A Rare Complication Due To Cervical Spinal Surgery: Bilateral Diaphragmatic Paralysis And Prolonged Respiratory Failure: A Case Report

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Abstract

Background: Postoperative diaphragmatic paralysis is a rare complication following heart surgery, esophagus surgery and neck dissection. Bilateral paralysis is rare and may be result with ventilatory failure. We present a case of bilateral diaphragmatic paralysis following servical spine surgery.

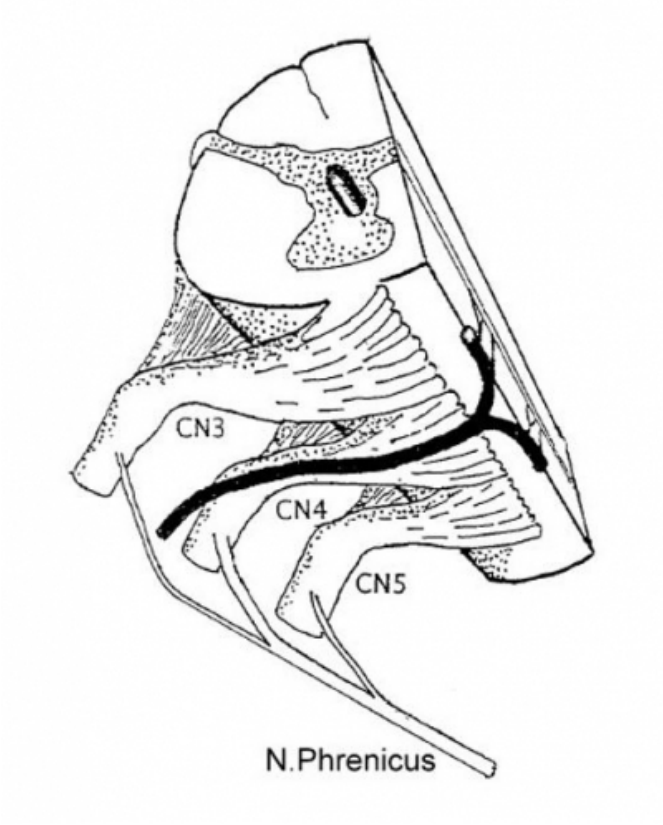
Case presentation: 67 year old female patient developed respiratory failure recquiring non-invasive mechanical ventilation support on 2nd day following cervical decompression and posterior instrumentation on postoperative 15th day she undergone diaphragma plication. Due to failed iprovement she was diagnosed as bilateral diaphragmatic paralysis which could not be evaluated previously. She was tracheostomized and weaned off the ventilator 5 months later.

Conclusion: Ventilatory failure following cervical spinal surgery should suggest bilateral diaphragmatic paralysis although very rare

INTRODUCTION

The diaphragm is the major muscle of inspiration [1]. It also separates the two largest cavities of the body, the abdominal and thoracic cavities [2]. The phrenic nerve innervates the diaphragm muscle. The phrenic nerve is composed of the ventral branches of the cervical 3rd, 4th and 5th nerves [2-3]. (Figure 1[3])

Figure 1



Diaphragmatic paralysis results from phrenic nerve damage and may be unilateral or bilateral. Bilateral diaphragmatic paralysis is usually the symptomatic form [5]. When diaphragmatic paralysis occurs, it pushes the diaphragm upwards with the combined effect of abdominal positive pressure and intrathoracic negative pressure. This paradoxical action reduces vital capacity and disturbs the ventilation-perfusion balance [6]. When diaphragmatic paralysis is unilateral, respiratory capacity is reduced by one-third [5]. This results in the most frequent clinical presentation of shortness of breath in affected patients. The condition becomes symptomatic particularly with shortness of breath in the supine position and leads to hypoventilation [1].

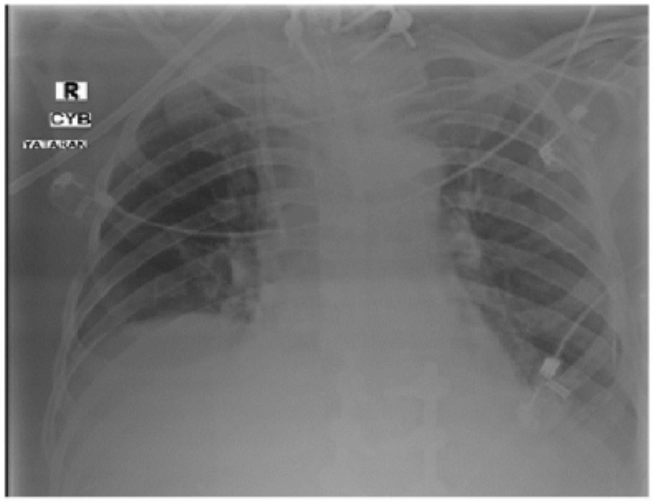
This article describes a bilateral diaphragmatic paralysis diagnosis established in a patient in an intensive care unit following cervical spinal stenosis surgery and her treatment course, and also discusses this case of bilateral diaphragmatic paralysis in light of the relevant literature.

CASE REPORT

A 67-year-old female patient with congenital hearing impairment presented to our hospital. The patient had known hypertension. Cervical spine magnetic resonance imaging (MRI) taken following her presentation with neck pain and numbness in both hands demonstrated spinal pressure at C4-5 and C5-6, and electromyography showed chronic-phase moderate-severe partial impact secondary to spinal stenosis in C8-T1 anterior root anterior horns. Cervical decompression together with posterior instrumentation surgery was then planned for the patient and posterior instrumentation was placed at C3-T1 along with a C4-5-6 corpectomy.

Following the surgery, the patient was transferred from the postoperative recovery unit to the regular care unit. Respiratory distress was seen in the latter, which suggested lung atelectasis and non-invasive mechanical ventilation was therefore performed. On postoperative day 4, carbon dioxide (PaCO2) was found to be 70 mmHg and the patient was transferred to the intensive care unit. PA lung radiographies taken while the patient was still on non-invasive mechanical ventilation raised the suspicion of right (unilateral) diaphragmatic paralysis (Figure 2).

Figure 2

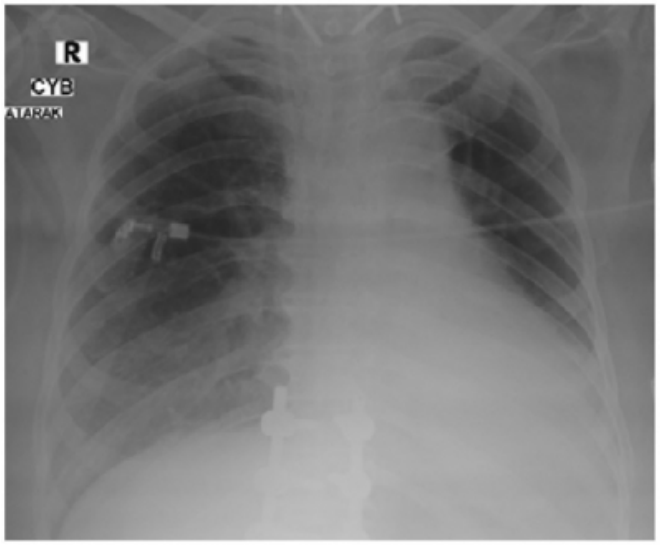


On day 7 of admission to the intensive care unit, diaphragm ultrasonography demonstrated no movement in the right diaphragm whereas the left diaphragm could not be evaluated. Unilateral diaphragmatic paralysis was considered and on postoperative day 15 and unilateral diaphragm plication was performed by the thoracic surgery team. The patient was extubated on day 2 following diaphragm plication and was transferred from the intensive care to the regular care unit. Because respiratory distress was observed again that evening, arterial blood gas measurement was performed. PaCO2 was seen to have increased to 80 mmHg

and the patient was transferred back to the ICU, intubated and attached to mechanical ventilation.

Lung radiography taken before intubation (Figure 3) suggested paralysis in the left diaphragm and fluoroscopy was planned. Tracheostomy was performed before fluoroscopy and the patient was put to mechanical ventilation with a household type ventilator. No findings suggestive of medullary ischemia was reported on the postoperative cervical CT of the patient. MRI could not be performed due to the metals inserted during the surgery. Fluoroscopy established the patient's diagnosis as bilateral diaphragmatic paralysis. The patient remained on ventilation support for a long time and was rendered completely free from ventilation in postoperative month 5.

Figure 3



DISCUSSION

Four main factors are involved in the etiology of diaphragmatic paralysis: trauma, inflammation, neurological events, and idiopathic conditions. Unilateral paralysis is much more common than the bilateral version [1,5]. Postoperative diaphragmatic paralysis may be seen in open heart surgery (especially in pediatric patients), esophagus surgery, mediastinal interventions, and neck dissection [1,7]. No example from orthopedic interventions could be found in the literature. This may be because unilateral paralyses usually go unnoticed while the bilateral ones are seen very rarely.

It was considered that the paralysis in our patient could be secondary to the surgery but could also result from injury due to over-torsion of the neck. Diaphragm paralysis due to torsion of the neck is more common whereas bilateral paralysis is much less likely in such cases. There have been a few case reports of bilateral diaphragmatic paralysis that developed as a result of manipulations during chiropraxy, a treatment being performed in the USA [1,8]. One might think that the torsion movement, which is similar to chiropraxy manipulation, could occur while the patient is changing from supine to facedown position, but the bilateral feature of the paralysis made it difficult to establish this correlation.

One of the causes of postoperative diaphragmatic paralysis described in the literature was the paralysis that occurred following jugular or subclavian vein catheterization [9]. This too, however, seemed unlikely to have caused bilateral paralysis.

Medulla spinalis contusions may be another cause that needs to be considered. In a study by C. Nicaise et al. in mice in Brussels and Philadelphia, experimentally induced prolonged contusion in the mid-cervical region of mice was shown to lead to degeneration in the phrenic nerve, resulting in diaphragmatic muscle strength failure [10]. We believe that tissue perfusion impairment secondary to spinal surgery in the cervix leads to bilateral diaphragmatic paralysis. It was first considered to be due to the edema at the surgery site and could be transient but it was later thought to be resulting from an ischemic cause as time progressed.

Matsumi et al. described that spinal cord infarction may lead to similar conditions and reported in one patient that bilateral anterior cord infarction between the 2nd and 5th cervical nerves resulted in bilateral diaphragmatic paralysis. [11]

In conclusion, unexplained respiratory distress following similar surgeries should suggest bilateral diaphragmatic paralysis as a complication, although this is a very rare occurrence.

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