly, and fixation of the scapular fracture was only required with displaced fractures [13]. The results of our study showed that two patients out of five who underwent clavicular fixation alone suffered failure of fixation, and in these cases the scapular fracture remained unreduced after clavicular fixation, as shown on an intraoperative radiograph. The failures of fixation were probably due either to inadequate fixation or overconcentration of the load on one side of the disruption.

The plate fixation was considered stable at the operation, and therefore we assumed that the failure was caused by concentration of the load at the clavicular fracture site, which had failed to reduce and stabilise the second disruption adequately. For this reason stabilisation was performed on both clavicular and scapular sides in patients with a displaced scapular fracture, which was not reduced after clavicular osteosynthesis.

Goss also recommended stabilisation of both sides and stated that conservative treatment causes drooping of the shoulder [5, 6]. In our patients who underwent osteosynthesis of both sides, the gap in the scapular neck fracture was identified intraoperatively as being more than 1 cm, despite clavicular fixation. Sound union and excellent functional results were achieved without symptoms of impingement or pneumothorax, which are reported as complications of surgery by Leung and Lam [9]. The results of this study show that scapular fractures which are displaced by more than 1 cm are associated with poor functional results. Stabilisation of both fractures is recommended in selected cases of double disruption of the SSSC in order to allow early rehabilitation, to obtain a good functional result, and to avoid the failure of fixation.

References

1. Ada JR, Miller ME (1991) Scapular fractures. Analysis of 113 cases. *Clin Orthop* 269:174–180
2. Bauer G, Fleischmann W, Dussler E (1995) Displaced scapular fractures: indication and long-term results of open reduction and internal fixation. *Arch Orthop Trauma Surg* 114:215–219
3. Edwards SG, Whittle AP, Wood GW II (2000) Nonoperative treatment of ipsilateral fractures of the scapula and clavicle. *J Bone Joint Surg [Am]* 82:774–780
4. Fleischmann W, Kinzl L (1993) Philosophy of osteosynthesis in shoulder fractures. *Orthopedics* 16:59–63
5. Goss TP (1993) Double disruptions of the superior shoulder suspensory complex. *J Orthop Trauma* 7:99–106
6. Goss TP (1999) Fractures of the scapula: Diagnosis and treatment. *Disorders of the shoulder: diagnosis and management*, 1st edn. Lippincott, Philadelphia, pp 597–637

7. Hardegger FH, Simpson LA, Weber BG (1984) The operative treatment of scapular fractures. *J Bone Joint Surg [Br]* 66: 725–731
8. Herscovici D Jr, Fiennes AG, Allgower M, Ruedi TP (1992) The floating shoulder: Ipsilateral clavicle and scapular neck fractures. *J Bone Joint Surg [Br]* 74:362–364
9. Leung KS, Lam TP (1993) Open reduction and internal fixation of ipsilateral fractures of the scapular neck and clavicle. *J Bone Joint Surg [Am]* 75:1015–1018
10. Low CK, Lam AW (2000) Results of fixation of clavicle alone in managing floating shoulder. *Singapore Med J* 41:452–453
11. Mayo KA, Benirschke SK, Mast JW (1998) Displaced fractures of the glenoid fossa. Results of open reduction and internal fixation. *Clin Orthop* 347:122–130
12. Ramos L, Mencia R, Alonso A, Ferrandez L (1997) Conservative treatment of ipsilateral fractures of the scapula and clavicle. *J Trauma* 42:239–242
13. Rikli D, Regazzoni P, Renner N (1995) The unstable shoulder girdle: early functional treatment utilizing open reduction and internal fixation. *J Orthop Trauma* 9:93–97
14. Romeo J, Schai P, Imhoff A.B (2001) Scapular neck fracture – the influence of permanent malalignment of the glenoid neck on clinical outcome. *Acta Orthop Trauma Surg* 121:313–316