

## Cholecystitis in Situs Inversus Totalis

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Acute cholecystitis is a common surgical problem; however, the diagnosis may be difficult when the patient has situs inversus, or mirror-image reversal of the organs. This case report discusses the clinical presentation, diagnosis, radiographic images, and surgical management of cholecystitis in the face of situs inversus totalis.

### Introduction

While acute cholecystitis is one of the most common diagnoses requiring surgical management, it can be difficult to correctly diagnose in a patient with situs inversus. We present a case of acute cholecystitis in situs inversus totalis, and review of current literature.

### Case Report

A 36-year-old male presented to the emergency room with a one day history of left upper quadrant abdominal pain, associated with nausea, non-bilious vomiting, subjective fevers and chills. The patient described the pain as cramping in nature, with radiation to the epigastric region. He denied prior episodes. The

patient denied any past medical history. His previous surgeries included: two exploratory celiotomies (the first operation after a stab wound to the abdomen many years prior, and the second operation 1 year prior to this admission for lysis of adhesions secondary to a small bowel obstruction). The patient was not taking any medications and had no known drug allergies. He stated past use of cocaine, but denied any intravenous drug use. Family history was unknown. The patient was currently incarcerated.

Upon physical exam, the patient was afebrile with vital signs in the normal range. He was a well-developed and well-nourished male, in no apparent distress, and alert, oriented, and appropriate. Skin exam was normal, with no evidence of jaundice. Head and neck exam was normal, with anicteric sclerae. Heart sounds were auscultated in the right chest. Pulmonary exam was normal. Inspection of the abdomen revealed a flat abdomen with a well-healed midline celiotomy scar. Abdominal exam revealed tenderness to palpation of the left upper quadrant and epigastric region, with voluntary guarding and no peritoneal signs. Genital and extremity exams were normal. A physical finding similar to Murphy's sign was present but elicited in the left upper quadrant.

Laboratory tests revealed a white blood cell count of 25,000, with neutrophils of 90 percent. The liver function tests were the following: alkaline phosphatase 174, alanine aminotransferase (ALT) 688, aspartate amin-

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Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging

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Figure 1. 36-year-old man with situs inversus totalis. CT shows liver and gallbladder to left of midline, and aorta and stomach to right of midline.

otransferase (AST) 533, total bilirubin 2.5, and direct bilirubin 2.2. Chemistry panel and pancreatic enzymes were normal.

A computed tomography scan was performed initially (Fig. 1), given the patient's prior surgical history and presenting symptoms, which revealed situs inversus totalis, as well as a gallbladder with gallstones and a thickened wall with adjacent pericholecystic changes, consistent with acute cholecystitis. A pre-operative chest x-ray demonstrated dextrocardia (Fig. 2).

Upon repeat questioning of the patient, he stated he had knowledge of the situs inversus totalis diagnosis, but had neglected to mention it at the time of the initial history and physical exam. An sonogram of the left upper quadrant was performed, which revealed acute gangrenous cholecystitis with gallstones, sludge and edematous wall measuring 4 millimeters. The common bile duct measured up to 5 millimeters with a thickened wall.

Based on the clinical, laboratory and radiographic findings the diagnosis of acute cholecystitis was made. After the administration of intravenous antibiotics (Ertapenem) and fluid resuscitation, the patient was taken to the operating room for cholecystectomy. Given the patient's prior surgical history, a decision was made to perform an open cholecystectomy through a left subcostal incision.

The operative technique performed was identical as for a routine open cholecystectomy; however the positions were completely reversed, as if operating in a mirror. The surgeon stood on the left side of the patient,



Figure 2. 36-year-old man with situs inversus totalis. Chest radiograph demonstrates dextrocardia.

and a left subcostal incision was utilized. There were significant adhesions encountered upon entering the peritoneal cavity, and lysis of adhesions was performed. The gallbladder was markedly inflamed, tense, and partially necrotic. To facilitate grasping the gallbladder during dissection of the structures of Calot's triangle, the gallbladder was opened to remove two stones, each approximately 1.5 centimeters in diameter, and with a typical cholesterol appearance. The relative positions of the cystic duct, common bile duct and cystic artery were normal, with the exception of being 180 degrees reversed. The remainder of the case was uneventful.

The patient's postoperative course was uneventful. He tolerated a regular diet on the first postoperative day and was discharged from the hospital on the third postoperative day.

### Discussion

The first historical description of situs inversus was in animals by Aristotle [1-3]. Situs inversus totalis is a rare condition, affecting approximately 1 in 10,000 individuals [4]. There are two major types: situs inversus and situs ambiguus: inversus indicates a position that is the mirror image of normal, whereas ambiguus refers to abnormal position of an organ, but in an unordered way [5]. Dextrocardia (right-sided heart) can also be found as an isolated anomaly. Situs inversus may be partial

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(partialis) or complete (totalis), thus either thoracic or abdominal viscera may be reversed in partialis, whereas both are reversed in totalis [6]. Most cases of situs inversus are thought to be due to a sporadic genetic mutation, but other patterns of inheritance have been described (autosomal dominant, autosomal recessive, and X-linked recessive), and more than 20 genes are responsible for this phenomenon [5, 7].

About 25 percent of patients with dextrocardia (right-sided heart) will also have Kartagener's syndrome (also known as primary ciliary dyskinesia or immotile cilia syndrome), characterized by situs inversus, paranasal sinusitis, and bronchiectasis [8]. Male sterility and reduced female fertility are also characteristics of Kartagener's syndrome. Fifty percent of patients with Kartagener's syndrome will have situs inversus. These patients may manifest common surgical problems as do patients with normal anatomy, such as appendicitis, cholecystitis, and diverticulitis. However the anatomic location of symptoms will be reversed, thus confounding the ability to diagnose these conditions expeditiously [9].

There have been several published case reports on performing laparoscopic procedures on patients with situs inversus totalis, such as cholecystectomy, common bile duct exploration, appendectomy, Nissen fundoplication, hemicolectomy, Roux-en-Y gastric bypass, sleeve gastrectomy, and gastric banding, among others [2, 6, 10-16]. The common points to all case reports were that the mirror-image anatomy makes the operation more challenging, and to be aware that anatomic variants may be present, thus further complicating the case. Operative times will likely be increased in such cases [6].

It is advisable that any laparoscopic procedure on a patient with situs inversus may be best performed by an experienced laparoscopic surgeon. In addition, performing a procedure such as a laparoscopic cholecystectomy may prove difficult for a right-handed surgeon, and may in fact, be easier for a left-handed surgeon, due to the reversal of port positioning. Another option is to perform the surgery with the patient in lithotomy position, with the surgeon between the patient's legs, to feel more oriented to the reversed anatomy, as opposed to standing on the opposite side of the patient [15]. Whether the surgery is to be performed open or by utilizing a minimally invasive technique, once the diagnosis of situs inversus is discovered in a potential surgical candidate, proper planning and careful execution make it possible to treat these patients safely and effectively.

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