Case Report

Extensive traumatic anterior chest wall injury including type I manubriosternal dislocation

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ABSTRACT

Manubriosternal joint dislocation (MSD) is a rare traumatic injury, usually preceded by a high energy trauma. We report a case of a 40-year-old female who was involved in a motor vehicle accident and presented to a tertiary trauma centre. She suffered from severe chest wall injuries, including significantly displaced manubriosternal dislocation with lung herniation, bilateral rib fractures and hemopneumothoraces. She underwent a chest wall reconstruction with open reduction and internal fixation with sternal and costal plates with good functional outcome. In this case report we discuss the management of these rare and unstable type I manubriosternal dislocation with associated rib fractures.

Introduction

The manubriosternal joint is a strong synchondrotic or synostotic junction, additionally it provides attachment to a powerful ligamentous network offering structural stability to the thorax. As a consequence, manubriosternal joint dislocation (MSD) is a rare traumatic injury, most commonly preceded by a high energy trauma. MSD occurs in about 1.3–3 % of all trauma cases [1].

The following case sustained an extreme chest wall damage including a rare type I MSD secondary to a high energy blunt trauma. We discuss our surgical approach and management for such a mechanically unstable chest wall injury and its clinical outcome.

Case report

A 40-year-old woman was transferred to the emergency department of our tertiary trauma centre following a motor vehicle collision. She was an unrestrained driver in a single vehicle to pole collision at about 60 km/h. On arrival, she was alert and complaining of significant anterior chest wall pain. On examination, she showed signs of increased work of breathing, anterior surgical emphysema, an obvious chest wall instability with a clinical left-sided flail chest as well as a step deformity at the manubriosternal junction. Her medical background included no previous surgeries, well controlled asthma and depression.

An electrocardiogram was unremarkable and serial troponins were negative. The initial computer tomography (CT) and angiography showed a type I MSD with significant craniocaudal separation (38 mm gap in mid-sternal plane), left 3rd to 5th and right 2nd to 4th displaced rib fractures with bilateral hemopneumothoraces, extensive surgical emphysema, retro-manubrial hematoma (Fig. 1); the angiography showed normal mediastinal vasculature, but non-opacification of both internal mammary arteries at level of the MSD. Bilateral chest tubes for drainage were placed. Within 2 h of arrival she subsequently developed type 2 respiratory failure requiring...
intubation and admission to the intensive care unit for ongoing management.

On day two of admission, a chest wall reconstruction was performed under general anaesthesia. In supine position, a 10 cm transverse incision over the MSJ was done, the anterior sternal surfaces were dissected, bilateral superior lung lobes were found in between the manubriosternal gap as well as the thrombosed ends of the bilaterally ruptured internal mammary arteries which were subsequently clipped. The MSD was anatomically reduced with pointed bone reduction forceps and the lungs and anterior mediastinal structures were protected with a metal ruler. The fixation was performed using two 7-hole 3.5 mm Locking Compression Plates, that were applied longitudinally between the manubrium and body of the sternum. Both plates were secured with three 16 and 18 mm self-tapping head locking screws on each side of the dislocation (Fig. 2).

Displaced fractures of the right 2nd and left 3rd ribs anteriorly were identified, dissected, anatomically reduced and fixed with 50 mm RibLock plates using low profile instruments. This was followed by washout, exchange of bilateral intercostal catheters and wound closure in layers.

The patient was uneventfully extubated 3 days after her operation. A multidisciplinary team approach was required during her recovery as she developed a hospital acquired pneumonia that was managed with antibiotics, chest physiotherapy and a pain regimen guided by anaesthetics. She was discharged on day 6 after surgery with regular outpatient reviews, chest physiotherapy and an analgesia treatment plan.

On her 3 months follow up, she returned to normal activities with no functional restrictions, there was no clinical evidence of sternal instability and she was requiring simple analgesia. Her radiography showed a corrected and stable manubriosternal joint (Fig. 3).

Discussion

Manubriosternal joint dislocation is rare, with a limited number of cases available in the literature. There are two types of manubriosternal dislocations depending on the mechanism of injury. Type I injuries are the least common, usually caused by direct impact to the body of the sternum, in which the sternum dislocates posteriorly with respect to the manubrium. Type II, which are more common, the manubrium dislocates posteriorly with respect to the sternum, due to indirect hyperflexion of the upper thoracic spine that transmit a downwards and posterior force to the manubrium via the first rib [2].

MSD can be suspected on physical examination and confirmed by lateral chest radiograph or CT scan. CT is helpful in detecting other chest injuries including associated life-threatening injuries to the aorta, mediastinal great vessels, trachea, main bronchi and oesophagus.

Given the limited numbers of cases and supporting literature of MSD, its management is controversial and there has not been an agreement on standardised treatment protocols. Long term and functional outcomes of MSD are also limited to support a gold standard management. Non-operative management is associated with a significant rate of subluxation, recurrence, chronic pain syndrome and

Fig. 1. (A) Preoperative sagittal view computer tomography of type I manubriosternal dislocation. (B) Preoperative 3D reconstruction for surgical planning.
pseudoarthrosis. Conservative options post reduction includes, plaster bandage or correction tape, analgesia, local ice and rest [3]. Surgical management with open reduction and internal fixation is usually indicated if there is presence of associated injuries, intractable pain, respiratory distress and mechanically unstable sternal injury [4]. Several fixation methods have been described in the literature, of which wiring and plating are most regularly used. Plating has been shown to provide more stability, better restoration of anterior chest wall function, less associated operative complications and better bone healing, compared to wires [5]. Davisi et al. [6], in a small case series, compared the use of titanium wire versus titanium plates in conjunction with demineralised bone graft in 3 and 8 patients respectively. The latter one showed better outcomes in terms of shorter hospital stay, lower iatrogenic complications, better sternal alignments and less chances of reoccurrence. In regards of mechanical advantages when compared with wiring, plating would resist one of the most important components of motion, flexion and extension. Some of the limitations of plating are the need of bicortical drilling which can lead to injury to adjacent structures, migration or implant failure [7].

Given our positive experience and good functional outcome, using standard plating for unstable and significantly displaced manubriosternal dislocation, may help to establish the operative procedure of choice for this group of patients. Nevertheless, of imperative importance for a good outcome is a multidisciplinary approach, including surgeons, acute pain services and intensive chest physiotherapy to achieve optimal functional outcome and avoid chest wall and pulmonary complications.

Declaration of competing interest

None declared.
Fig. 3. Postoperative lateral chest X-ray view: two 3.5 mm Locking Compression Plates for reduction of MSD and two RibLock plates for reduction of right 2nd and left 3rd ribs fractures.

References

[1] A.A. Sarkeshik, A. Jamal, P.A. Perry, Manubriosternal joint dislocation due to blunt force trauma, Trauma Case Rep. 21 (2019) 100187.
[2] M.A. Gloyer, H.C. Frei, T.K. Hotz, et al., Osteosynthesis of traumatic manubriosternal dislocations and sternal fractures with a 3.5/4.0 mm fixed-angle plate (LCP), Arch. Orthop. Trauma Surg. 131 (2011) 1261.
[3] T. Kalicke, T.M. Frangen, E.J. Muller, et al., Traumatic manubriosternal dislocation, Arch. Orthop. Trauma Surg. 126 (2006) 411–416.
[4] S. Nijs, P. Broos, Sterno-manubrial dislocation in a 9-year old gymnast, Acta Chir. Belg. 105 (2005) 422–424.
[5] D.S. Klei, M.B. de Jong, F.C. Oner, et al., Current treatment and outcomes of traumatic sternal fractures - a systematic review, Int. Orthop. (SICOT) 43 (2019) 1455–1464.
[6] D. Divisi, R. Crisci, Use of demineralized bone matrix and plate for sternal stabilization after traumatic dislocation, Gen. Thorac. Cardiovasc. Surg. 59 (2011) 52–56.
[7] R.J. Gaines, A. Wilson, J. Antevil, M. Demaio, Parallel plating for a sternomanubrial dislocation, Orthopaedics (Online) 35 (8) (2012) e1276-e1278, 08.