



COMPLICATED POSTERIOR STERNOCLAVICULAR JOINT DISLOCATION WITH AORTIC ARCH IMPINGEMENT

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SUMMARY – Posterior sternoclavicular dislocation accompanied by clavicular end fracture is an extremely rare injury according to the available literature. We present a case of a young male with this injury, resulting from a vehicle accident, and additionally complicated by a clavicular bone fragment in the proximity of the aortic arch. An initial X-ray showed no signs of bone trauma, which was, however, revealed on a CT scan. Stable fixation of the fragment and sternoclavicular joint was achieved utilizing a plate and screws. The osteosynthetic material was removed after eight weeks due to the plate breaking. There were no complications in the 5-year follow-up period, and a full range of motion was accomplished. We aimed to emphasize the importance of early diagnosis and appropriate surgical management of complicated posterior sternoclavicular dislocations to avoid life-threatening events.

Keywords: *Shoulder dislocation; Sternoclavicular joint; Aortic arch; Fracture fixation*

Introduction

Among shoulder girdle injuries, traumatic sternoclavicular dislocations account for only 3% of cases, whereas the posterior type comprises only a minority of those^{1,2}. In cases of posterior sternoclavicular

dislocation (PSCD), diagnosis should be carried out promptly, as serious complications such as pneumothorax, vascular compromise, dysphagia, and death may occur due to the compression of the clavicle on surrounding structures^{3,4}. PSCD can be easily overlooked on plain radiographs. This should be avoided by utilizing additional X-ray projections and computed tomography⁵.

PSCD combined with medial clavicular fracture is an extremely rare variant of isolated posterior dislocation. Sporadic cases of dislocation with an overlooked fracture are described in skeletally immature patients. Such cases are underreported due to difficulties in

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Received October 4, 2018, accepted May 23, 2019

the detection of such injuries with both conventional X-ray and computed tomography. As recently shown, magnetic resonance imaging (MRI) of the sternoclavicular joint can be crucial in diagnosing medial clavicle physal fracture⁶. Since the medial end of the clavicle is expected to reach its final ossification by the age of 22 to 25, in patients with unfused medial clavicle physis, fracture occurs through it and is usually not significantly displaced but can seriously impact ossification⁷. Unlike those “transient” fractures, evident fractures with displaced fragments have so far been described in two cases^{8,9}. In our case, the fracture was evident on the CT scan and the clavicular fragment was significantly dislocated, thereby jeopardizing the aortic arch and requesting immediate surgical intervention. In contrast to the previously described cases, our patient was 21 years old, and therefore, ossification of his medial clavicle was not finished. However, his fracture was not “transient” as in skeletally immature cases. Thus, the fracture’s characteristics and subsequent dislocation resembled mature cases.

Case report

A 21-year-old right-handed male suffered multiple impacts while involved in a car accident, including rollover of his vehicle, which he was driving. Clinical examination revealed lacero-contused wounds of the soft tissues of the head, swelling and asymmetry of the superior chest wall and left hemithorax, and a painful iliolumbar region. Radial pulses were symmetric in both upper extremities. The range of motion of the arm on the injured site was limited mostly due to pain. A conventional X-ray scan did not show signs of bone trauma. A contrast-enhanced CT scan, conducted according to the typical polytrauma protocol, detected a medial clavicular epiphyseal fracture with PSCD and close contact of the clavicular bone fragment with a segment of the aortic arch between the left common carotid artery and the left subclavian artery (Figure 1A). However, the aortic arch remained intact, and no contrast extravasation was noticed during the scan. The patient was hemodynamically and respiratory

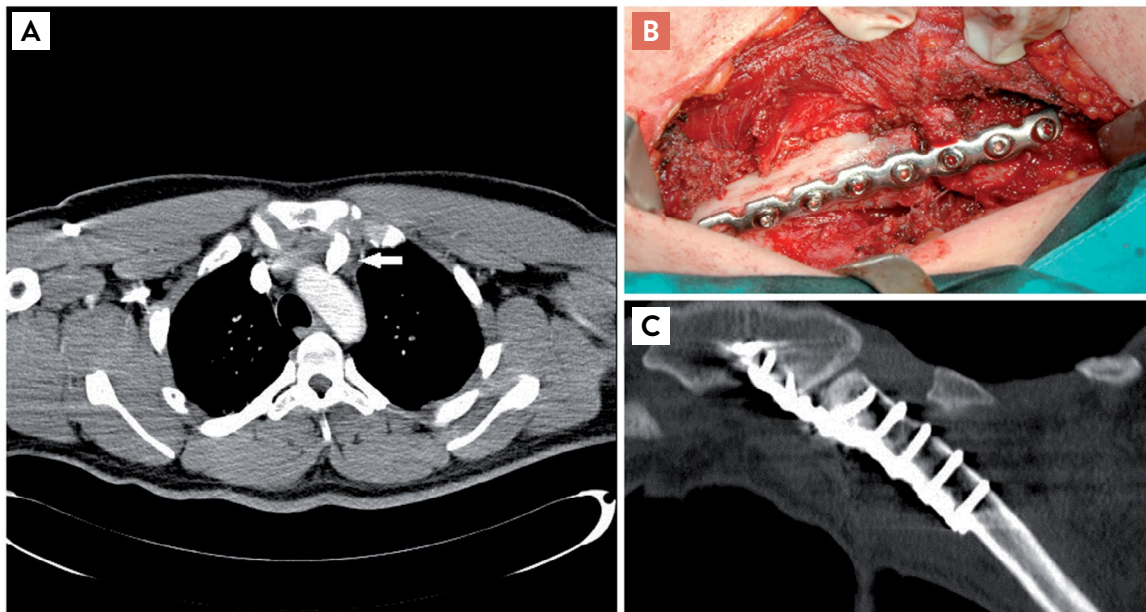


Figure 1. PSCD with medial clavicular fracture. The initial CT scan (A) revealed a clavicular fragment closely related to the aortic arch (white arrow). The intraoperative image shows the plate with screws used to obtain stable fixation of the medial clavicular end and manubrium (B). The postoperative CT scan confirmed the stabilization of fragments (C).

PSCD = posterior sternoclavicular dislocation

stable. Due to the proximity of the bone fragment and the aorta, surgical management was indicated. A left supraclavicular incision was performed to approach the medial clavicular end and manubrium. A resection of the sternoclavicular articular disk and the repositioning of the clavicle was performed, followed by a transfixation of the sternoclavicular joint using a reconstruction plate in the superoanterior position (Figure 1B). The postoperative period was satisfactory with no reported complications. A control CT scan confirmed the correct placement of the osteosynthetic material and the stable position of the clavicle (Figure 1C). The patient's shoulder was immobilized with a Desault bandage for three weeks, followed by physical rehabilitation with non-weight-bearing exercises. The regular clinical and radiological follow-up during eight weeks showed satisfactory morphological and functional findings. The X-ray scan performed on the last day of the eight-week period revealed breakage of the osteosynthetic plate without dislocation in the sternoclavicular joint. Thus, the removal of osteosynthetic material was indicated. The intraoperative inspection of the sternoclavicular joint showed an anatomically correct interrelation between the clavicle and sternum. A complete range of motion and unrestricted activities were reached within one year.

Discussion

Vascular complications of PSCD have been thoroughly described and could be potentially life-threatening¹⁰. We described a patient with PSCD associated with medial clavicular fracture, in which a dislocated fragment compromised the aortic arch. Therefore, stable fixation was highly recommended due to current knowledge on the management of such injuries. K-wire fixation is considered inappropriate due to multiple reports of K-wire migration in surrounding structures^{11,12}. Different techniques of successful sternoclavicular joint stabilization were described, including locking plate constructs, temporary plate fixation, reconstruction with free tendon grafts and synthetic materials¹³⁻¹⁶. In line with the proposed techniques, we obtained stable fixation with a plate and screws. After breakage, we immediately removed the osteosynthetic material and avoided its migration. The stability of

fragments was achieved, and no complications were reported in the five-year follow-up period. The postoperative control X-ray confirmed the correct placement of fragments with no migration. Ultrasound was recently suggested as a useful tool for recognizing posterior dislocations¹⁷. When a patient is sitting in front of the examiner with exposed sternoclavicular joints, a linear transducer should be placed along the clavicle and sternoclavicular joint. Therefore, one can readily identify whether the clavicular end is anteriorly or posteriorly displaced in relation to the manubrium. Additionally, we would suggest using ultrasound during the follow-up of PSCD patients, since it can reveal even a small migration of the adjacent fragments.

Collectively, our current knowledge should be sufficient to recognize acute PSCD with or without clavicular fracture and provide a proper treatment that avoids life-threatening complications.

References

1. Robinson CM, Jenkins PJ, Markham PE, Beggs I. Disorders of the sternoclavicular joint. *J Bone Joint Surg Br.* 2008 Jun;90(6):685-96. doi: 10.1302/0301-620X.90B6.20391.
2. 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. doi: 10.1097/TA.0b013e3182092c7b.
3. Nakayama E, Tanaka T, Noguchi T, Yasuda J, Terada Y. Tracheal Stenosis Caused by Retrosternal Dislocation of the Right Clavicle. *Ann Thorac Surg.* 2007 Feb;83(2):685-7. doi: 10.1016/j.athoracsur.2006.06.022.
4. Jougon JB, Lepront DJ, Dromer CE. Posterior Dislocation of the Sternoclavicular Joint Leading to Mediastinal Compression. *Ann Thorac Surg.* 1996 Feb;61(2):711-3. doi: 10.1016/0003-4975(95)00745-8.
5. Hidalgo Ovejero AM, García Mata S, Sanchez Villares JJ, Martínez de Morentin J, Martínez Grande M. Posterior sternoclavicular dislocation. Report of two cases. *Acta Orthop Belg.* 2003 Apr;69(2):188-92.
6. Beckmann N, Crawford L. Posterior sternoclavicular Salter-Harris fracture-dislocation in a patient with unossified medial clavicle epiphysis. *Skeletal Radiol.* 2016 Apr; 45(8):1123-7. doi: 10.1007/s00256-016-2399-2.

7. 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. doi: 10.1097/BPO.000000000000114.
8. Pency RA, Eglseder WA. Posterior sternoclavicular fracture-dislocation: A case report and novel treatment method. *J Shoulder Elbow Surg.* 2010 Jun; 19(4):e5-8. doi: 10.1016/j.jse.2009.11.050.
9. Kanoksikarin S, Wearne WM. Fracture and retrosternal dislocation of the clavicle. *Aust N Z J Surg.* 1978 Feb;48(1):95-6. doi: 10.1111/j.1445-2197.1978.tb05816.x.
10. Jougon JB, Lepront DJ, Dromer CE. Posterior Dislocation of the Sternoclavicular Joint Leading to Mediastinal Compression. *Ann Thorac Surg.* 1996 Feb;61(2):711-3. doi: 10.1016/0003-4975(95)00745-8.
11. Smolle-Juettner FM, Hofer PH, Pinter H, Friehs G, Szyskowitz R. Intracardiac malpositioning of a sternoclavicular fixation wire. *J Orthop Trauma.* 1992;6(1):102-5.
12. Tubbax H, Hendzel P, Sergeant P. Cardiac perforation after Kirschner wire migration. *Acta Chir Belg.* 1989 Nov-Dec;89(6):309-11.
13. Shuler FD, Pappas N. Treatment of posterior sternoclavicular dislocation with locking plate osteosynthesis. *Orthopedics.* 2008 Mar;31(3):273. doi: <https://doi.org/10.3928/01477447-20080301-35>.
14. 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.
15. 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. doi: 10.5312/wjo.v7.i4.244.
16. Antabak A, Matković N, Stanić L, Deutsch JA, Papeš D, Karlo R, et al. RESULTS OF CLAVICLE FRACTURE TREATMENT IN CHILDREN. *Acta Clin Croat.* 2015 Sep;54(3):345-50.
17. Bengtzen RR, Petering RC. Point-of-Care Ultrasound Diagnosis of Posterior Sternoclavicular Joint Dislocation. *J Emerg Med.* 2017;52(4):513-5. doi: 10.1016/j.jemermed.2016.11.001.

Sažetak

KOMPLICIRANA POSTERIORNA DISLOKACIJA STERNOKLAVIKULARNOG ZGLOBA SA SRAZOM AORTNOG LUKA

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Posteriorna sternoklavikularna dislokacija, udružena s prijelomom kraja ključne kosti, iznimno je rijetka ozljeda prema dostupnoj literaturi. Prikazujemo slučaj mladog muškarca s navedenom ozljedom, nastalom uslijed prometne nesreće, dodatno kompliciranu koštanim fragmentom ključne kosti u blizini aortnog luka. Inicijalno rendgensko snimanje nije pokazalo znakove koštane traume, koja je, međutim, otkrivena na CT-u. Stabilna fiksacija fragmenta i sternoklavikularnog zgloba postignuta je uporabom ploče i vijaka. Osteosintetski materijal uklonjen je nakon osam tjedana zbog loma ploče. Tijekom petogodišnjeg praćenja nisu zabilježene komplikacije, a postignut je puni opseg pokreta. Cilj nam je bio naglasiti važnost rane dijagnostike i adekvatnog kirurškog liječenja kompliciranih posteriornih sternoklavikularnih dislokacija kako bi se izbjegli životno ugrožavajući događaji.

Ključne riječi: *Dislokacija ramena; Sternoklavikularni zglob; Aortni luk; Fiksacija prijeloma*