JSES International 4 (2020) 55–58

Contents lists available at ScienceDirect

JSES International

journal homepage: www.jsesinternational.org

Recurrent anterior sternoclavicular joint subluxation: long-term implant-related recurrence

Gavin S. Hautala, MD *, Srinath Kamineni, MD, BSc, FRCS

Department of Orthopaedic Surgery and Sports Medicine, Elbow Shoulder Research Center, University of Kentucky, Lexington, KY, USA

ARTICLE INFO

Keywords:
Sternoclavicular joint
instability
subluxation
dislocation
EndoButton
FiberWire

Sternoclavicular joint (SCJ) instabilities are rare, and traumatic sternoclavicular injuries comprise only 3% of all shoulder injuries, with anterior dislocations more common than posterior dislocations.[9] Despite the direction of dislocation, it is currently recommended to attempt closed reduction to prevent poor long-term clinical outcomes.[17] However, closed reduction is successful in only 38% of attempts,[10] and despite successful closed reduction, residual instability often remains. If closed reduction does not work, then open treatment should be considered.

A significant amount of force, directed from a posterolateral direction, axially applied to the acromioclavicular joint on a fixed torso, is required to disrupt and anteriorly dislocate this joint. Although there are various stabilization techniques with varied results described in the literature, none have taken into account the configuration of the ligaments and the force vector of translation at the SCJ. We describe a technique that incorporates fixation in conjunction with a reversal of the displacing force vector.

Case report

A 17-year-old male student complained of pain in the SCJ after completing bench presses in the gym. He had no relevant medical or surgical history. This pain continued and gradually became worse over the next few months. The patient felt pain and a sense of anterior instability and clicking with overhead activities at the SCJ, which progressed when performing simple activities of daily living.

The joint reduced spontaneously initially and by self-manipulation later, and finally, it was difficult to manually reduce and was extremely painful. After 4 months, the patient saw 2 shoulder surgeons, who advised continued nonoperative management. He then attended our practice because of continued and severely debilitating symptoms. He presented with a frequently irreducible and painful SCJ that significantly affected his activities of daily living and disturbed his sleep, and he regularly took time off work because of pain.

Physical examination findings showed laxity in the anterior direction with palpation of the right medial clavicle and spontaneous subluxation with overhead shoulder motion (Fig. 1). This required manual digital compression to reduce. No esophageal or tracheal manifestations were noted, and the region was neurovascularly intact. No other physical findings were evident, with a normal acromioclavicular joint and glenohumeral joint. The results of plain radiographs and computed tomography scans were unremarkable. Because the pain and subluxation worsened despite nonoperative treatment for a total of 6 months and the patient needed to return to his manual work, the decision to perform reduction and stabilization with surgery was made.

Operative technique

A 5-cm horizontal incision was made centered over the SCJ with layered dissection protecting the larger cutaneous nerves and elevation of the platysma muscle down to the SCJ. A horizontal incision was made through the anterior capsule and its ligaments with these structures elevated from the anterior aspect 2 cm on either side of the SCJ, dissecting meticulously over the superior aspect and then the posterior aspect of the joint (Fig. 2). The lateral 50% of the sternal footprint of the sternocleidomastoid was

* Corresponding author: Dr. Gavin S. Hautala, MD, Department of Orthopaedic Surgery and Sports Medicine, Elbow Shoulder Research Center, University of Kentucky, 740 S Limestone, Ste K401, Lexington, KY 40536-0284, USA.
E-mail address: gha273@uky.edu (G.S. Hautala).

https://doi.org/10.1016/j.jses.2019.10.105

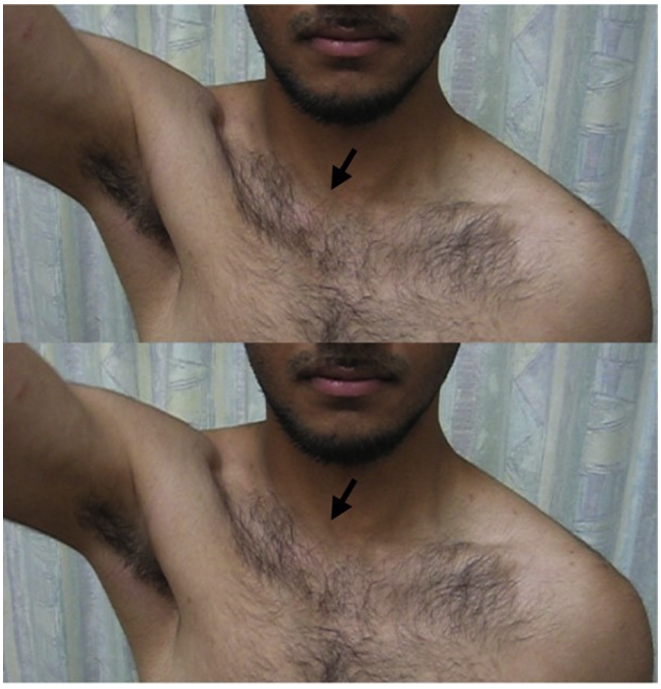

Figure 1 Anterior subluxation with arm elevation. *Top arrow* shows sternoclavicular joint subluxation. *Bottom arrow* shows sternoclavicular joint reduction.

elevated as part of the capsulo-periosteal sleeve. The posterior dissection carefully elevated the periosteum from the manubrium and medial clavicle to allow placement of a protective blunt metal retractor.

A 4-mm drill hole was made at 1 cm on either side of the joint directed in the anteroposterior plane protecting the posterior mediastinal structures. The great vessels of the superior mediastinum are immediately posterior to the SCJ. These include the aorta and its principal branches, the jugular vein, and the superior vena cava. The trachea, esophagus, and recurrent laryngeal nerve are also in close proximity.

A TightRope (Arthrex, Naples, FL, USA), more commonly used in the stabilization of a diastasis in ankle fractures, was used. A 4-strand dual-EndoButton nonabsorbable suture (Smith & Nephew Endoscopy, Andover, MA, USA) was introduced through the manubrium in the anteroposterior direction and through the hole in the medial clavicle in a posteroanterior direction (Figs. 3 and 4). The EndoButton was positioned to reduce and hold the sternal end of

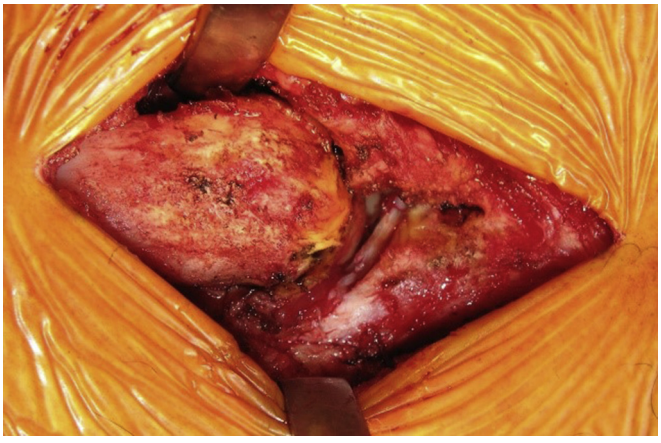

Figure 2 Intraoperative exposure of right sternoclavicular joint.

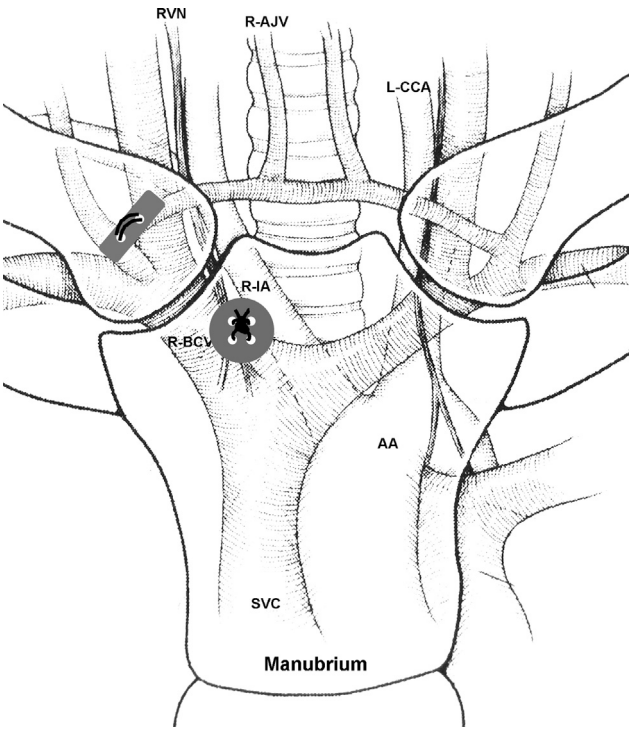

Figure 3 Diagram of the TightRope implant. *RVN*, right vagus nerve; *R-AJV*, right anterior jugular vein; *R-IA*, right innominate artery; *R-BCV*, right brachiocephalic vein; *L-CCA*, left common carotid artery; *AA*, aortic arch; *SVC*, superior vena cava.

the clavicle in a direction 30° superior and posterior to the horizontal. This reversed the instability vector of anterior translation. The periosteal sleeve and the footprint of the sternal head of the sternocleidomastoid were double-breasted with No. 2 Vicryl

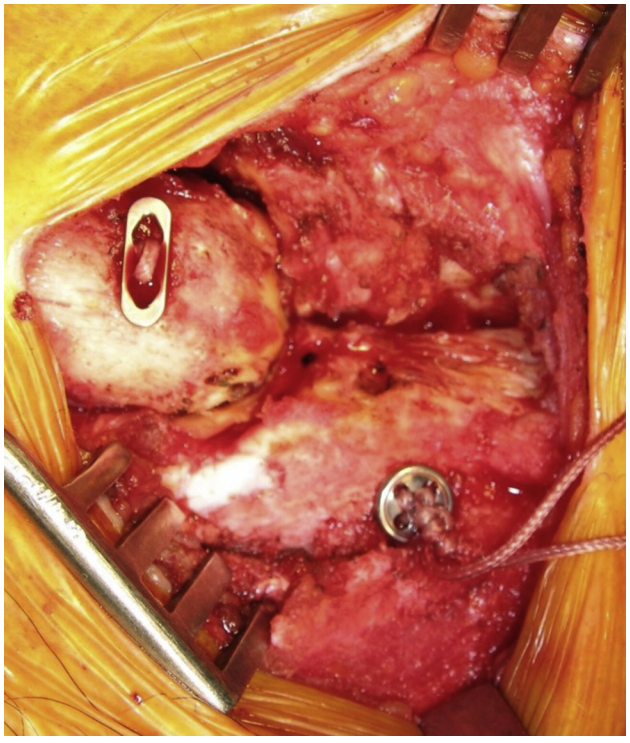

Figure 4 Photograph of TightRope implant.

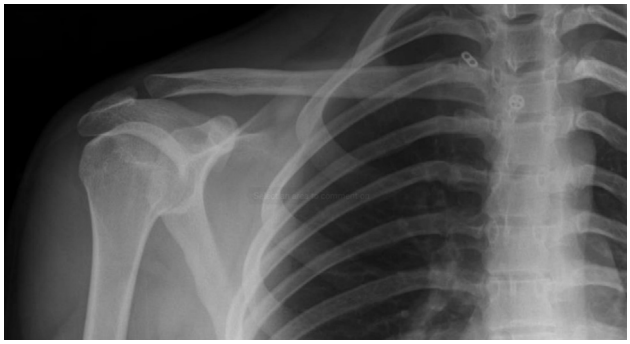

Figure 5 Postoperative radiograph.

(Ethicon, Somerville, NJ, USA) to plicate the structures anterior to the EndoButton (Fig. 5).

The patient underwent rehabilitation in a broad arm sling; cryotherapy and nonsteroidal anti-inflammatory tablets were avoided to prevent a delay in tissue healing. Gentle mobilization exercises were commenced for 6 weeks, and full active range-of-motion exercises, by 3 months. He became symptom free at 6 months (Fig. 6) and remained symptom free at a 3-year review. However, at a 5-year review, he started to show anterior instability again and to have pain, with no specific history of injury, although he continued his manual work and gym workouts. We have subsequently ceased using the TightRope device for SCJ instability and have progressed to tendon allograft reconstruction.

Discussion

Owing to anatomic considerations, dislocation occurs in anterior, posterior, and anterosuperior directions, with rupture of the sternoclavicular joint, interclavicular ligaments, and costoclavicular ligaments. Only one-fourth of the clavicle articulates with the fibrocartilage of the sternum and the cartilage of the first rib, resulting in a saddle-like articulation that is incongruent and potentially unstable. The ligaments and an intra-articular disk compensate for the anatomic incongruity.[16] The capsule and its thickenings reinforce the joint, with the anterior and posterior sternoclavicular ligaments securing the medial end of the clavicle to the sternum. The tendon of the sternocleidomastoid reinforces the capsule anteriorly, supported by the sternohyoid muscle posteriorly and the costoclavicular ligament inferiorly. The interclavicular ligament is a continuous band connecting the superior and inner aspects of each clavicle with the joint capsule and upper manubrium.[4] The costoclavicular, or rhomboid, ligament is an extra-articular ligament that anchors the metaphysis of the medial portion of the clavicle to the first rib.[10]

Figure 6 Examination at 6 months postoperatively.

The management of anterior SCJ dislocation warrants careful assessment of associated injuries. The diagnosis may be obvious from the history and clinical examination findings in many cases, which reveal localized tenderness and prominence of the medial end of the clavicle with possible evidence of instability. Some patients can demonstrate clicking and palpable subluxation with elevation of the arm. Occasionally, however, physical findings are subtle and radiographic studies are not helpful to confirm the diagnosis owing to the dynamic nature of the instability. Axial computed tomography has been particularly useful in some, but not all, situations.[19] The clinical history and examination findings appear most sensitive to an accurate diagnosis, with imaging studies highly dependent on the acuity and positioning of the limb.

Nonoperative treatment of sternoclavicular instability is based on the supposition that persistent anterior clavicular prominence causes no significant functional difficulties and that recurrent, and even irreducible, anterior dislocations are usually tolerated without significant sequelae or complications.[12] Despite the direction of dislocation, it is currently recommended to attempt closed reduction to prevent poor long-term clinical outcomes.[12,13,17] However, closed reduction is successful in only 38% of attempts,[10] and despite successful closed reduction, residual instability often remains. If closed reduction does not work, then open treatment should be considered. It has been reported that closed reduction has poor results with a high failure rate of maintaining reduction and requires a subsequent second operation.[6] However, if the closed reduction is a success, it has similar functional outcomes to open reduction.[13]

Although there are various stabilization techniques with varied results described in the literature,[1-3,7,11,12,14,15,18,20] none have taken into account the configuration of the ligaments and the force vector of translation at the SCJ. K-wires and/or pins are no longer used as there are significant complications with pin breakage and migration leading to fatal perforation of the aorta[5] and the main trunk of the pulmonary artery, pericardial tamponade, mediastinal migration, and cardiac perforation. Postoperative pain and scarring, iatrogenically induced decreased range of motion, and recurrence of SCJ instability remain concerns. Other techniques using hardware such as locking plates[20] and Balser plate stabilization[8,21] require implant removal.

We describe a technique that successfully restores the anterosuperior displacing vector with a double-EndoButton nonabsorbable suture construct. This requires correct identification of the direction of instability to reverse the vector with the surgical construct. It is also dependent on careful limited dissection posterior to the clavicle and manubrium to avoid injury to the mediastinal structures. However, the short-term success in the first 3 years after surgery did not translate into permanent stabilization. This could possibly be due to the cheese wiring of the nonabsorbable FiberWire suture material through the bone, thereby allowing joint laxity to re-emerge.

Conclusion

Because the potential cheese-wiring effect of the TightRope implant is a concern for future recurrence of dislocation and instability, we no longer recommend this device for SCJ

stabilization. We favor the described surgical technique of neutralizing the displacing vector but with tendon allograft reconstruction in place of the TightRope implant.

Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Abiddin Z, Sinopidis C, Grocock CJ, Yin Q, Frostick SP. Suture anchors for treatment of sternoclavicular joint instability. J Shoulder Elbow Surg 2006;15:315–8. https://doi.org/10.1016/j.jse.2005.07.005.
2. Ao R, Zhu Y, Zhou J, Jian Z, Shi J, Li C, et al. Locking plate for treating traumatic sternoclavicular joint dislocation: a case series. BMC Musculoskelet Disord 2018;19:7. https://doi.org/10.1186/s12891-017-1903-8.
3. Brinker MR, Bartz RL, Reardon PR, Reardon MJ. A method for open reduction and internal fixation of the unstable posterior sternoclavicular joint dislocation. J Orthop Trauma 1997;11:378–81.
4. Buckerfield CT, Castle ME. Acute traumatic retrosternal dislocation of the clavicle. J Bone Joint Surg 1984;66:379.
5. Clark RL, Milgram JW, Yawn DH. Fatal aortic perforation and cardiac tamponade due to a Kirschner wire migrating from the right sternoclavicular joint. South Med J 1974;67:316–8.
6. Eskola A, Vainionpaa S, Vastamaki M, Slatis P, Rokkanen P. Operation for old sternoclavicular dislocation. Results in 12 cases. J Bone Joint Surg Br 1989;71:63–5.
7. Fery A, Sommelet J. Sternoclavicular dislocations. Observations on the treatment and result of 49 cases. Int Orthop 1988;12:187–95.
8. Franck WM, Jannasch O, Siassi M, Hennig FF. Balser plate stabilization: an alternate therapy for traumatic sternoclavicular instability. J Shoulder Elbow Surg 2003;12:276–81. https://doi.org/10.1016/S1058-2746(02)86802-1.
9. Friedman RJ. Die Instabilität des Sternoklavikulargelenks [Instability of the sternoclavicular joint]. Orthopade 1998;27:567–70 [in German].
10. Gerich T, Hoffmann A, Backes F, Duinslaeger AD, Seil R, Pape D. Anterior buttress plate is successful for treating posterior sterno-clavicular dislocation. Knee Surg Sport Traumatol Arthrosc 2019;27:251–8. https://doi.org/10.1007/s00167-018-5298-3.
11. Groh GI, Wirth MA, Rockwood CA Jr. Treatment of traumatic posterior sternoclavicular dislocations. J Shoulder Elbow Surg 2011;20:107–13. https://doi.org/10.1016/j.jse.2010.03.009.
12. Kalandiak SP, Wirth MA, Rockwood CA. Unstable sternoclavicular joint: indications for and techniques of reconstruction. Tech Elbow Shoulder Surg 2002;3:151–66. https://doi.org/10.1097/00132589-200209000-00002.
13. Kirby JC, Edwards E, Kamali Moaveni A. Management and functional outcomes following sternoclavicular joint dislocation. Injury 2015;46:1906–13. https://doi.org/10.1016/j.injury.2015.05.050.
14. O'Reilly-Harbidge SC, Balogh ZJ. Three-point suture anchor repair of traumatic sternoclavicular joint dislocation. ANZ J Surg 2013;83:883–6. https://doi.org/10.1111/ans.12403.
15. Rockwood CA Jr, Odor JM. Spontaneous atraumatic anterior subluxation of the sternoclavicular joint. J Bone Joint Surg 1989;71:1280–8.
16. Rogers LF. Radiology of skeletal trauma. The shoulder and humeral shaft. New York: Churchill Livingstone; 1992. p. 670–80.
17. Sernandez H, Riehl J. Sternoclavicular joint dislocation: a systematic review and meta-analysis. J Orthop Trauma 2019;33:251–5. https://doi.org/10.1097/BOT.0000000000001463.
18. Thomas DP, Williams PR, Hoddinott HC. A 'safe' surgical technique for stabilisation of the sternoclavicular joint: a cadaveric and clinical study. Ann R Coll Surg Engl 2000;82:432–5.
19. Waters PM, Bae DS, Kadiyala RK. Short-term outcomes after surgical treatment of traumatic posterior sternoclavicular fracture-dislocations in children and adolescents. J Pediatr Orthop 2003;23:464–9. https://doi.org/10.1097/01241398-200307000-00010.
20. Wirth MA, Rockwood CA Jr. Acute and chronic traumatic injuries of the sternoclavicular joint. J Am Acad Orthop Surg 1996;4:268–78.
21. Zhang C, Lin L, Liang J, Wang B, Chen G, Chen H. Efficacy analysis of a novel sternoclavicular hook plate for treatment of unstable sternoclavicular joint dislocation or fracture. J Orthop Surg (Hong Kong) 2017;25. 2309499016684488. https://doi.org/10.1177/2309499016684488.