

Posterior sternoclavicular dislocations: a brief review and technique for closed management of a rare but serious injury

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Abstract

Posterior sternoclavicular dislocations are rare but serious injuries. The proximity of the medial clavicle to the vital structures of the mediastinum warrants caution with management of the injury. Radiographs are the initial imaging test, though computed tomography and magnetic resonance imaging are essential for diagnosis and preoperative planning. This paper presents an efficient diagnostic approach and effective technique of closed reduction of posterior sternoclavicular dislocations with a brief review of open and closed reduction procedures.

Introduction

Posterior dislocations of the sternoclavicular joint (SCJ) are rare events, occurring most commonly from motor vehicle accidents, athletic injuries, and falls.¹ Due to the vital structures that lie posterior to the medial clavicle, namely the innominate artery, innominate vein, trachea, esophagus, and thoracic duct, this injury is a true emergency.

The SCJ provides the only true articular attachment of the upper extremity to the axial skeleton and allows passive movement in three planes primarily through the action of the scapula on the thoracic wall.² The medial clavicle articulates with the superomedial manubrium in a shallow saddle joint that requires the subclavius muscle and four ligaments for stability.² The anterior and posterior sternoclavicular ligaments stabilize the joint in the anteroposterior plane, the interclavicular ligament connects the medial heads of each clavicle, and the costoclavicular or rhomboid ligament with its anterior and posterior laminae provides support from the first rib and costal cartilage.³

Posterior dislocation of the SCJ requires

compromise of these ligaments and can occur either indirectly by posterolateral force applied to the shoulder girdle or less commonly a direct anteroposterior force applied to the medial clavicle.^{2,4} The anterosuperior and posterior capsular thickenings form a capsular ligament,⁵ which inserts at the medial clavicular epiphysis, a site prone to fracture in the young adult as the epiphysis typically ossifies late by age 25.^{6,7} But due to a similar clinical presentation and difficulty in diagnosis through CT scans, posterior SCJ dislocations and epiphyseal fractures are often difficult to distinguish in the absence of surgical intervention with up to half of epiphyseal disruptions missed by initial imaging only to be diagnosed after unsuccessful closed reduction.^{2,8}

Methods

A review of literature was performed using PubMed to search for relevant publications described the management of posterior sternoclavicular dislocations using the search terms *posterior sternoclavicular dislocation* and *sternoclavicular injury*. Techniques to treat anterior sternoclavicular dislocations were excluded. Articles from 1967 to 2012 were analyzed for study size and design, management technique, and clinical outcomes.

Preoperative planning and technique

Patient should be admitted For observation prior to closed reduction in the operating room. Radiographs should be obtained in anteroposterior and serendipity views,⁹ though CT or MR imaging should be obtained to identify injury to surrounding structures. Patients should also be consented for the possibility of open reduction internal fixation, and a cardiothoracic surgeon consulted and available during the attempted reduction. Under general anesthesia with endotracheal intubation, the patient is placed supine on a radiolucent table with a 3-4 inch bolster beneath the scapulae to allow for extension of both shoulders. Care must be taken to position the patient's head so the neck is neither flexed nor extended. Intraoperative fluoroscopy should be utilized for visualization of the SCJ throughout the case. With abduction and extension of the ipsilateral arm, anteroposterior pressure is applied to both shoulders over the glenohumeral joint with simultaneous traction to the ipsilateral arm resulting in successful reduction confirmed by intraoperative fluoroscopy (Video 1). Intraoperative CT scan has recently been described to verify reduction.¹⁰

Post-procedure care

The patient is placed in a figure-of-eight clavicle brace and right shoulder sling and admitted for monitoring of damage to the sur-

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rounding vital structures. Post-reduction, anteroposterior and serendipity radiographs should be taken to verify the position of the clavicle. A CT scan of the chest may be indicated to demonstrate reduction. The patient should remain in the brace for 4 weeks and the sling for 6 weeks following reduction and be seen in follow-up within one week of the reduction and again at two and six weeks for repeat radiographs. At two weeks, internal and external rotation of the adducted arm is permissible. Activity should be limited until the six week follow-up appointment when the sling can be discontinued. Return to sport is dependent on individual athletes and competition levels.

Case Report #1

The patient is an 18 year-old male college student with no past medical history who presented with severe pain, difficulty swallowing, and decreased range of motion of his right shoulder after he was driven to the ground playing rugby. He was seen at the emergency department and presented for a second opinion for sternoclavicular joint injury. Radiographs and CT scan were performed and demonstrated a posterior superior sternoclavicular dislocation (Figure 1A-C). On exam, there was significant tenderness localizing over the right SCJ as well as an obvious deformity with less promi-

nence of the joint on the right as compared to the left. He was neurovascularly intact. Radiographs of the right shoulder demonstrated SCJ asymmetry on the right as compared to the left, and MRI demonstrated a superior and posterior SCJ dislocation.

The patient was scheduled for urgent closed reduction within 24 hours, and underwent closed reduction of the right posterior SCJ dislocation by the technique described 3 days post injury confirmed by radiographs (Figure 2A). At twelve weeks, the patient had no complaints, and the joint was stable on exam. Radiographs demonstrated no change in position of the SCJ, with slight superior and anterior displacement (Figure 2A, B). He returned to sports 6 months post injury without difficulty (Figure 3).

Case Report #2

Patient is a 22 year-old female college student with no past medical history who presented with severe pain, difficulty swallowing, and decreased range of motion of her right shoulder after sustaining an injury five days prior during a rugby match. She was driven to the ground on her right shoulder, feeling immediate pain around the right sternoclavicular joint and shoulder. She was seen at the emergency department initially and diagnosed with an acromioclavicular sprain and presented at the office for a second opinion. Radiographs and MRI were performed. She has been taking ibuprofen as needed for pain.

On exam, there was significant tenderness

localizing over the right SCJ as well as an obvious deformity with less prominence of the joint on the right as compared to the left. She had no tenderness of the acromioclavicular joint and reported tingling in her small and ring finger but was otherwise neurovascularly intact. Radiographs of the right shoulder demonstrated SCJ asymmetry on the right as compared to the left (Figure 4A), and CT scan demonstrated a superior and posterior SCJ dislocation with no other significant injuries (Figure 4B). On the sixth day after sustaining the injury, the patient underwent closed reduction of her right posterior SCJ dislocation by the technique described. At four days post-reduction, the patient noted popping of the right SCJ and was found on exam to have some evidence of anterior superior instability. At

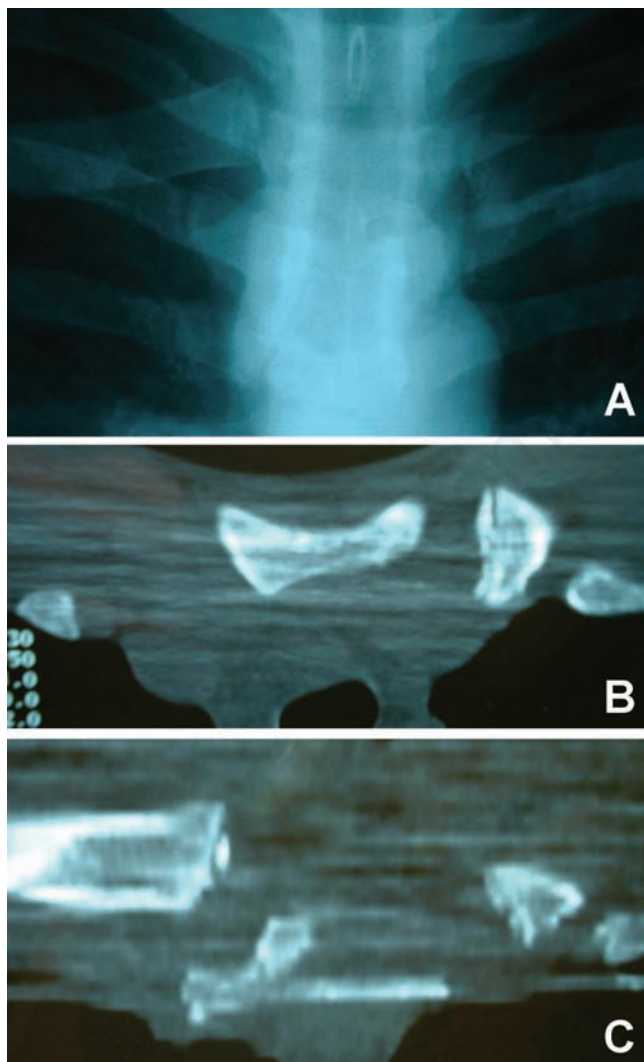


Figure 1. A) Radiograph demonstrating posterior-superior dislocation of the right SCJ. B) and C) successive axial cuts of CT scan demonstrating posterior-superior dislocation of the right SCJ (courtesy of TAB).

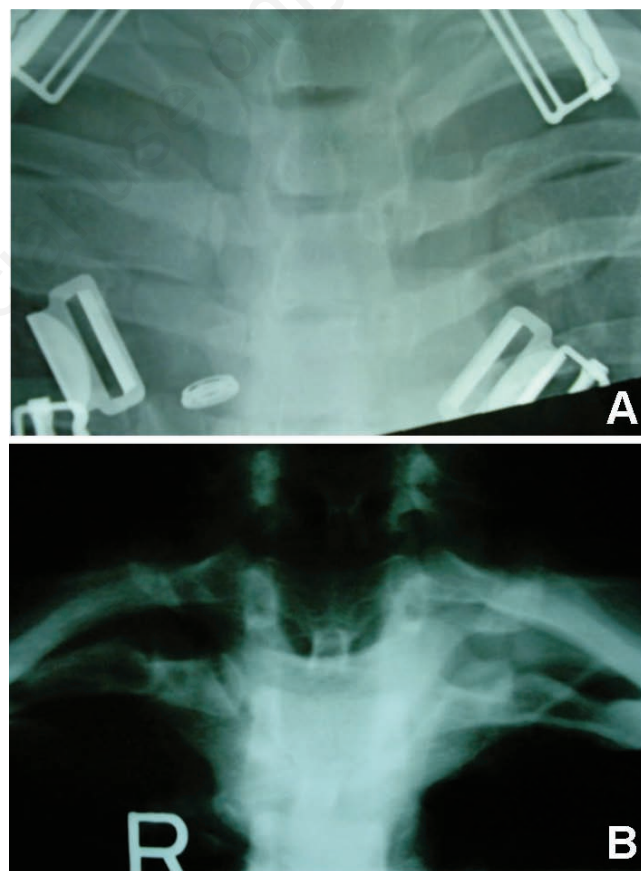


Figure 2. A) Post-reduction radiograph of close reduced right SCJ; B) radiograph at 6 week follow-up demonstrating maintained closed reduction of right SCJ (courtesy of TAB).

this point, conservative management was recommended, and at follow-up one week later, radiographs demonstrated no change in position of the joint with the medial clavicle slightly anterior and superior as well as some calcification suggesting a possible healing epiphyseal fracture (Figure 4C). At six weeks, the patient had no complaints, and the joint was stable on exam.

Discussion

The largest study of the diagnosis and management of posterior SCJ dislocations is a retrospective study of the clinical results of 30 patients.⁸ Lafosse *et al.* recommended that closed reduction in posterior SCJ dislocations should only be attempted within 48 hours of injury in patients with no signs of mediastinal compromise, and if unsuccessful, surgical repair of the capsular ligamentous structures including the costoclavicular ligament and stabilization of the joint should be performed.⁸ The case presented in this paper demonstrates successful closed reduction of a posterior SCJ dislocation six days after the initial injury. Anterior instability of the joint has been described as a complication of closed reduction,¹¹ though in the case presented here, the instability noted within one week post-reduction had resolved by the two-week visit.

Treatment options, as noted, include both closed reduction and open reduction with internal fixation performed under general anesthesia. A cardiothoracic surgeon must be available during the procedure because of risk of damage to the underlying structures of the clavicle. The methods for closed reduction include the technique used in this case in which the abducted and extended arm is used to apply traction to the shoulder.² If unsuccessful, the medial clavicle can be grasped using a towel clip and sterile technique to assist with traction.¹² Closed reduction can also be

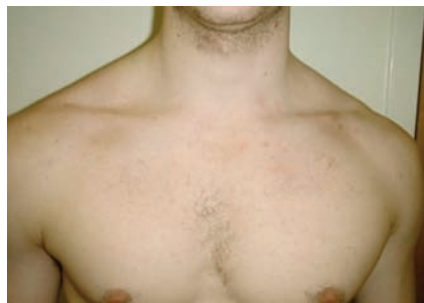


Figure 3. Clinical photograph of the symmetric gross appearance of the SCJ at 6 week follow up (courtesy of TAB).

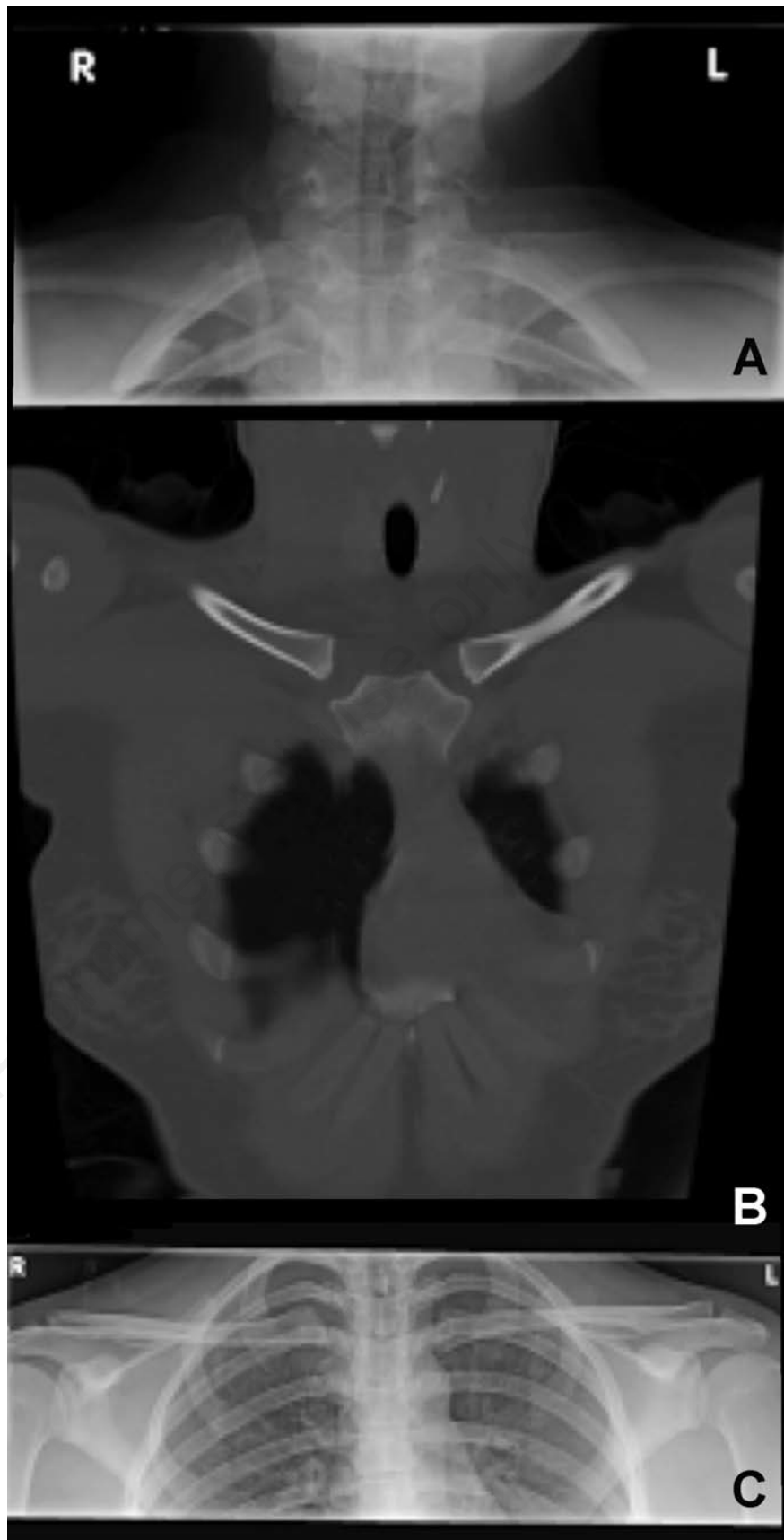


Figure 4. A) Serendipity view of the SCJ showing a posterior SCJ dislocation; B) coronal cut of CT scan demonstrating posterior-superior SCJ dislocation; C) post-reduction radiograph demonstrating reduced right SCJ (courtesy of TAB).

achieved by applying anteroposterior pressure to the glenohumeral joint simultaneously with traction applied to the shoulder with the arm in adduction.^{13,14} If closed reduction is unsuccessful, the patient presents greater than 48 hours after dislocation, or epiphyseal fracture is found on imaging, open reduction with internal fixation may be considered in the patient.⁸ Kirschner wires or Steinmann pins are contraindicated because of the risk of migration into nearby structures including the aorta, heart, subclavian artery, pulmonary artery, and lung.^{15,16}

Primary repair of the ligamentous structures is usually not feasible following reduction, and little consensus exists in the literature on an optimal method of repair. Repair using the subclavius muscle tendon involves removing the clavicular attachment of the muscle and inserting it through a drilled hole in the medial clavicle and suturing the tendon upon itself which attempts to replicate the costoclavicular ligament disrupted by the injury.¹⁷

Rockwood described fifteen cases of resection of the medial clavicle after chronic pain from sternoclavicular dislocation.¹⁸ The surgeon resects of the medial head of the clavicle with transfer of the intra-articular ligament and disc to the medial medullary canal, which requires attachment of the surrounding soft tissues to the intact costoclavicular ligament.¹⁸ The authors noted that maintaining an intact or reconstructing the injured costoclavicular ligament were essential for positive outcomes.¹⁸ Study of the long-term follow-up of patients who underwent clavicular resection for dislocation and arthritis demonstrate common unsatisfactory outcomes in regard to function and pain, making this an unfavorable technique.^{19,20}

The semitendinosus tendon graft in a figure-of-eight configuration involves passing the graft through pre-drilled holes in the medial clavicle and manubrium then tying a square knot secured with sutures.²¹ A systematic review of literature recommended this technique for repair of unstable injuries.²² In a cadaveric biomechanical study, the semitendinosus graft reconstruction was superior to both intramedullary ligament and subclavius tendon reconstructions when examining strength of posterior stiffness though not significantly different from the subclavius tendon approach with regard to anterior instability.²¹ This study also found that 25% of the subclavius tendons were of insufficient length to perform the subclavius approach. A recent case series of six patients with sternoclavicular instability following traumatic dislocation reported good outcomes and return to contact sports at 6 months after figure-of-eight reconstruction using either semitendinosus or gracilis tendon.²³

The tendon of the sternal head of the stern-

ocleidomastoid muscle have been successfully used to stabilize the sternoclavicular joint by reflecting the tendon along its sternal attachment and passing it through a drill hole in the medial clavicle, then suturing it to the underlying tissues.²⁴ In seven patients, the authors reported two asymptomatic patients, four patients with transient subluxation, and one patient with persistent subluxation of the sternoclavicular joint requiring activity modification postoperatively.²⁴

Suture anchor repair of SCJ instability has been described in a series of eight patients.²⁵ Anchors were placed in the lateral manubrium with sutures passed through drilled holes in the medial clavicle avoiding the articular surface. One patient ruptured the repair from a fall, and one patient reported recurrent pain requiring revision surgery, but none of the patients reported recurrent instability.

The use of a clavicular hook plate or modified Balser plate has been described as techniques to stabilize the joint and allow for early mobility;^{26,27} however, the insertion of the hook into the manubrium can damage the physis, cartilage, and meniscus.⁸ Shuler and Pappas successfully repaired two patients with recurrent posterior dislocations after initial unsatisfactory closed reduction using locking plate osteosynthesis.²⁸ Open reduction with the use of two large-bore cannulated screws for fixation has also been described as an acceptable method of fixation in an unstable SCJ with minimal risk of migration of hardware, though a second operative procedure is required at three months for hardware removal.²⁹

A stainless steel pelvic reconstruction plate spanning both clavicles and the manubrium has been described for fixation of a posterior SCJ dislocation.³⁰ The patient had an uncomplicated recovery however the plate and screws were removed at five months in a second procedure preventing late screw and plate breakage and migration.

A novel method has been described using K-wires to cross the SC joint and tension-banding to maintain the reduction in nine cases.³¹ The authors reported excellent outcomes in eight patients and no complications, however noted the potential grave complication of fixation failure and K-wire migration.

Conclusions

Posterior SC dislocations are rare but serious injuries due to the proximity of the medial clavicle to the vital structures of the thorax. Open techniques for fixation have associated risks and mixed outcomes for patient satisfaction based mainly on case studies and series. We present a technique for closed reduction of these injuries by orthopedic surgeons under

general anesthesia in the operating room. These two cases demonstrate successful closed reduction of a posterior SCJ dislocation within one week after injury. The successful results in these patients are contrary to previous literature stating that closed reduction should only attempted in the first 48 hours following injury.⁸ Closed reduction on a semi-urgent basis performed under controlled conditions in the operating room has been successful in our practice, and may be performed by an orthopaedic surgeon using the techniques described.

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