International Surgery Journal
Hayler RR et al. Int Surg J. 2022 Dec;9(12):2042-2044
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20223168

Case Report

Phrenic nerve injury occurring from removal of a chest drain in a 26-year-old male

Raymond R. Hayler*, Selwyn T. Selvendran, Mary E. Langcake

Department of Surgery, St. George Hospital, Kogarah, Australia

Received: 17 October 2022
Accepted: 10 November 2022

***Correspondence:**
Dr. Raymond R. Hayler,
E-mail: raymond.hayler@gmail.com

ABSTRACT

Chest tubes are a common procedure performed worldwide, especially in trauma. Complications arising can be from the result of insertion, incorrect position, or infection. Phrenic nerve injury has previously been a rare complication, found usually in neonates. We described the unusual and previously unreported case of a 26-year-old male who suffered a right phrenic nerve injury as a result of a misplaced chest tube, occurring not in insertion but during removal. The chest tube was placed initially emergently during a polytrauma for bilateral pneumothoraces. With removal, sudden tachypnea was noted with negative workups for pulmonary embolus or reaccumulation of pneumothorax. There was ongoing reduction of spirometry volumes and a persistently raised right hemidiaphragm, with suspicion for bronchial plugging and resorption atelectasis. Following respiratory review, the diagnosis was confirmed with chest wall fluoroscopy with a 'Sniff test'. With good recovery of overall respiratory function, the patient was discharged with conservative management.

Keywords: Chest tube, Phrenic nerve, Trauma

INTRODUCTION

A chest tube (tube thoracostomy) is a common procedure performed for drainage of the pleural space of air, fluid or blood as well as delivery of medications such as sclerosing agents.[1]

In trauma, the role is for decompression of pneumothoraxes or drainage of haemothorax. Complications can be divided into early and late (before and after 24 hours) with incidence at 3% and 8-10% respectively.[2] There are a number of anatomical structures at risk, including lung, vasculature, oesophagus, cardiac structures and even extra-thoracic structures such as liver or spleen, all described at various rates of injury in the literature.

Injury to the phrenic nerve from chest tubes is rare, with a systematic review of tube thoracostomy complications and structured review of case reports identifying 124 reports, four of which feature phrenic nerve injury. Three of these were in neonates, with one in a three-and-a-half-year-old.[3] There are no recorded events occurring in adults.

We describe phrenic nerve injury occurring due to the result of tube thoracostomy in a 26-year-old male involved in a polytrauma event.

CASE REPORT

A 26-year-old male involved in a high-speed motor vehicle accident suffered fractures of right sided ribs 1-7 anteriorly and 3-7 posteriorly as well as left sided rib fractures 1-3 anteriorly. He also suffered a comminuted fracture of his right acetabulum. He remained haemodynamically stable on scene, and was intubated for pain control. He was extracted from the vehicle and taken to a local hospital, a rural centre. He underwent a CT scan of brain, c-spine,

chest, abdomen and pelvis which revealed the above injuries, as well as bilateral pneumothoraces. Chest tubes sized 24 Fr were placed bilaterally. He was then transferred by road ambulance to a major trauma centre. A repeat CT chest abdomen pelvis (Figure 1) revealed a significantly misplaced right chest tube, with the right side impacting the pericardium and displaced inferiorly.

The chest tube was withdrawn based on the excess length seen on CT imaging. Following this, repeat chest X-ray revealed the tube to now be positioned adequately. Incentive spirometry was limited by significant pain, being controlled with bilateral erector spinae blocks and a PCA. His left chest tube was removed on day four without complication. During removal of his right chest tube on day seven, there was no significant force required, however the patient began to demonstrate increased respiratory rate and discomfort.

A post removal chest X-ray revealed a raised right hemidiaphragm, persistent beyond this through admission. He was stepped down to the ward on day ten, with incentive spirometry between 500-750 ml, thought to be limited by pain. His elevated respiratory rate in combination with increased work of breathing led to a CT pulmonary angiography to rule out a pulmonary embolism, for which there was none. The clinical picture with a collapsed right sided lung was discussed, with differentials relating to poor incentive effort due to pain with splinting, as well as a bronchial clot with resorptive atelectasis distally.

A respiratory consult was organised suggested a possible right phrenic nerve injury. A fluoroscopic study was performed (a 'Sniff' test) revealing paradoxical upward movement of the hemidiaphragm on inspiration, the classical appearance for phrenic nerve injury. Given his overall return in function, he was discharged home on day 22 with conservative management and follow-up with both a local physiotherapist for ongoing mobility rehabilitation as well as a respiratory physician for pulmonary function testing.

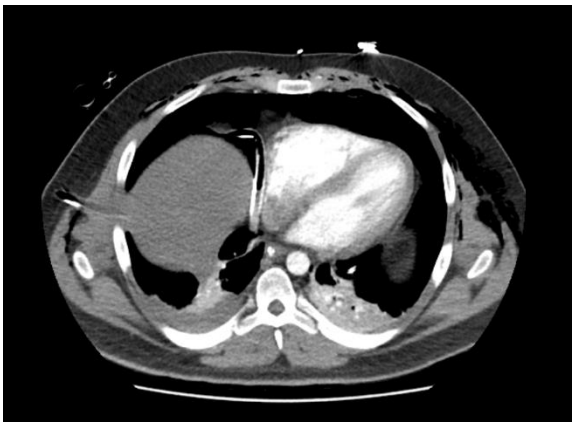

Figure 1: CT chest showing initial placement of right sided intercostal catheter impacting the right ventricle.

DISCUSSION

This is the first known report of phrenic nerve injury from tube thoracostomy in an adult, with all previously described occurring in paediatric populations, primarily neonates.[3,4] There were significant technical considerations to be aware of in this case and the excessive depth of insertion was certainly a precipitant of injury. It is proposed that the tube was initially abutting the phrenic nerve, with a traction injury occurring with removal, possibly due to adhesion formation.

As the sole supply to the hemidiaphragm, phrenic nerve injury can range from asymptomatic to disabling shortness of breath, depending on comorbidities such as obesity or underlying poor respiratory function. Symptoms may include positional dyspnoea and sleeping disorders such as sleep apnoea.[5]

Phrenic nerve injury manages ranges from conservative management, diaphragmatic plication and phrenic nerve repair/pacing techniques. Plication aims at symptomatic improvement through stopping paradoxical movement by fixation of the diaphragm with sutures. Phrenic nerve repair involves neurolysis in freeing the nerve to assist in spontaneous recovery or nerve grafting with donor nerves such as the sural.

Phrenic nerve pacing is usually reserved in quadriplegia for bilateral phrenic palsy, as it is difficult to pace and match contralateral central supply. Any intervention is recommended to only be used after an 18 month period allowing for potential recovery.[5] Given the mechanism we proposed, we are hopeful our patient will have recovery from what may be a potential neuropraxia.

CONCLUSION

Phrenic nerve injury is a rare complication from tube thoracostomy, previously not described in adults, and should be considered in the management of patients with altered respiratory function post insertion or removal.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Porcel JM. Chest Tube Drainage of the Pleural Space: A Concise Review for Pulmonologists. Tuberc Respir Dis (Seoul). 2018;81(2):106-15.
2. Kwiatt M, Tarbox A, Seamon MJ, Swaroop M, Cipolla J, Allen C, et al. Thoracostomy tubes: A comprehensive review of complications and related topics. Int J Crit Illn Inj Sci. 2014;4(2):143-55.
3. Aho JM, Ruparel RK, Rowse PG, Brahmbhatt RD, Jenkins D, Rivera M. Tube Thoracostomy: A Structured Review of Case Reports and a

Standardized Format for Reporting Complications. World J Surg. 2015;39(11):2691-706.
4. Hernandez MC, Khatib M, Prokop L, Zielinski MD, Aho JM. Complications in tube thoracostomy: Systematic review and meta-analysis. J Trauma Acute Care Surg. 2018;85(2):410-6.
5. Whiteley J, Shoeib M, Bilancia R. Iatrogenic phrenic nerve palsy. Shanghai Chest. 2020;5.

Cite this article as: Hayler RR, Selvendran ST, Langcake ME. Phrenic nerve injury occurring from removal of a chest drain in a 26-year-old male. Int Surg J 2022;9:2042-4.