

Bilateral Diaphragm Paralysis in Deep Neck Infection: Mimicking Respiratory Distress in Sepsis

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ABSTRACT

Background: This case report highlights an occurrence of bilateral diaphragm paralysis following surgical drainage for deep neck infection.

Case: A 56-year-old male underwent surgical drainage and tracheostomy for a deep neck infection. Before the second surgical drainage, he exhibited tachypnea (>30 bpm), although his general condition was not significantly compromised. Following a successful drainage procedure, he was transferred to the intensive care unit and placed on mechanical ventilation. Despite attempts at spontaneous breathing trials (SBT), he failed each trial, leading to a deterioration in his general condition. Subsequently, he was diagnosed with diaphragm paralysis.

Conclusion: The clinical manifestations of bilateral diaphragm paralysis closely resemble the common symptoms of sepsis. Therefore, it is crucial to recognize that surgical interventions for deep neck infections may pose a risk of developing diaphragm paralysis, likely associated with phrenic nerve palsy.

Keywords: Deep neck infection, diaphragm paralysis, phrenic nerve palsy, tachypnea

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INTRODUCTION

Deep neck infections, particularly those affecting the retropharyngeal and parapharyngeal areas, pose a life-threatening risk and can lead to conditions such as sepsis, mediastinitis, empyema, or necrotizing fasciitis.¹ In some cases, surgical drainage, tracheostomy to maintain the airway and postoperative intensive care are necessary.² The potential risk of diaphragm paralysis, stemming from the inherent possibility of phrenic nerve injury during neck surgery, has been reported.³ The reported incidence of immediate postoperative phrenic nerve paresis varied between 0% and 5.3%.³ Therefore, aggressive bilateral cervical drainage may lead to bilateral diaphragm paralysis, which implies that diaphragmatic weakness refers to the complete absence of muscle strength to generate the necessary pressure for adequate ventilation.⁴ However, recognizing bilateral diaphragm paralysis could be challenging as the symptoms of sepsis may mask respiratory distress associated with this condition. We present a case where bilateral diaphragm paralysis occurred after surgical drainage for a deep neck infection.⁴⁻⁶

CASE

Written informed consent was obtained from the patient for the publication of this case report and accompanying

images. A 56-year-old male was scheduled for bilateral pleural abscess drainage. He had been experiencing acute pharyngitis for the past 5 days. His laboratory data showed a C-reactive protein level of 29.6 mg/dL and a white blood cell count of 13,100 cells/ μ L. *Streptococcus anginosus* was detected in his pharyngeal swab. Before the planned surgery, he underwent emergency bilateral cervical and mediastinal drainage, as well as tracheostomy due to a retropharyngeal abscess (**Figure 1A**). Residual abscess was identified in both pleural cavities (**Figure 1B**). Although his general condition was relatively stable, occasional increases in respiratory rate beyond 30 bpm were noted, attributed to sepsis.

The surgical drainage was performed under general anesthesia. His hemodynamic condition was compromised during the procedure, necessitating the administration of noradrenaline (0.15 μ g/kg/minutes) and vasopressin (2 units/h). While oxygenation was temporarily affected, it appeared to be associated with one-lung ventilation. Following successful drainage, he was transferred to the intensive care unit under mechanical ventilation. Over the next 12 hours, he was successfully weaned off vasoactive agents and regained consciousness after discontinuation of sedatives.

Despite these positive developments, attempts to conduct spontaneous breathing trials (SBT) with pressure support at 5 cmH₂O and positive end-expiratory pressure (PEEP)

at 5 cmH₂O resulted in failure during each trial, significantly impacting his overall condition, leading to the development of tachypnea (>30 bpm) and tachycardia (>130 bpm). His body temperature also rose to 38.6°C due to an increase in respiratory effort. Ultimately, diaphragmatic ultrasound (Phillips CX-50 ultrasound machine and an L3–12 linear transducer, Philips Japan, Tokyo) revealed bilateral insufficient diaphragmatic excursion and diaphragmatic thickening (**Figure 2A** and **2B**) during inspiratory periods (0.4–0.5 seconds), leading to the diagnosis of diaphragm paralysis along with considering other clinical symptoms. Ultrasound B mode image shows the diaphragm. Thickening of the diaphragm was hardly observed during inspiratory phase. We didn't anticipate that we had completely injured the phrenic nerves at that time. Therefore, we waited for the spontaneous resolution of his nerves. Approximately 5 weeks later, he successfully weaned off mechanical ventilation, and 7 weeks later, his tracheal tube was extubated. Otherwise, sustained ventilatory support might still have been required.

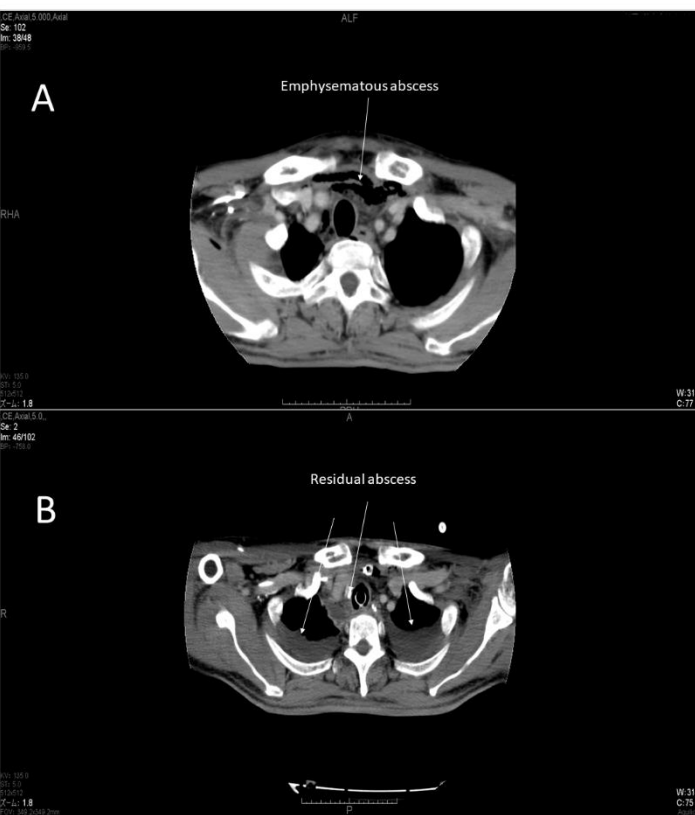


Figure 1. Retropharyngeal and mediastinal abscess before the initial drainage (A) and residual abscess post-first drainage (B). A tracheostomy tube and drainage tube were inserted (B).

DISCUSSION

Surgical procedures for deep neck infections in diabetic patients theoretically carry a risk of developing phrenic nerve palsy. This risk arises not only due to the inherent possibility of phrenic nerve injury during neck surgery³ but also because diabetic patients may be more susceptible to phrenic nerve impairment.⁵ However, to the best of our knowledge, there have been no reports of bilateral diaphragm paralysis resulting from deep neck infections in the field of intensive care.

The prognosis for patients with bilateral diaphragm paralysis is generally poor without specific treatments.^{4,6} Given the development of bilateral diaphragm paralysis in this case, it is natural that the patient failed all spontaneous breathing trials (SBTs). Consequently, subjecting the patient to multiple SBTs

only imposed severe respiratory burdens. In such cases, instead of repeating SBTs, consideration of alternative options such as diaphragm plication, diaphragmatic pacemaker placement, or long-term mechanical ventilation is warranted.⁴

The clinical features of bilateral diaphragm paralysis, especially after surgical drainage, mimic common symptoms of sepsis, including tachypnea, fever, and tachycardia. Detecting the coexistence of this disease may be challenging without awareness of its potential occurrence. Knowledge about this condition can help avoid unnecessary SBTs and promote consideration of alternative therapeutic options in the early stages when patients with deep neck infections undergo surgical procedures.

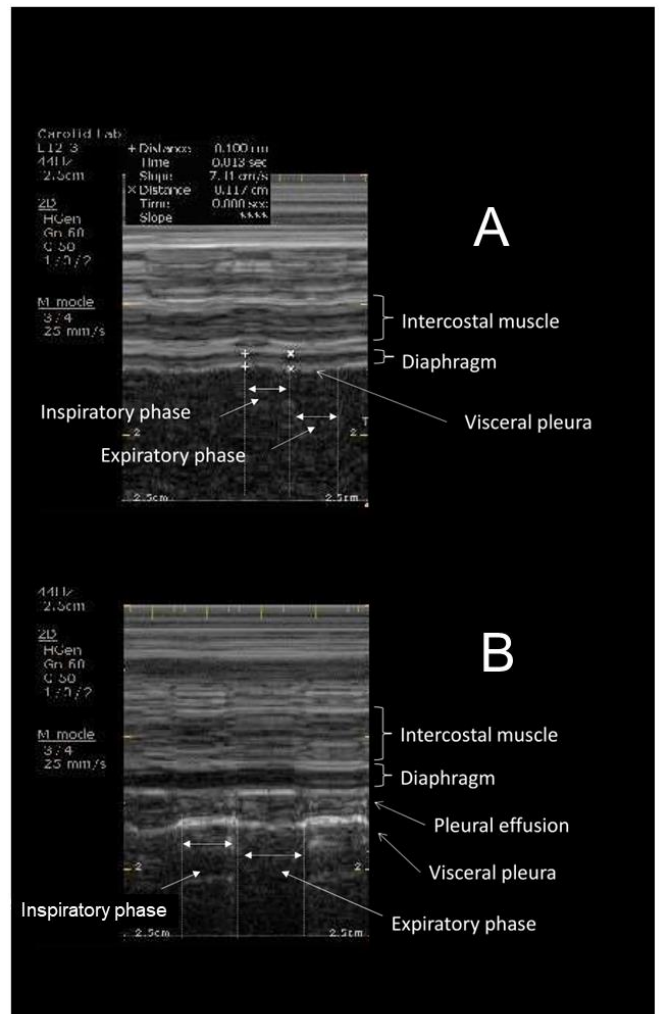


Figure 2. Ultrasound evaluation of the left (A) and right (B) diaphragm.

Additionally, it has been reported that diabetic patients are more likely to develop severe complications than non-diabetic patients when individuals develop deep neck infections.⁷ In diabetic cases, particular attention should be given to assessing diaphragmatic function. Severe cases of deep neck infection are potentially fatal and necessitate advanced life-support therapies.² Due to the catastrophic nature of these conditions, diaphragm paralysis may have been overlooked in progressively deteriorating patients. In the case of elective neck surgery, phrenic nerve injury might be avoided through careful procedures.³ However, in cases of massive deep neck infections, phrenic nerves might already be injured by the infectious insult itself.

Lastly, diaphragmatic ultrasound evaluation combined with other physiological symptoms emerges as a

promising diagnostic tool for detecting diaphragm paralysis and predicting outcomes of weaning from mechanical ventilation.^{8,9} An index used for the diagnosis of diaphragmatic paralysis is the thickening of the diaphragm <2 mm.⁴ In our case, the left side measured 1.1 mm, and the right side measured 1.5 mm.

In conclusion, the clinical manifestations of bilateral diaphragm paralysis closely resemble the common symptoms of sepsis. Therefore, it is crucial to recognize that surgical interventions for deep neck infections may pose a risk of developing diaphragm paralysis, likely associated with phrenic nerve palsy.

CONCLUSION

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CONFLICT OF INTEREST

The author declares there is no conflict of interest.

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