Acta Biomed 2020; Vol. 91, Supplement 14: e2020025 DOI: 10.23750/abm.v91i14-S.10949

Case report

A rare case of complicated pure posterior sternoclavicular dislocation in a young athlete

Filippo Calderazzi, Margherita Menozzi, Piergiulio Valenti, Alessandra Colacicco, Paolo Bastia, Francesco Pogliacomi, Francesco Ceccarelli

Department of Medicine and Surgery, Orthopaedic Clinic, Parma University Hospital, Parma, Italy

Summary. Sternoclavicular joint dislocation (SCJD) is a rare injury, generally classified in anterior and posterior. The posterior SCJD is very infrequent yet potentially associated with life-threatening complications. In patients with unfused medial clavicle physis, SCJD can be associated with fracture-dislocation (Salter type I or II). We hereby present the case of a 12- year-old basketball player with severe pain in sternoclavicular region and arising dysphagia after a fall and tackle by another player. A SCJ injury was hypothesised and the CT scan detected the presence of a true posterior SCJD with no associated fracture, which was also confirmed during open reduction. As the patient complained dysphagia, it was also necessary to study other possible mediastinal compressions by a contrast medium CT scan of the great vessels. The CT scanned brachiocephalic vein compression without additional clinical evidence or signs. Twenty hours after the trauma the patient underwent an unsuccessful closed reduction**;** for this reason, surgical treatment with open reduction and fixation was mandatory. After 12 weeks of therapy she returned to her previous sport activity. (www.actabiomedica)

Keywords: Sternoclavicular dislocation, Adolescent, Surgery

Background

Injuries to the sternoclavicular joint (SCJ) are rare and represent less than 1% of all fractures or dislocations (1-3).

Displacement of medial clavicle may be either anterior, most frequent, or posterior, which increases the risk of mediastinal structures compression and injuries (2,4-6). Physeal fractures of the medial clavicle in paediatric patients with SCJ injuries may be quite common because the medial clavicular physis does not ossify until 21-25 years of age (1,6-10)

Actually, most of the paediatric patients undergoing open reduction and internal fixation of posteriorly displaced sternoclavicular joint injuries has a fracture of the medial clavicle physis (1,8,11).

We hereby report the case of a paediatric patient with unossified medial clavicle epiphysis displaying a true posterior dislocation with no associated fracture.

Case Report

A 12-year-old girl fell on her right shoulder after being tackled by another player during a basketball Little League match. She was admitted to our ER the same day of the injury, in the evening. She reported sharp pain in her right sternoclavicular region and slight dysphagia immediately after the trauma. Physical examination of the patient revealed deformity and tenderness in the right sternoclavicular joint. Radiography (Fig. 1)

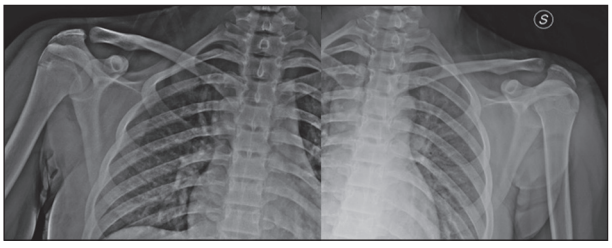

Figure 1. Pre-operative radiography of right and left SCJ: dislocation of the right SCJ

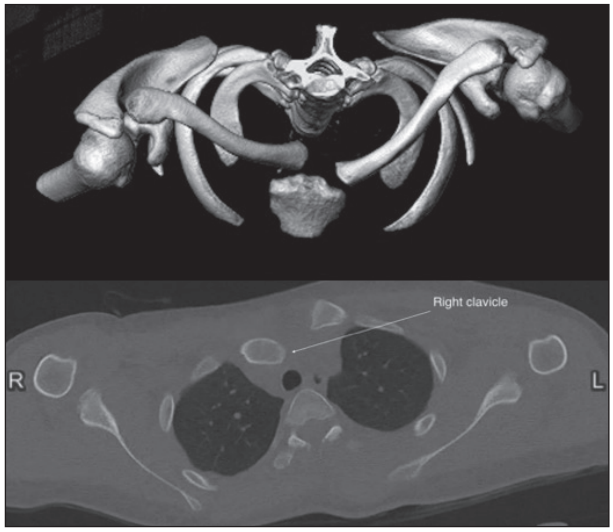

Figure 2. Pre-operative CT scan: posterior dislocation of the right SCJ

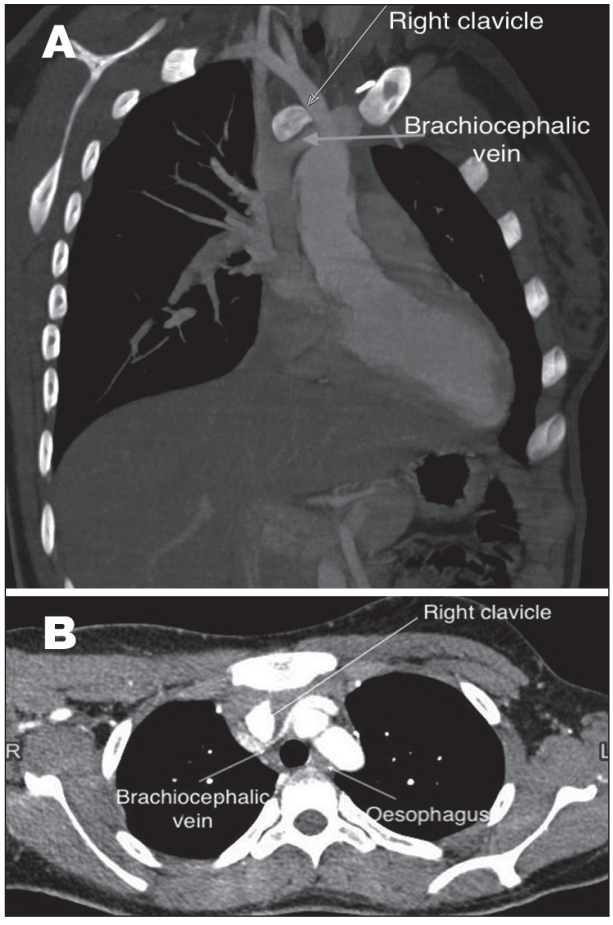

Figure 3. a) Pre-operative angioCT scan: the medial end of the clavicle compresses the right brachiocephalic (innominate) vein; b) The oesophagus is not dislocated

and CT scan (Fig. 2) showed posterior displacement of the right medial end of the clavicle. This diagnosis made necessary to further investigate the injury with angio-CT to identify potential lesions of the mediastinal structures; the exam showed compression of the right brachiocephalic (innominate) vein by the clavicle, but no vessel lesion (Fig. 3a). On the CT axial scan the oesophagus was not clearly displaced (Fig. 3b).

The patient was stable in the hours following the trauma. As the dysphagia was increasing, we immediately decided to perform the reduction manoeuvre (about twenty hours after trauma) in the operating room (OR).

A closed reduction was attempted under general anaesthesia with the patient in beach-chair position and a sandbag between the shoulders. A wrapped sheet was positioned behind the back of the patient as a support, then the right upper arm was extended and pulled, at the same time two percutaneous reduction clamps were positioned around the central part of the clavicle and they were pulled outward (Fig. 4).

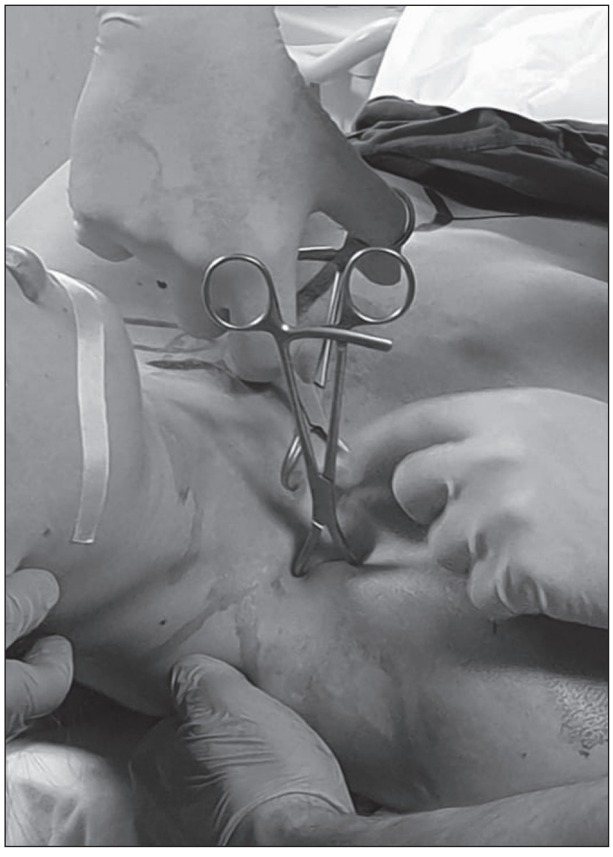

Figure 4. Attempt of percutaneous reduction of the dislocation

However, the clinical picture remained unclear and fluoroscopy did not help clarify; besides, we could not hear an audible "clunk", sign of reduced dislocation (12); for these reasons, a chest CT under general anaesthesia was performed and it showed that the clavicle was still displaced (Fig. 5). Open reduction was performed immediately after. The patient was placed in the same position. the thoracic surgeon and vascular surgeon were on standby in the OR. A skin incision was made just inferior to the SCJD (Fig 6a). The right sternoclavicular space was exposed; the clavicle was so posteriorly displaced that we had to detach the sternocleidomastoid muscle (SCM) from its sternal insertion to allow clavicle reduction (Fig 6b). The reduction of the clavicle was performed using a pointed reduction clamp and it was then temporary stabilized with a sternoclavicular Kirschner wire (Fig 6c). The medial clavicular epiphysis was intact: no line of fracture was observed. Two drill holes were made in the superior and inferior cortex of medial clavicular epiphysis and two more in the superior and inferior cortex of lateral sternal manubrium (Fig. 6d). The final fixation of the joint was carried out with a trans osseous suture in a "figure-of-eight" from the medial clavicular epiphysis to the sternal manubrium using a double Fiberwire® suture thread, thus achieving good stability (Fig 6e). Then, we sutured the sternocleidomastoid muscle to its sternal insertion with resorbable stitches for both functional and aesthetic reasons (Fig. 6f). No complication occurred during the operation. After the surgery and X-rays check (Fig. 7), a shoulder sling was positioned for 4 weeks. Passive shoulder motion with 90° range of abduction was started 4 weeks after the surgery. After 6

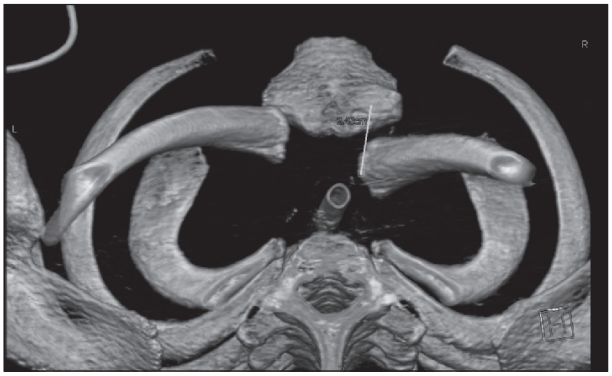

Figure 5. Intraoperative CT scan: The right SCJ is still dislocated

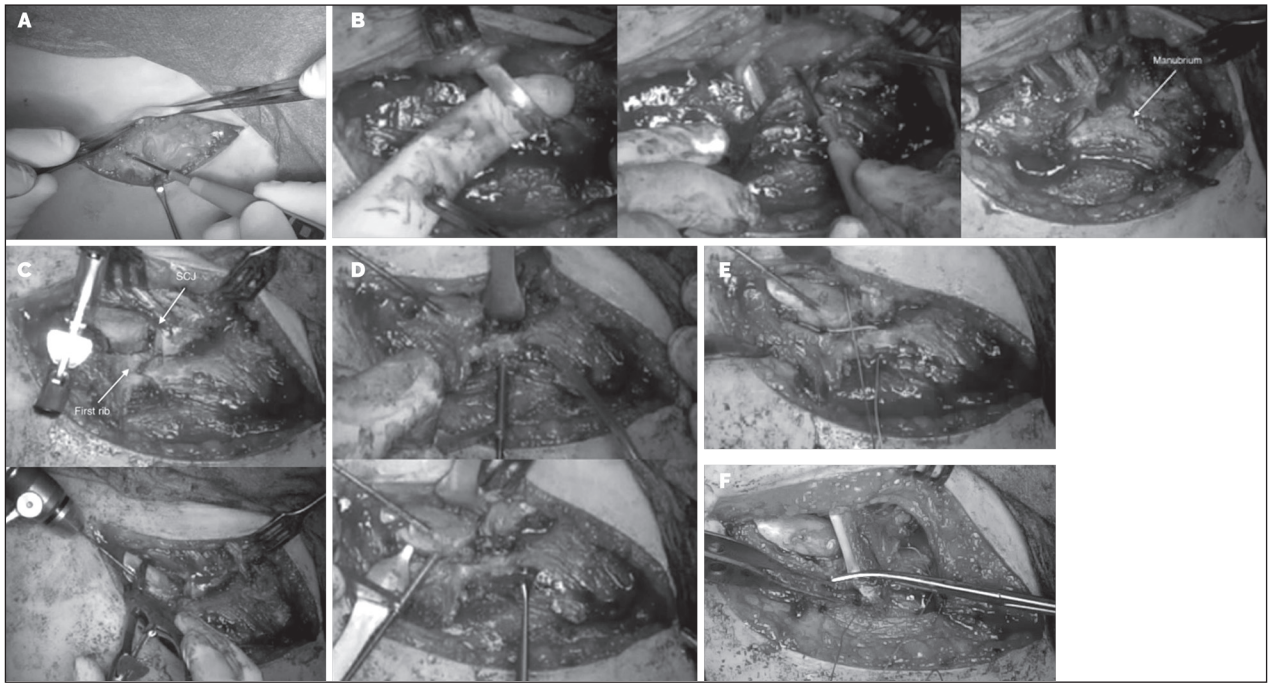

Figure 6. a) Surgical incision; b) The sternal end of SCM is found and cut; c) Reduction of SCJ with a clamp and temporary fixation with a Kirshner wire; d) Bone tunnels of the sternal manubrium and medial end of clavicle; e) Transosseous double "figure of eight" suture with Fiberwire®; f) Suture of sternal end of SCM

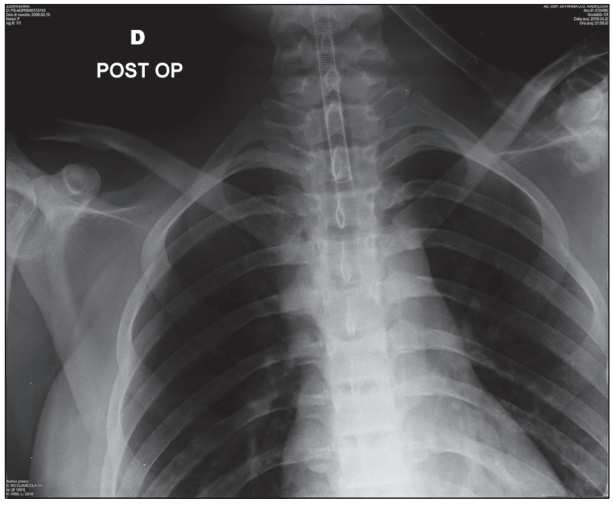

Figure 7. Postoperative X-ray

weeks, physical therapy up to 100° range of abduction was started and weight bearing was increased according to the clinical course. At final follow-up, 12 weeks after the injury, the sternoclavicular joint was stable, the patient had no pain and could start strengthening and athletic training (Fig. 8).

Discussion

Posterior SCJD may occur due to high-energy trauma at any age (6,10,11,13). This rolling happens following a direct blow on the medial clavicle, as it frequently occurs to patients run over by a vehicle or during contact sport-related activities. Also, a compressive force applied to the lateral aspect of the shoulder girdle may result in the shoulder rolling forward, and the medial end of clavicle dislocating posteriorly (2,8). The unossified medial clavicular physis in adolescents, in addition to the common participation of this age group in athletic events and contact sports, may make these patients more susceptible to this injury (9).

Before closure of the growth plate of the medial end of the clavicle at 22 to 25 years of age, posterior SCJD may present as an epiphyseal disruption with posterior clavicle medial end displacement, rather than as a true posterior dislocation (1,5,6,8,11).

However, it is often very difficult to distinguish these two conditions, as the circumstances and mechanism of injury, the clinical presentation and the potential immediate complications are similar (14); the right diagnosis in fact might be missed with conventional X-rays for the presence of an open medial clavicular physis. Sometimes CT scan can occult medial physeal fracture in skeletally immature patients and the true diagnosis occurs on the operating table (5,7,11,15,16).

At present, axial CT is the most reliable and informative diagnostic exam to assess these injuries and can confirm the diagnosis of medial clavicular physeal fracture if epiphyseal ossification has occurred (8).

Figure 8. Clinical assessment at 12 months follow-up

As a consequence, the incidence of physeal fracture of medial clavicle is uncertain (8,11). Lee at al. (1) published a study showing that posterior SCJD and medial clavicular physeal fracture both occur with thoroughly equivalent prevalence in patients with an open medial physis. Conversely, many other Authors stated that while true posterior dislocation can occur in children, the majority of the injuries are posteriorly displaced fractures (or Salter-Harris 1 or 2) of the medial clavicular physis (5,10,16-19).

Recognition of medial clavicle fracture/dislocation is important as well, as these injuries are unlikely to be reduced with closed treatment (3,20); as medial end of the clavicle is pushed behind the sternum into the mediastinum, posterior SCJD is potentially associated with life-long-treating complications and clinical symptoms of mediastinal compression may occur in up 25-50% of patient (8,9,16,21). Pneumothorax, vascular injury and injury to brachial plexus have been described (6,8,10,22,23). Symptoms such as dyspnea, dysphonia, dysphagia, hoarseness or odynophagia might onset up to 30% of the patients (15% with dysphagia alone, 8% with dyspnea alone, and 6.5% with both) (9,10,12,23) and suggest compression of the trachea, vagus nerve, oesophagus, venous vessels (8,9,12). Death secondary to the initial injury is reported in 1 case (0.72%) because of a complete laceration of the brachiocephalic vein (9). This group of symptoms may be the expression of mediastinal syndrome.

The case described above shows a very young patient with dysphagia occurred immediately after the trauma. While CT scan was performed to confirm the suspicion of a posterior SCJD, the occurrence of dysphagia led us to further investigate by contrast medium CT scan all secondary complications arising from possible compression of mediastinal structures (10,12).

As dysphagia worsened starting from the following morning, this scenario became a clinical emergency and the patient had to be taken immediately to the OR for the reduction of the dislocation (24).

Several Authors agree that a closed reduction must always be attempted (5,8,9,15,24). They report a success rate of 55.8% for a closed reduction performed within 48 hours from the injury (3,5,7,10,15, 16).

In their systematic review Glass et al. (16) reported that zero out of the 80 posterior SCJDs taken into consideration, zero had been treated nonoperatively, while sixteen (20%) of the open reductions had a reported failed closed reduction before the open reduction.

The elapsed time from injury to closed reduction will impact the likelihood of a successful closed reduction. If a closed reduction of an acute posterior SCJD is attempted within 48-72 from injury, the chance of a successful maneuver is better compared with the one attempted after 72 hours (3). In our case, although closed reduction was attempted approximately twenty hours after the trauma, it didn't prove effective and open reduction and fixation were required.

Operative management has not been standardized so far. Multiple different reconstruction approaches for the SCJ have been described (16). They include repair using suture anchors (13), Kirschner and Steinmann pins (14,25), or reconstruction using autologous grafts (fascia lata, tenodesis of subclavius, hamstrings) (26-28). Moreover, internal fixation with plates and/or screws has been proposed (29-31).

Reconstruction techniques using tendon grafts have the disadvantage of the need for grafting with the additional risk of atrophy and elongation of the graft which may result in recurrent joint instability (4).

The fixation technique of using k-wires across the SCJ has shown an approximate death rate of 40% as a result of vascular complications because of wire migration (2)

Open reduction and internal fixation by use of plates and/or screws have the disadvantage of rigid fixation with the risk of implant failure, implant migration, and the need for implant removal (4).

We have chosen a transosseous suture with FiberWire® in a "figure-of-eight", as described by Adamcik et al. (4). Fiberwire® has excellent characteristics in terms of strength and flexibility which provides an optimal replacement for damaged ligaments. The need for tendon grafting is eliminated by at the same time, thus avoiding the effects of tendon atrophy and elongation.

In conclusion, after the diagnosis, a closed reduction must be attempted as soon as possible, mostly if there are any symptoms related to mediastinal compression; if it proves unsuccessful, an open reduction will be necessary.

The operative management should be adapted deciding whether the injury is a true posterior dislocation, as we have just reported in this case of a promising young basketball player, or a medial clavicular physeal fracture, which is the most likely occurrence during adolescence.

Actually, it is really important the choice of a confident surgical technique adapting it to the different patient needs. The trans osseous Fiberwire® suture in a "figure-of-eight" could be a valid option.

Authors contribute: All authors contributed to and approved the final version of manuscript

Conflict of interest: Each author declares that he or she has no commercial associations that might pose a conflict of interest in connection with the submitted article.

References

1. Lee JT, Nasreddine AY, Black EM, Bae DS, Kocher MS. Posterior sternoclavicular joint injuries in skeletally immature patients. J Pediatr Orthop. 2014 Jun;34(4):369-75.
2. Dhawan R, Singh RA, Tins B, Hay SM. Sternoclavicular joint. Shoulder Elbow. 2018 Oct;10(4):296-305.
3. Sernandez H, Riehl J. Sternoclavicular Joint Dislocation: A Systematic Review and Meta-analysis. J Orthop Trauma. 2019 Jul;33(7):e251-e255.
4. Adamcik S, Ahler M, Gioutsos K, Schmid RA, Kocher GJ. Repair of sternoclavicular joint dislocations with FiberWire®. Arch Orthop Trauma Surg. 2017 Mar;137(3):341-345
5. Laffosse JM, Espié A, Bonnevialle N, Mansat P, Tricoire JL, Bonnevialle P, Chiron P, Puget J. Posterior dislocation of the sternoclavicular joint and epiphyseal disruption of the medial clavicle with posterior displacement in sports participants. J Bone Joint Surg Br. 2010 Jan;92(1):103-9
6. Kirby JC, Edwards E, Kamali Moaveni A. Management and functional outcomes following sternoclavicular joint dislocation. Injury. 2015 Oct;46(10):1906-13.
7. Robinson CM, Jenkins PJ, Markham PE, Beggs I. Disorders of the sternoclavicular joint. J Bone Joint Surg Br 2008;90(6):685–96.
8. Sewell MD, Al-Hadithy N, Le Leu A, Lambert SM. Instability of the sternoclavicular joint: current concepts in classification, treatment and outcomes. Bone Joint J. 2013 Jun;95-B(6):721-31.
9. Tepolt F, Carry PM, Heyn PC, Miller NH. Posterior sternoclavicular joint injuries in the adolescent population: a meta-analysis. Am J Sports Med. 2014 Oct;42(10):2517-24
10. Groh GI, Wirth MA, Rockwood CA Jr. Treatment of traumatic posterior sternoclavicular dislocations. J Shoulder Elbow Surg. 2011;20:107–113.
11. Garg S, Alshameeri ZA, Wallace WA. Posterior sternoclavicular joint dislocation in a child: a case report with review of literature. J Shoulder Elbow Surg. 2012 Mar;21(3):e11-6.
12. Cruz MF, Erdeljac J, Williams R, Brown M, Bolgla L. Posterior sternoclavicular joint dislocation in a division football player: a case report. Int J Sports Phys Ther. 2015 Oct;10(5):700-11.
13. Abiddin Z, Sinopidis C, Grocock CJ, Yin Q, Frostick SP. Suture anchors for treatment of sternoclavicular joint instability. J Shoulder Elbow Surg. 2006 May-Jun;15(3):315-8. doi: 10.1016/j.jse.2005.07.005. PMID: 16679231.
14. Leighton RK, Buhr AJ, Sinclair AM. Posterior sternoclavicular dislocations. Can J Surg 1986;29:104-6.
15. Deren ME, Behrens SB, Vopat BG, Blaine TA. Posterior sternoclavicular dislocations: a brief review and technique for closed management of a rare but serious injury. Orthop Rev (Pavia). 2014 Mar 12;6(1):5245.
16. Glass ER, Thompson JD, Cole PA, Gause TM 2nd, Altman GT. Treatment of sternoclavicular joint dislocations: a systematic review of 251 dislocations in 24 case series. J Trauma. 2011 May;70(5):1294-8.
17. Gilot GJ, Wirth MA, Rockwood CA. Injuries to the sternoclavicular joint. In: Rockwood CA, Green DP, editors. Fracture in adults. Sixth edition. Philadelphia: Lippincott William & Wilkins; 2006. p. 1363-97
18. Gobet R, Meuli M, Altermatt S, Jenni V, Willi UV. Medial clavicular epiphysiolysis in children: The so-called sternoclavicular dislocation. Emerg Radiol 2004;10:252-5.
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 Jul-Aug;23(4):464-9.
20. Lampasi M, Bochicchio V, Bettuzzi C, Donzelli O. Sternoclavicular physeal fracture associated with adjacent clavicle fracture in a 14-year-old boy: a case report and literature review. Knee Surg Sports Traumatol Arthrosc. 2008 Jul;16(7):699-702.
21. Martin SD, Altchek D, Erlanger S. Atraumatic posterior dislocation of the sternoclavicular joint: a case-report and literature-review. Clin Orthop Relat Res. 1993;292:159-164.
22. Medvecky MJ, Zuckerman JD. Sternoclavicular joint injuries and disorders. Instr Course Lect 2000;49:397–406.
23. Bontempo NA, Mazzocca AD. Biomechanics and treatment of acromioclavicular and sternoclavicular joint injuries. Br J Sports Med. 2010 Apr;44(5):361-9. doi: 10.1136/bjsm.2009.059295. PMID: 20371562.
24. Morell DJ, Thyagarajan DS. Sternoclavicular joint dislocation and its management: A review of the literature. World J Orthop. 2016 Apr 18;7(4):244-50.
25. Lunseth PA, Chapman KW, Frankel VH. Surgical treatment of chronic dislocation of the sterno-clavicular joint. J Bone Joint Surg Br. 1975 May;57(2):193-6. PMID: 1141285.
26. Burrows HJ. Tenodesis of subclavius in the treatment of recurrent dislocation of the sterno-clavicular joint. J Bone

Joint Surg Br. 1951 May;33B(2):240-3. PMID: 14832323.
27. Castropil W, Ramadan LB, Bitar AC, Schor B, de Oliveira D'Elia C. Sternoclavicular dislocation--reconstruction with semitendinosus tendon autograft: a case report. Knee Surg Sports Traumatol Arthrosc. 2008 Sep;16(9):865-8. doi: 10.1007/s00167-008-0527-9. Epub 2008 Apr 17. PMID: 18418578.
28. Armstrong AL, Dias JJ. Reconstruction for instability of the sternoclavicular joint using the tendon of the sternocleidomastoid muscle. J Bone Joint Surg Br. 2008 May;90(5):610-3.
29. Shuler FD, Pappas N. Treatment of posterior sternoclavicular dislocation with locking plate osteosynthesis. Orthopedics. 2008 Mar;31(3):273.
30. 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 Sports Traumatol Arthrosc. 2019 Jan;27(1):251-258.
31. Franck WM, Jannasch O, Siassi M, Hennig FF. Balser plate stabilization: an alternate therapy for traumatic sternoclavicular instability. J Shoulder Elbow Surg. 2003 May-Jun;12(3):276-81.

Received: 14 November 2020
Accepted: 17 November 2020
Correspondence:
Filippo Calderazzi, MD, PhD
Orthopaedic Clinic
Via Gramsci 14. 43126 Parma, Italy
Phone: +39-0521/704640
E-mail: filippo.calderazzi@icloud.com