

## CASE REPORT

# Inadvertent Diaphragmatic Rent Following Thoracic Surgery for Empyema Thoracis Successfully Repaired With Mesh

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### ABSTRACT

Iatrogenic diaphragmatic entry following thoracic surgery is rare with only two cases reported till date. This case reports on a 46-year-old male with persistent pleural sepsis due to right empyema thoracis despite best medical efforts. Following a right thoracotomy and decortication, the right diaphragm was inadvertently incised due to dense adhesions between the diaphragm and thickened cortex. To our knowledge, this is the third case reported of iatrogenic diaphragmatic entry following thoracic surgery for empyema thoracis. The pearls from this case report is that any evidence of empyema thoracis involving the lower lobe on imaging should warn the surgeons to be aware of inadvertent entry into the peritoneal cavity, as the diaphragm can be adherent to the cortex trapping the lower lobe.

**Keywords:** Diaphragm, Iatrogenic disease, Empyema, Thoracotomy

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### INTRODUCTION

Diaphragmatic entry following thoracic surgery is a rare occurrence (1). Till date, there are only 27 reported cases of iatrogenic diaphragmatic entry in the literatures. Causes of iatrogenic diaphragmatic entry were mainly from abdominal operative procedures of cholecystectomy, hepatectomy, splenectomy, gastrectomy, liver transplant and nephrectomy (2). There were only two cases of iatrogenic diaphragmatic injury following thoracic surgery for lobectomy and excision of hydatid cysts of lung (3,4). We report on a 46-year-old man who had an inadvertent injury to the right hemi-diaphragm during an elective thoracotomy and decortication for right lung empyema thoracis. To our knowledge, this is the first case that describes an iatrogenic diaphragmatic rent during thoracotomy which occurred while attempting to dissect the thick cortex encasing the lower lobe that was densely stuck to the diaphragm.

### CASE REPORT

A 46-year-old male was referred to our regional cardiothoracic surgery department for persistent pleural sepsis due to right lung empyema. At a previous admission, he was treated for ten days at a district

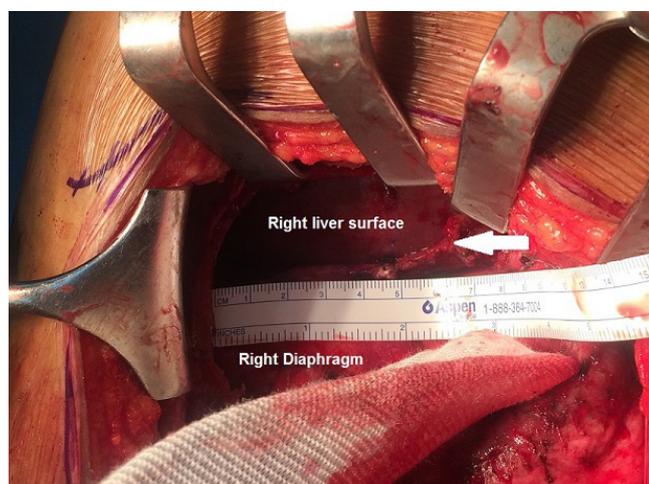
hospital for hypertensive emergency. In the course of treatment, the patient developed hospital acquired pneumonia with pleural effusion seen on the chest roentogram. A tube thoracostomy was performed and the drained pleural fluid cultures were sterile. Screening for pulmonary tuberculosis and blood cultures were negative. The composition of pleural fluid was exudative in nature with a protein level of 58g/dl(>30), lactate dehydrogenase level of 2378.9u/l(>200) and pleural to serum protein ratio of 0.9(>0.5). Despite best medical efforts with antibiotics, the patient remained febrile and a computed tomography (CT) thorax revealed middle and lower lobe consolidation with multiloculated empyema. There was a thick cortex surrounding the lung causing a trapped right lower lobe (Fig. 1,2). In view of sepsis and right lung empyema thoracis, the patient underwent an elective right thoracotomy and decortication. Intra-operatively, infected debris and slough was evacuated. There was also a thick cortex surrounding the right middle and lower lobes with dense adhesion to the right hemi-diaphragm. Despite meticulous dissection to decorticate the trapped right lower lobe, an inadvertent perforation of the right hemi-diaphragm occurred. The perforation was 9cm in length and 4cm in width exposing the superior surface of the liver (Fig. 3). This was due to the thick cortex and dense adhesions between the right lower lobe and diaphragm. Fortunately, the iatrogenic rent was identified and repaired during the same operative setting. The diaphragmatic defect was primarily approximated using polypropylene 1/0 interrupted mattress sutures. This was reinforced with an on-lay light-weight condensed polytetrafluoroethylene



**Figure 1: Coronal view of CT thorax showing right lung empyema with atelectasis and raised right diaphragm (green arrow).**



**Figure 2: Mediastinal axial view showing multi-loculated pus collections (green arrow)**



**Figure 3: Right posterolateral thoracotomy view from above showing a 9cmx4cm diaphragm rent exposing the superior surface of right dome of liver**

mesh and anchored with polypropylene 2/0 sutures. As the diaphragm was still considerably inflamed due to empyema thoracis, a mesh was used to reinforce the approximated defect to reduce the risk of dehiscence during the post-operative period. The patient was extubated on the second post-operative day. He continued to make an uneventful recovery. Surgical drains were removed on post-operative day four and he was discharged well on the sixth post-operative day.

**DISCUSSION**

Incidence of iatrogenic injury to the diaphragm following thoracic surgery is rare (5). There were only three reported case (including this case) of diaphragmatic injury following thoracic surgery after literature review. The first case reported was by Fukami et al of a left diaphragmatic hernia following thoracoscopic resection of bronchopulmonary tumor four months after surgery (3). Second case reported was by Ibrahim et al which had a delayed discovery of diaphragmatic hernia discovered 17 years after a posterolateral thoracotomy for right hydatid cyst excision (4). Both cases reported by Fukami and Ibrahim et al had their diaphragm repaired via primary suture without mesh. Empyema thoracis is a common condition being treated in major respiratory and cardiothoracic centers (1). Despite being a common condition, its complications after open thoracotomy and decortication of diaphragmatic rupture is rare (5). Furthermore, the discovery was made intraoperatively and repair was carried out during the same operative setting.

The pathophysiology of empyema can be divided into the exudative(acute), fibrinopurulent(transitional) and organizing(chronic) stage. If left untreated, the empyema progresses into an organizing state which leaves a thick peel of cortex trapping the lung from expanding fully (1). In our patient, the thick cortex trapped the right lower lobe which was densely adhered to the diaphragm. The adhesions and thick cortex had to be removed to allow adequate expansion of the lung post-operatively. Discovery of the iatrogenic injury was made only after complete separation of the diaphragm from the lower lobe of right lung. From a surgical point of view, the repair of diaphragm was difficult due to the large defect and friable inflammatory changes. To approximate the defect, mattress sutures were placed and re-enforced with an on-lay mesh to reduce the tension over the repaired diaphragm. We acknowledge that there were risks of mesh infection in this case. But the risks were reduced to a minimal by following strictly adhering to surgery principals of through thoracic cavity lavage, adequate debridement of devitalised tissue, placement of drain to channel reactionary thoracic fluid out and continuation of antibiotics. Abdominal pack was used to plug the tear and followed thereafter through lavage of the thoracic cavity. The repair was performed with meticulous care via continuous suction that prevented the spillage of

pus into the peritoneal cavity. Therefore, the concerns of peritoneal spillage were kept in mind while repairing the diaphragm tear via a thoracic approach to minimize contamination of pus into the peritoneal cavity. The risk and benefit of infection versus dehiscence of the wound was kept in mind during surgery. With a large defect such as in our case, we could not risk a dehiscence in this case, but in case if an infection occurred, there were still options of upgrading antibiotics, radiological guided insertion of second chest drain and lastly re-thoracotomy with mesh removal.

In this case, we acknowledge that there were risks of developing mesh infection post-operatively. But the risks were reduced to a minimal by strictly adhering to surgery principals of thorough thoracic cavity lavage, adequate debridement of devitalized tissue, placement of drain to channel reactionary thoracic fluid out and continuation of antibiotics. Abdominal packs were used to plug the tear and followed thereafter continued lavage of the thoracic cavity. The repair was performed with meticulous care via continuous suction that prevented the spillage of pus into the peritoneal cavity. In addition, a thorough thoracic lavage was already performed before the iatrogenic diaphragmatic tear occurred. Hence in a field after thorough cleaning was performed resulting in a minimally contaminated field, it may be justifiable to use non-absorbable mesh with small risk of chronic infection which is in line with the European management of hernia guidelines on a case to case basis (6). The benefit in this case is the strengthening of the diaphragm function which outweighs the risk of chronic mesh infection that may be lowered after thorough thoracic cavity washout and treatment with antibiotics.

## CONCLUSION

In conclusion, surgeons must be mindful and aware of the anatomy and unexpected entry into the diaphragm when dealing with empyema thoracis involving the lower lobe. This is more significant when the diaphragm is densely adherent to the underlying trapped lower lobe. The repair over the diaphragm should be carried out in a tension free state to prevent shearing during spontaneous breathing.

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