

## Case Report: Trans-thoracic Cholecystectomy

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### Abstract

A 52 year-old female with a history of remote trauma requiring laparotomy presented with acute cholecystitis. She was transferred from an outside hospital following failed laparoscopic converted to attempted open cholecystectomy. The referring surgeon reported an inability to reach the gallbladder. CT scan revealed a significantly elevated, right hemidiaphragm suspicious for diaphragmatic hernia. Percutaneous cholecystostomy was performed and her acute cholecystitis resolved. Six weeks later, to definitively treat her symptomatic cholelithiasis, a unique combined approach between Thoracic and General Surgery utilizing VATS, a right thoracotomy, and an intra-operative, ultrasound guided trans-diaphragmatic cholecystectomy.

**Keywords:** Cholecystectomy; Lacerations; Trans-thoracic

### Introduction

Cholecystectomy is traditionally performed via an abdominal approach. However, patients with diaphragmatic elevation, rupture or significant abdominal adhesive disease precluding such an approach may present and require surgical intervention. Hepatic resection via a combined abdominal and thoracic approach has long been used to approach tumors of the superior and posterior liver in select cases [1-4]. However, to our knowledge, the trans-thoracic approach for cholecystectomy for acute on chronic cholecystitis in a patient with elevated, paralyzed right hemidiaphragm who failed both laparoscopic and open trans-abdominal cholecystectomy, has not been previously reported.

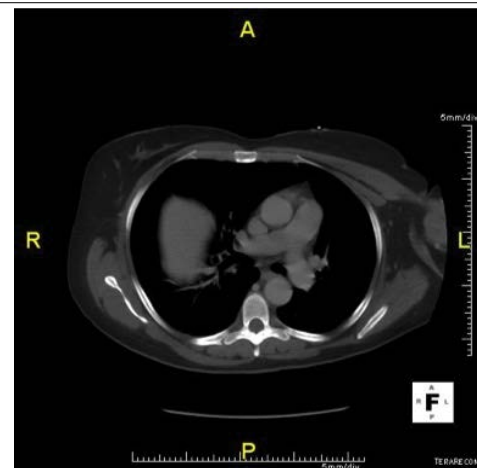
### Case Presentation

A 52-year-old African American woman with history of COPD, asthma, polyarthritis, hypertension and depression presented with acute cholecystitis to a satellite hospital in our system. She had been involved in a motor vehicle accident 21 years prior and at that time underwent laparotomy for blunt trauma and required splenic resection and repair of liver and kidney lacerations. Her initial evaluation on this visit included computed tomography of her chest and abdomen which showed right hemidiaphragm elevation to the 4<sup>th</sup>- 5<sup>th</sup> intercostal space with concern for either diaphragmatic hernia or rupture and evidence of acute cholecystitis with an enlarged gallbladder with stones and pericholecystic fluid (Figure 1-3).

The referring surgeon initially attempted a laparoscopic cholecystectomy, but was unable to visualize the gallbladder due to impenetrable, dense intra-abdominal adhesions and therefore proceeded on to an open cholecystectomy via a right subcostal incision to aid with exposure. However, he was still unable to visualize the gallbladder or liver despite being at the level of the fifth rib interspace anteriorly. The operation was aborted and the patient was transferred to our institution for further management.

Given the patient's most recent operation, the decision was made to manage her acute cholecystitis with percutaneous cholecystostomy via a transperitoneal approach. The patient defervesced, pain improved, and her leukocytosis and liver function tests normalized. She was discharged to home with cholecystostomy tube in situ and after three weeks, her drain was removed. However, given her cholelithiasis, concern for chronic cholecystitis and risk of further episodes of acute cholecystitis, we recommended that the patient undergo cholecystectomy to definitively treat her cholelithiasis. Based on her

recent failed laparoscopic and open cholecystectomy and concern for massive diaphragmatic hernia, it was decided to perform a video-assisted thoracoscopic surgery (VATS) with possible right thoracotomy with resection of gallbladder and diaphragmatic repair. The chest was entered in the fourth interspace and thoracoscope placed. Surprisingly, the diaphragm was found to be completely intact. This was more consistent with phrenic nerve paresis and a paralyzed diaphragm from her prior accident and there was no hernia or rupture seen. Next, an anterolateral thoracotomy was performed in the seventh interspace under thoracoscopic guidance (Figures 4 and 5). The intent was to attempt downward pressure on the diaphragm and liver to facilitate an abdominal approach to open cholecystectomy. However, due to severity of adhesions in the abdomen, there was minimal mobilization of the liver and abdominal viscera inferiorly and we did not feel that diaphragmatic



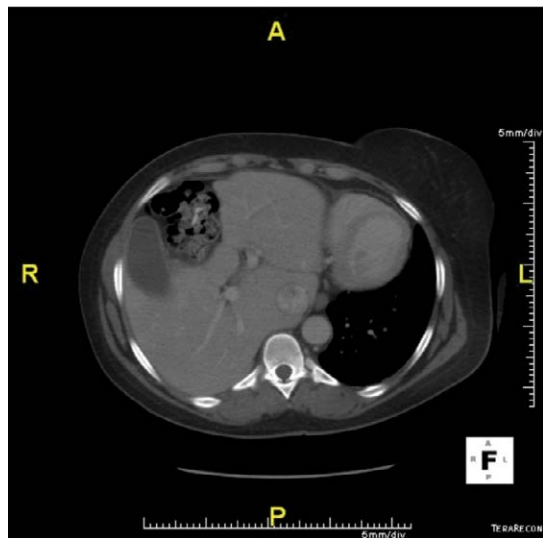
**Figure 1:** Transverse CT scan showing dome of liver at the level of the pulmonary artery bifurcation.

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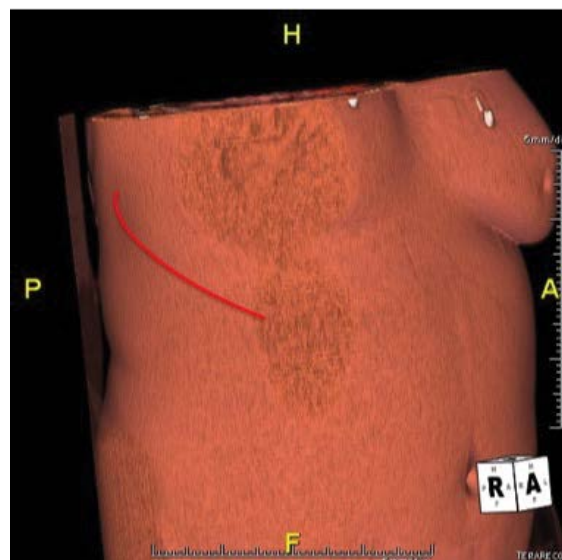
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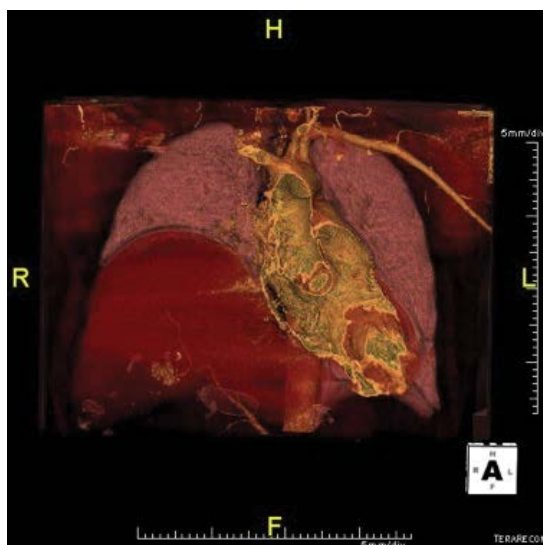
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**Figure 2:** Gallbladder with wall thickening and peri-cholecystic fluid and significantly elevated liver.



**Figure 4:** 3D CT reconstruction outlining planned thoracotomy incision at skin level.



**Figure 3:** 3D CT reconstruction demonstrating extent of hemidiaphragm elevation.



**Figure 5:** 3D CT reconstruction demonstrating relationship between thoracotomy site, liver and gallbladder.

plication followed by intra-abdominal dissection of the gallbladder would be possible. Therefore, we used intra-operative ultrasound via the thoracotomy, to identify the gallbladder under the anterolateral aspect of the diaphragm. An 8 cm incision was made through the diaphragm and with some dissection the cystic artery and duct were identified and ligated in the standard fashion and the gallbladder was removed. The abdomen was irrigated, #10 JP drain was placed in the gallbladder bed and brought out through a separate stab incision in the diaphragm and laterally in the 8<sup>th</sup> interspace. The diaphragmatic defect was closed with a running looped #1 prolene suture. A 24fr chest tube was placed along the diaphragm. The thoracotomy was closed in usual fashion. The thoracotomy and trans-diaphragmatic access and closure were performed by a thoracic surgeon and the ultrasound, intra-abdominal dissection and cholecystectomy by a general surgeon. On post-operative day #1 the patient's chest tube was removed. On post-

operative day #4 she was noted to have bile leaking from her JP drain and the following day she underwent ERCP, which noted no identifiable bile leak; however, sphincterotomy was performed and biliary stent placed. She was discharged on post-operative day #6 with JP drain in situ and tolerating a regular diet. Her JP drain was removed on POD #9 in clinic. One month later her biliary stent was retrieved. The rest of her post-operative course was uneventful.

## Discussion

Trans-thoracic access for resection of the gallbladder has been reported in combination with right diaphragmatic hernia or rupture where there is existing communication between thoracic and abdominal cavities [5]. Furthermore, report of intra-thoracic gallbladder resection through abdominal exposure following traumatic rupture also exists [6]. However, to our knowledge, there are no reports of trans-diaphragmatic incision through intact diaphragm, followed by open cholecystectomy.

The use of trans-diaphragmatic trocars to aid with exposure during laparoscopic resection of posterosuperior liver lesions has been shown to be safe in a 25 patient case series<sup>4</sup> and a recent case report documented an entirely thoracoscopic, trans-diaphragmatic approach to a lesion in the dorsal segment VII/VII in a patient with previous abdominal surgery and significant intra-abdominal adhesions precluding a laparoscopic approach [2].

Our approach was unique in that it allowed for access the anterior and inferior aspect of the liver due to the cephalad displacement of the patient's liver caused by diaphragmatic paralysis. The use of ultrasonography to determine location of diaphragmatic incision directly over the gallbladder was critical to reduce unnecessary dissection within the liver parenchyma.

This clinical scenario is admittedly exceptionally rare, thus requiring an innovative approach to this uncommon anatomical situation. However, this access is feasible and was necessary in this unique circumstance. In the setting of failed trans-abdominal exposure for cholecystectomy, a trans-thoracic approach may be considered

when performed in a tertiary referral center where both a thoracic and general surgeon can work together in a multi-disciplinary setting to provide an optimal, patient-tailored surgical approach to their individual pathology.

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