

Iatrogenic Bilothorax: A Rare Complication of Orthotopic Liver Transplant

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ABSTRACT

Bilothorax is a rare condition involving drainage of bile from the biliary system into the lung's pleural space. Several cases have been reported in the literature, where the most commonly reported cause is iatrogenic injury. To date, no cases of bilothorax as a complication of liver transplantation have been reported. Given its rarity and concurrent morbidity, early recognition is paramount as this condition can quickly deteriorate into adult respiratory distress syndrome.

INTRODUCTION

Bilothorax is a rare condition involving drainage of bile from the biliary system into the pleural space. It is a complication that primarily arises from the formation of a biliopleural fistula, which can be caused by congenital, traumatic, or an erosive defect. The



Figure 1. Chest x-ray on admission showing right-sided pleural effusion.



Figure 2. Chest x-ray following readmission showing resolving right-sided pleural effusion following chest tube placement.

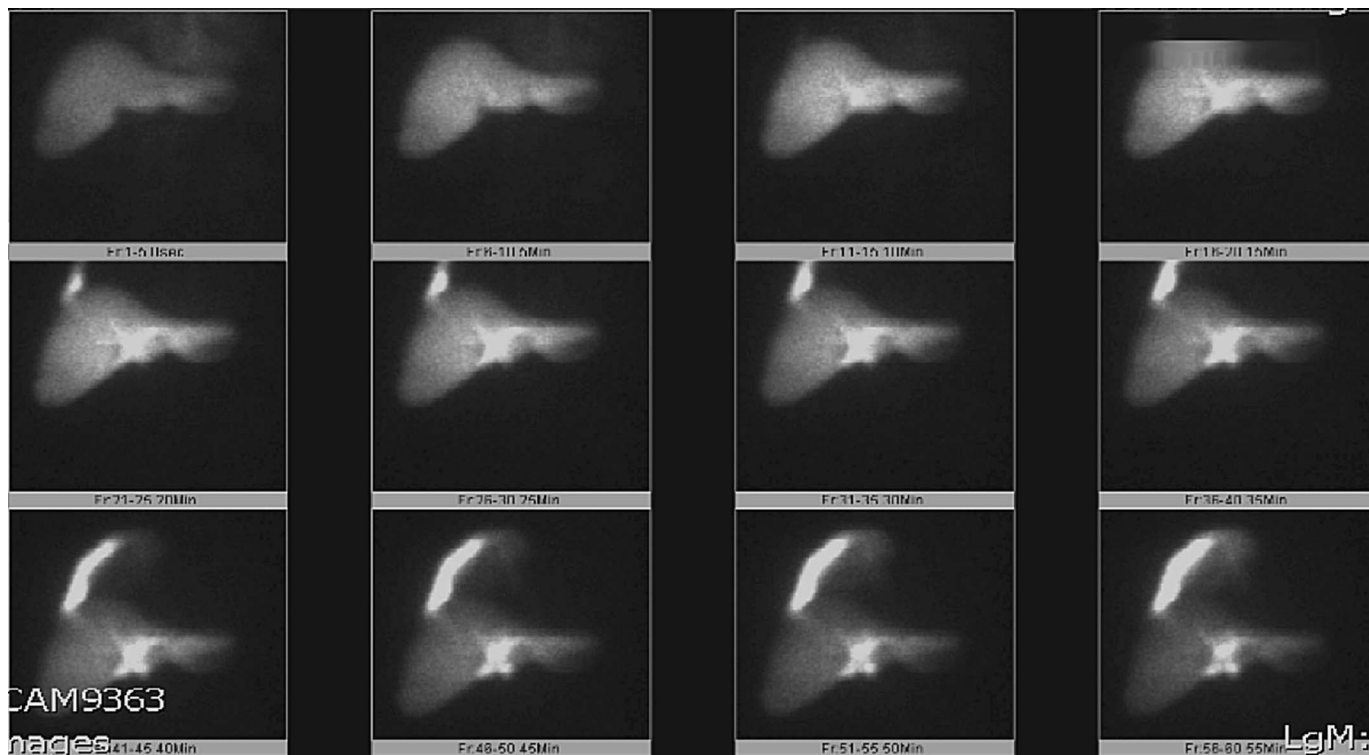


Figure 3. Hepatobiliary iminodiacetic acid scan showing bile acid flowing from the hepatobiliary system into the pleural space.

most common etiologies of biliopleural fistula formation include iatrogenic causes such as percutaneous biliary drainage and hepatic trauma, parasitic liver disease, and subphrenic abscess formation in the setting of biliary obstruction.¹ Bilothorax often presents as respiratory distress in patients with a recent gastrointestinal or hepatic procedure. The mechanism of dyspnea is due to a right-sided pleural effusion.² Pleural fluid analysis will reveal a greenish dark or straw color and the presence of glycocholic acid, a major component of bile acid.³ Several cases of bilothorax have been documented in the literature and will be discussed here. Our case is unique because it involves an iatrogenic cause in the setting of a recent liver transplantation.

CASE REPORT

A 62-year-old Asian American man with a medical history significant for hepatocellular carcinoma secondary to hepatitis B presented from an outpatient hepatology appointment for further evaluation given a comprehensive metabolic panel, which demonstrated an elevated serum creatinine. Notably, the month prior, he had received an orthotopic liver transplant as treatment for his hepatocellular carcinoma. Three days ago, he was discharged after being treated for a right-sided pleural effusion. It was suspected to be a loculated hydropneumothorax due to pneumonia. The effusion was drained and he was given a short course of intravenous antibiotics.

On readmission, he was afebrile and had decreased breath sounds in his right lung lobes along with unlabored respirations.

He had an intact wound vacuum in place over his right upper quadrant, and a mildly distended abdomen that was non-tender to palpation. He also had a trace of bilateral lower extremity edema. His laboratory tests were significant for an elevated anion gap (16), serum creatinine (3.13 mg/dL), blood urea nitrogen (99 mg/dL), and leukocytosis (14,200 cells/mL) with a predominance of neutrophils (82.7%). Liver function tests, including total and direct bilirubin, were normal.

On gross inspection of the drained pleural effusion, the fluid was dark green in color. Analysis of the fluid revealed an exudative effusion with a pleural fluid/serum fluid ratio for lactate dehydrogenase (LDH) of 1.6, and a pleural LDH (787 U/L), greater than two-thirds the upper limits of normal serum LDH (190 U/L). The fluid also had a normal cell count with negative Gram stain and culture. During his previous admission, a multidisciplinary team of clinicians had overlooked his green pleural fluid; it was thought to be infectious in origin especially in the context of immunosuppressive therapy. However, given the recurrence of this pleural effusion and its color, a total bilirubin level of the pleural fluid was ordered and found to be grossly elevated at 18.5 mg/dL.

An abdominal ultrasound did not show any evidence of ascites. A chest x-ray revealed complete opacification of the right hemithorax with initial evidence of a right-to-left cardiomeastinal shift (Figure 1). After chest tube drainage, a follow-up chest x-ray revealed reduced fluid accumulation (Figure 2). Given the patient's recent surgical history and the results of the pleural fluid

Table 1. Summary of reported causes, diagnostic methods, and treatments for reported cases of bilothorax

Authors	Cause	Diagnostic method(s)	Treatment
Aydogan et al. ¹³	Laparoscopic cholecystectomy	Fluid analysis from thoracentesis	Thoracentesis, respiration physiotherapy, analgesia, and antibiotics
Basu et al. ²	Biliary peritonitis following cholecystectomy and hepaticojejunostomy	Fluid analysis from thoracentesis	Intercostal tube drain and ventilator support
Bilal et al. ¹⁴	Percutaneous transhepatic biliary drainage	Fluid analysis from thoracentesis	Broad-spectrum antibiotics, chest tube, and continued use of percutaneous transhepatic biliary drain
Cooper et al. ⁸	Blunt abdominal trauma	Fluid analysis from thoracentesis	Thoracostomy tube drain
Dahiya et al. ⁷	Abdominal trauma secondary to gunshot injury	Fluid analysis from thoracostomy tube and ^{99m} Tc mebrofinin hepatobiliary scan	Chest tube, endoscopic sphincterotomy, biliary stenting, and subphrenic pigtail catheter
Hamers et al. ¹²	Liver metastasectomy	Fluid analysis from thoracostomy tube	Empiric antibiotics, thoracostomy tube, biliary stent
Jenkinson et al. ¹	Bilious ascites secondary to perforation of gallbladder during laparotomy	Fluid analysis from thoracocentesis	Open cholecystectomy and abdominal wash out
Kim and Zangan ¹⁵	Percutaneous transhepatic biliary drainage	Fluid analysis of thoracocentesis and cholangiogram	Tunneled PleurX catheters and continued percutaneous transhepatic biliary drainage
Prabhu et al. ¹⁶	Open cholecystectomy	Fluid analysis of thoracocentesis, ERCP, percutaneous transhepatic cholangiogram, and HIDA scan	Intercostal drain, percutaneous transhepatic biliary drain, hepaticoduchojejunostomy, and gastrojejunostomy
Ramnarine et al. ⁹	Choledochal cyst	Fluid analysis from intercostal drain and thoracotomy	Antibiotics, intercostal drainage, thoracotomy (cyst cortex removed and evacuated, pleurodesis, surgical closure of fistula), and stenting of common bile duct
Singh et al. ¹¹	Amoebic liver abscess (3 cases), pyogenic liver abscess (1), thoracoabdominal trauma (3), percutaneous transhepatic cholangiography (1)	Abdominal ultrasound, computed tomography, di-isopropyl iminodiacetic acid scan, ERCP	Thoracostomy, drainage of abscess, sphincterotomy (5 successful cases), and if unsuccessful, laparotomy for surgical closure of fistula (2) or choledochojejunostomy (1)
Turkington et al. ¹⁷	Percutaneous transhepatic biliary drainage	Fluid analysis of thoracocentesis	Intercostal drain and percutaneous biliary stents
van Niekerk et al. ⁶	Biliary tract perforation secondary to sphincterotomy and/or stent placement via ERCP	Fluid analysis of thoracocentesis and HIDA scan	Patient refused treatment
Yi-Yung Yu et al. ¹⁰	Percutaneous transhepatic biliary drainage	Fluid analysis of thoracocentesis and cholangiogram	Thoracostomy, antibiotics and surgical repair of biliopleural fistula

ERCP, endoscopic retrograde cholangiopancreatography; HIDA, hepatobiliary iminodiacetic acid.

analysis, suspicion was high for biliary drainage into the pleural space. A hepatobiliary iminodiacetic acid scan was subsequently performed and confirmed the presence of a biliary leak with radiotracer activity noted to be traveling into the right pleural space (Figure 3).

Endoscopic cholangiopancreatography identified the bile leak at the anastomotic site of the orthotopic liver transplant and a biliary stent was placed. The chest tube's drainage output was then noted to dramatically decrease and was eventually removed. Nearly 2 weeks after intervention, the patient's recurrent pleural effusions had completely resolved. An area of trapped lung had developed as a complication, but the identified area was deemed too small for decortication.

DISCUSSION

A review of the English language literature published after the year 2000 revealed several cases of bilothorax, cholethorax, or bilious pleural effusions. Our case represents the first bilothorax as a result of a liver transplant. A summary of all reported cases in the literature is listed in Table 1.

Bile leaks associated with biliary anastomoses in orthotopic liver transplantation occur at a rate between 2% and 25%.⁴ This can predispose patients to bilomas and, as observed in our case, biliopleural fistula formation. Although prophylactic internal biliary stents in orthotopic liver transplant recipients may hypothetically reduce the risk of bile leaks, one article found it is associated with

higher risk of multiple, invasive biliary interventions.⁵ Although there is little evidence to support prophylactic measures, the literature offers several recommendations for diagnosis and treatment.

Suspect bilothorax in patients with a history of upper gastrointestinal surgery, especially if it involves the biliary system.¹ Even though there has been at least one reported case of bilothorax due to endoscopic retrograde cholangiopancreatography, it is the optimal imaging modality for identifying a biliopleural fistula and also offers the benefit of therapeutic intervention.⁵⁻⁷ Initial management may include a chest x-ray to confirm the presence of a pleural effusion, early diagnostic thoracentesis, which should include the measurement of bile or bilirubin, and broad spectrum antibiotics.^{1,2,7} None of the reported cases in the literature report spontaneous resolution of bilothorax without further intervention, except one case where the patient refused treatment.⁶ Thoracostomy, percutaneous transhepatic biliary drainage, sphincterotomy and/or biliary stent placement are the most common and reportedly effective treatment modalities. However, one article reported that only in cases of persistently elevated or recurrence of tube thoracostomy output should endoscopic decompression of the biliary system be performed.⁸ Surgical closure of the biliopleural fistula is also another possible treatment option, especially if endoscopic intervention fails or is associated with an abscess.⁹⁻¹¹ Adjunctive treatment modalities have also been considered, such as somatostatin analogs and a low-fat diet.^{7,11}

Bilothorax should also be considered as a cause of rapid respiratory deterioration. Not only can lung volume be diminished by the presence of fluid, but bile can cause an inflammatory reaction due to a directly corrosive effect on the pleural layers resulting in adult respiratory distress syndrome or other pulmonary diseases.^{11,12}

DISCLOSURES

Author contributions: Both authors wrote the manuscript. NP Karnik is the article guarantor.

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