

# Costal Cartilage Disruption and Thoracoabdominal Hernia: Presentation and Management

Elwin Tham <sup>1</sup>, Fazil Abbas <sup>2\*</sup>, Ghulam Abbas <sup>1</sup>

<sup>1</sup> West Virginia University School of Medicine, Department of Cardiovascular and Thoracic Surgery

<sup>2</sup> West Virginia University Health Sciences, Informed Consent: See appendix (scan of patient's consent form)

**\*Corresponding Author:** Fazil Abbas, West Virginia University School of Medicine, Department of Cardiovascular and Thoracic Surgery.

**Received date:** November 28, 2022; **Accepted date:** December 30, 2022; **Published date:** February 03, 2023

**Citation:** Elwin Tham, Fazil Abbas, Ghulam Abbas. (2023), Costal cartilage disruption and thoracoabdominal hernia: Presentation and Management. *J, Clinical Case Reports and Studies*, 4(1); DOI:10.31579/2690-8808/0158

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## Abstract

Costal Cartilage disruption after forceful coughing in obese males is an uncommon occurrence. Rarely it is associated with diaphragmatic disruptions leading to herniation of the abdominal contents into the chest. A successful outcome requires correcting both elements, namely, repairing the diaphragmatic defect along with the reduction of hernia and repairing the costal cartilage fracture. In this manuscript, we present a case where the diaphragmatic hernia was repaired, but the costal cartilage disruption was missed resulting in a reoccurrence of the diaphragmatic hernia.

**Key Words:** costal cartilage disruption; diaphragmatic hernia; trauma; thoracoabdominal hernia

## Introduction

Costal-cartilage disruptions occur because of high-energy injuries, blunt trauma or spontaneously from forceful coughing. These disruptions present with pain and dyspnea and may be associated with thoracoabdominal/abdominal wall hernias [1-7]. Anecdotally, among the non-traumatic group, patients are commonly centrally obese and present with pain associated with a tearing sensation after a forceful cough.

Commonly delayed or missed in diagnosis secondary to normal or distracting radiological findings, the mainstay of diagnosis remains in history-taking and physical-exam [4]. Management typically includes pain control and rest with limited data on surgical management [5].

## Case Description

A 63-year-old man who presented to an outside hospital 3 weeks ago for left upper abdominal pain and dyspnea was found to have a diaphragmatic hernia from forceful coughing on CT scan but the fractured left costal cartilage was missed. The diaphragmatic hernia was repaired with laparoscopic suturing of the diaphragm.

Weeks later, he experienced recurrent symptoms with sinus-tachycardia, increasing oxygen requirements and was transferred to our institution for further investigation. Physical exam revealed a left subcostal bulge along with fractured left costal cartilage between the 8<sup>th</sup> and 9<sup>th</sup> rib. A CT scan with oral contrast (Figure 1) revealed a large left recurrent diaphragmatic hernia with mesenteric and small bowel extension through the hernia defect and confirmed the fractured left costal cartilage.



**Figure 1:** Coronal view of CT scan of patient with Thoracoabdominal hernia

The patient was brought to the operating room for repair. The repair included repair of: [1] diaphragmatic defect with mesh reinforcement, [2] costal-cartilage disruption

### Diagnosis

Costal-cartilage disruption may occur in association with thoracoabdominal hernias which may involve the triad of intercostal hernia or chest wall defect, abdominal wall hernia, and diaphragmatic hernia, though up to 25-66% of these hernias do not involve of all three structures (8). We identified three main radiological features of thoracoabdominal hernia.

One, thoracoabdominal hernia involves the disruption of inner muscle layers which include the transversus abdominis, intercostal muscles, and often the internal oblique. A clear distinction between thoracoabdominal hernias and pseudo-hernias with preoperative investigation is essential as these entities present identically though pseudo-hernias are treated symptomatically [9].

Two, superficial muscle layers such as the latissimus dorsi and external oblique muscles are typically preserved in Thoracoabdominal hernia [8,9]. Careful identification of the involved defects is essential to allow preoperative planning of the optimal operative approach and correct plane for mesh placement [10,11].

Three, thoracoabdominal hernia characteristically involve costal-cartilage disruption with defects varying from inferior rib displacement by hernia contents and unopposed traction of the abdominal muscle, to rib fractures [8,9]. Costal-margin-rupture is also commonly identified and can be associated with the hernia or present with rib pain as in slipped rib syndrome as described by Hansen et al. [12].

### Approach to repair

In our case, we proceeded with a left lower lateral thoracotomy approach. Intraoperatively, we identified a fracture of the left costal cartilage between the eighth and the ninth ribs with complete separation of the ribs and a tear in the diaphragm through which a small bowel loop herniated into the pleural space.

### Repair of Diaphragmatic defect

The diaphragmatic defect measured about 5 cm after reduction of the hernia contents back into the intra-abdominal space. This was easily approximated,

repaired primarily with #2 Ethibond sutures and reinforced with Gore-Tex mesh using interrupted #2 Ethibond sutures.

In a retrospective study [13] of primary thoracoabdominal hernia, majority of the diaphragmatic defects (n=13) were repaired primarily with permanent sutures. The role of mesh reinforcement in the repair of diaphragmatic hernias remains an ongoing debate although the use of mesh is particularly useful for associated abdominal and/or larger defects [8, 13].

### Repair of Costal cartilage disruption

For the repair of the costal cartilage disruption, the key lies in the stabilization and approximation of the ribs to repair the intercostal defect.

One study described 12 repairs of Thoracoabdominal hernia in which the chest wall defect was repaired with a combination of sternal wire sternal wire, cables or absorbable suture and rib-plating [8].

In our case, mobilization of the ninth rib allowed optimal approximation of the eighth and ninth ribs, after which, we placed interrupted #2 FiberWire sutures through the costal cartilage and around the rib to approximate the ribs. A mesh is needed to cover the gap if the ribs fail to approximate. Similarly, a mesh is used to repair the abdominal wall defect if present.

### Conclusion

Costal cartilage disruptions may occur in association with thoracoabdominal/abdominal hernias. Extensive investigation is essential for preoperative planning to achieve durable repair and reconstruction of thoracoabdominal wall. Further research into long-term outcomes is required for recommending surgical intervention to patients with such entities.

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DOI:10.31579/2690-8808/158

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