



# Pediatric Tips & Tricks: Management of Posterior Sternoclavicular Joint Injuries

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## Introduction

Posteriorly displaced physal fractures or dislocations at the sternoclavicular joint (SCJ) are rare in the childhood and adolescent populations and require prompt diagnosis and treatment to optimize outcomes and prevent possible life threatening complications. We prefer open reduction and fixation for injuries with posterior displacement, with cardiothoracic “backup” in the rare event of vascular complication associated with the injury or it’s treatment. Outcomes are generally successful with pain free range of motion and return to activity without disability.

## Background

The medial epiphysis of the clavicle is the last to ossify and fuse, at approximately age 18-20 and age 22-25, respectively<sup>1</sup>. An injury to the medial clavicle can result in a true dislocation or a physal fracture with displacement depending upon the patient’s age, with the relative rates under debate<sup>2</sup>. The SCJ is a di-artrodal saddle joint with minimal articular contact anteriorly and inferiorly, with stability depending upon ligamentous structures, particularly the posterior capsule. Many critical structures lie near the SCJ including the esophagus, trachea, brachiocephalic vein and subclavian artery, with the brachiocephalic an average of 6.6mm from the posterior clavicle<sup>3</sup>. Posterior displacement of the medial clavicle may be associated with compression of any of these structures including the brachial plexus.

While closed reduction and immobilization have been advocated, several studies in the pediatric population have suggested that re-

displacement is common<sup>2,4,5</sup>. Many centers such as ours now routinely perform open reduction and internal fixation.

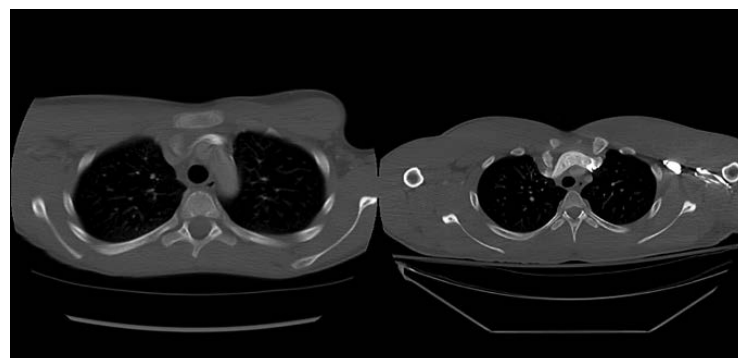
## Preoperative Evaluation

SCJ injuries are rare and a high index of suspicion, with a careful history and physical examination, are required to make the diagnosis. In addition to pain, up to half of patients present with symptoms such as dyspnea or dysphagia<sup>6</sup>, and up to 25% of injuries are missed initially<sup>2</sup>. Patients typically fall or sustain a blow to the lateral aspect of the shoulder and complain of “shoulder” pain. Asking the patient to place a finger where the site of maximal discomfort is can be helpful. Physical examination must include palpation of the entire shoulder girdle with assessment of airway, breathing, circulation and a neurovascular exam. Plain radiographs of the shoulder or clavicle often miss the diagnosis, although a serendipity (40-degree cephalic tilt) view may demonstrate the injury. A CT scan is suggested when there is clinical suspicion, and our cardiothoracic surgeons prefer the study is performed with contrast to assess for extravasation or compression<sup>7</sup> (Figure 1).

## Procedure

Our cardiothoracic team is on standby during the procedure, and several units of packed red blood cells are available. A sternotomy tray should be in the room, with the cardiopulmonary bypass machine immediately available.

The patient is positioned supine on a radiolucent table with a bump between the scapulae. The prepping and draping include the upper extremity, chest, and both sides of the



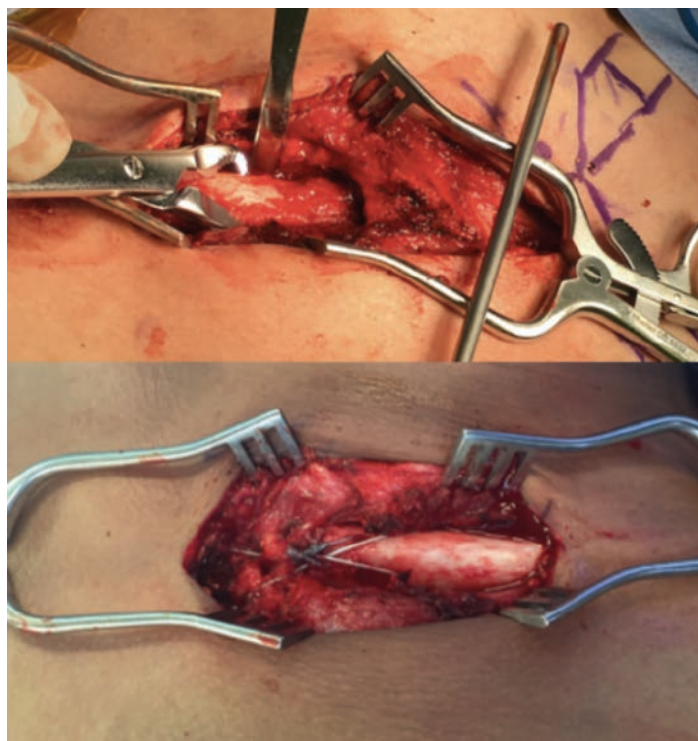
**Figure 1.** Posterior sternoclavicular dislocation demonstrating brachiocephalic compression.

neck and groin (Figure 2). An oblique incision is made starting along the medial clavicle at the first place it can be palpated, extending across the SCJ onto the manubrium below the sternal notch (Figure 2). The platysma is divided and periosteum incised. The pectoralis major is elevated off the manubrium, medial clavicle and SCJ. The anterior aspect of the clavicle is subperiosteally exposed between the pectoralis origin and the insertion of the trapezius/strap muscles, lateral to medial, and soft tissues/debris must often be removed anterior to the clavicle where it dives posteriorly under the manubrium (or epiphysis). Sub-periosteal dissection only needs to be enough to grasp the medial clavicle with a blunt bone holding clamp, and a freer elevator may also be used to subperiosteally dissect medially until the clavicle has been sufficiently mobilized for reduction. Two drill holes in the clavicle can also be made to grasp the bone with a towel clamp. Lateral force is applied either directly through the clamp with traction on the arm. Occasionally, a periosteal elevator is used as a “shoehorn” or “skid” to lever the medial clavicle from under the epiphysis or manubrium. Direct inspection will reveal if the injury was a fracture or dislocation.

Different techniques have been described for fixation of acute injuries including suture repair, suture anchors, cerclage wire or sternal cables, plate and screw fixation<sup>8</sup>. Kirschner wire fixation has been abandoned due to risk of intra-thoracic migration with visceral damage which could result in death<sup>9, 10</sup>. Plate fixation techniques include anterior plating and Balser plate application. These techniques are not well studied in the adolescent population and have a high rate of removal<sup>8, 11</sup>. A reconstruction using allograft is utilized for chronic injuries. We prefer to utilize a heavy non-absorbable suture technique. In physeal fractures, the medial aspect of the metaphysis is sutured to the epiphysis with or without the addition of a figure-of-eight suture from the medial clavicle into the manubrium via unicortical drill holes, whereas the figure-of-eight technique is required in dislocations (Figure 3). An attempt is made to repair the periosteum and deep soft tissue envelope, followed by repair of platysma, subcutaneous tissues, and skin.



**Figure 2.** Relevant anatomy showing a direct anterior approach to the medial clavicle with prep and drape in case of need of bypass.



**Figure 3.** Posterior fracture dislocation and an example of figure of eight suture repair

### Postoperative Protocol

Patients are admitted overnight for monitoring. A shoulder immobilizer is utilized for 4-6 weeks, and physical therapy is considered after 6 weeks. Return to sports is permitted 6 months after surgery if patient is asymptomatic.

### Discussion

Posterior sternoclavicular joint injuries can be potentially life threatening and require proper identification and treatment. Although pediatric literature for these injuries is sparse, closed reduction has a high rate of redisplacement, and open reduction and fixation is currently recommended in many treatment centers. Outcomes appear favorable, with Waters et al demonstrating full return to activity in 13/13 patients at an average of 22 months<sup>5</sup>, and other authors reporting full return to function and excellent outcomes in acute and chronic settings<sup>4, 12, 13</sup>.

### References

1. Webb PAO, Suchey JM. Epiphyseal union of the anterior iliac crest and medial clavicle in a modern multiracial sample of American males and females. *American Journal of Physical Anthropology*. 1985;68(4):457-66.
2. Lee JT, Nasreddine AY, Black EM, Bae DS, Kocher MS. Posterior sternoclavicular joint injuries in skeletally immature patients. *Journal of Pediatric Orthopedics*. 2014;34(4):369-75.
3. Ponce BA, Kundukulam JA, Pflugner R, McGwin G, Meyer R, Carroll W, et al. Sternoclavicular joint surgery: how far does danger lurk below? *Journal of Shoulder and Elbow Surgery*. 2013;22(7):993-9.
4. Laffosse JM, Espie A, Bonneville N, Mansat P, Tricoire JL, Bonneville P, et al. Posterior dislocation of the sternoclavicular joint and epiphyseal disruption of the medial clavicle with posterior displacement in sports participants. *The Journal of Bone and Joint Surgery British volume*. 2010;92(1):103-9.

- 5. Waters PM, Bae DS, Kadiyala RK.** Short-term outcomes after surgical treatment of traumatic posterior sternoclavicular fracture-dislocations in children and adolescents. *Journal of Pediatric Orthopedics*. 2003;23(4):464-9.
- 6. Tepolt F, Carry PM, Heyn PC, Miller NH.** Posterior sternoclavicular joint injuries in the adolescent population: a meta-analysis. *The American Journal of Sports Medicine*. 2014;42(10):2517-24.
- 7. Groh GI, Wirth MA.** Management of traumatic sternoclavicular joint injuries. *Journal of the American Academy of Orthopaedic Surgeons*. 2011;19(1):1-7.
- 8. Chaudhry S.** Pediatric Posterior Sternoclavicular Joint Injuries. *The Journal of the American Academy of Orthopaedic Surgeons*. 2015;23(8):468-75.
- 9. Kumar P, Godbole R, Rees GM, Sarkar P.** Intrathoracic migration of a Kirschner wire. *Journal of the Royal Society of Medicine*. 2002;95(4):198-9.
- 10. Venissac N, Alifano M, Dahan M, Mouroux J.** Intrathoracic migration of Kirschner pins. *The Annals of Thoracic Surgery*. 2000;69(6):1953-5.
- 11. Franck WM, Jannasch O, Siassi M, Hennig FF.** Balser plate stabilization: an alternate therapy for traumatic sternoclavicular instability. *Journal of Shoulder and Elbow Surgery*. 2003;12(3):276-81.
- 12. Tepolt F, Carry PM, Taylor M, Hadley-Miller N.** Posterior sternoclavicular joint injuries in skeletally immature patients. *Orthopedics*. 2014;37(2):e174-81.
- 13. Ting BL, Bae DS, Waters PM.** Chronic posterior sternoclavicular joint fracture dislocations in children and young adults: results of surgical management. *Journal of Pediatric Orthopedics*. 2014;34(5):542-7.