A Case of Left-Sided Acute Appendicitis in a 45-Year-Old Man with Situs Inversus Totalis Managed by Emergent Laparoscopic Appendectomy

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Patient: Male, 45-year-old
Final Diagnosis: Acute appendicitis – left sided
Symptoms: Left lower quadrant abdominal pain • nausea • non bilious non bloody emesis
Clinical Procedure: Laparoscopic appendicectomy
Specialty: Surgery

Objective: Congenital defects/diseases

Background: Situs inversus totalis (SIT) is a rare congenital abnormality that includes mirror-image transposition of both the abdominal and the thoracic organs. It may remain undetected into adulthood until an acute medical emergency results in diagnostic imaging. This report presents a challenging case of left-sided acute appendicitis in a 45-year-old man with SIT.

Case Report: A 45-year-old man with a medical history of gastroesophageal reflux disease, class 2 obesity, prediabetes, and elevated low-density lipoprotein cholesterol presented with severe acute abdominal pain localized in the left lower quadrant with localized tenderness, nausea, and 2 episodes of non-bloody and non-bilious emesis that started a day before the clinical encounter. Computed tomography of the abdomen and pelvis revealed previously undiagnosed congenital SIT. In addition, physical, laboratory, and radiological findings suggested early acute appendicitis with no evidence of complications. Hence, the patient was managed with an emergent laparoscopic appendectomy. Acute appendicitis was confirmed in the post-surgery histopathological examination. The post-surgery recovery was uneventful, and the patient was discharged home on the second postoperative day.

Conclusions: This report highlights that SIT may remain undiagnosed into adulthood and poses a challenge in the diagnosis of left-side appendicitis due to atypical symptom presentation, supporting the findings of previous case reports. Therefore, the inclusion of left-sided acute appendicitis in the differential diagnosis of abdominal pain in the left lower quadrant is warranted.

Keywords: Appendicitis • General Surgery • Heterotaxy, Visceral, X-Linked • Hispanic or Latino

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Background

About 230 incident cases of acute appendicitis are reported annually per 100 000 population, with a 20% increase in incidence rate between 1990 and 2019 [1]. Despite the appendix vermiformis being anatomically located in the lower right abdomen, only one-third of patients experience lower right pain associated with acute appendicitis, due to positional differences [2]. Appendicitis associated with left abdominal pain (left-sided acute appendicitis) has been reported but is uncommon; it occurs in patients with situs inversus totalis (SIT) or midgut malrotation, both of which are rare congenital conditions [2]. SIT is marked by a complete mirror-image transposition of the thoracoabdominal viscera but not the peripheral nervous system [3]. Although reliable estimates of SIT incidence are unavailable, the current literature suggests a wide variability in the frequency, ranging from 1 in 20 000-25 000 in Western countries to as high as 1 in 4100 in the Japanese population [3,4].

SIT is usually asymptomatic, but the transposition of organs poses diagnostic challenges when patients are examined for unrelated conditions due to atypical symptom localization [3]. Given the rarity of clinical encounters with SIT, many physicians may not suspect, for example, acute appendicitis for complaints of left-side abdominal pain, which is usually indicative of acute diverticulitis. Such situations can result in misdiagnosis or significant delays in diagnosis [5] and may increase the risk of morbidity and mortality in patients with previously undiagnosed SIT, as well as requiring emergency surgery [6]. Additionally, SIT can pose practical problems in surgical procedures due to the predominant righthandedness of surgeons. About 9% of surgeons are left-handed [7], on par with estimates in the general population [8], and the design of surgical procedures and instruments for right-handed use, such as trocar positioning in laparoscopic procedures, may lead to wrong incision sites [3,6]. About half of left-handed surgeons report laterality-associated discomfort while handling endoscopic instruments [7,8].

Appendectomy is among the most commonly reported surgical procedures in patients with SIT [9-11], followed by cholecystectomy, gastrectomy, and colorectal resections [3]. Several case reports have documented successful management of left-sided acute appendicitis with laparoscopic appendectomy [10,12-15]. For instance, 2 recent reports by Hoang et al [15] and Abdulla et al [13] described left-sided acute appendicitis in a 42-year-old man and a 65-year-old man, respectively, with previously undiagnosed SIT. Both were successfully managed with laparoscopic appendectomy. In both cases, the laparoscopic appendectomy procedure had to be adapted due to the transpositions of the organs. This report presents a challenging case of left-sided acute appendicitis in a 45-year-old man with SIT, and contributes to the growing body of literature on left-sided acute appendicitis surgically managed with an emergent laparoscopic appendectomy.

Case Report

A 45-year-old man presented with severe acute abdominal pain localized in the left lower quadrant with localized tenderness, nausea, and 2 episodes of non-bloody and non-bilious emesis that started a day before the clinical encounter. The patient had class 2 obesity (body mass index of 33.75 kg/m²) without severe comorbidity, and was being treated for prediabetes (metformin XR 500 mg), elevated low-density lipoprotein (LDL) cholesterol (atorvastatin 20 mg), and chronic knee pain (1% diclofenac gel and naproxen 500 mg). The patient was also diagnosed with gastroesophageal reflux disease 5 months before the clinical encounter. He reported being a never-smoker, had abstained from alcohol intake in the past 3 years, and denied any history of allergies or disorders requiring anticoagulants or steroids.

The patient’s pulse rate (86 beats/min), blood pressure (106/75 mmHg), pulmonary effort (15 breaths/min; SpO₂=100%), oral temperature (37.4°C), skin condition (capillary refill <2 min), and neurological status (focal deficit and alertness) were unremarkable during the initial clinical examination. There was abdominal tenderness but without any distention. Complete blood count (CBC) showed elevated white blood cells (15.08×10³ cells/ml; reference range: 4.8-10.8×10³ cells/ml), and the comprehensive metabolic panel (CMP) showed elevated blood glucose (134 mg/dl; reference range: 74.0-109.0 mg/dl). Other parameters of CBC and CMP were unremarkable (data not shown).

A CT scan (with intravenous contrast) of the abdomen and pelvis was conducted on the same day, revealing congenital SIT (Figure 1). We excluded the possibility of midgut malrotation or situs ambiguous, as the abdominal CT revealed transposition of all visceral organs, most prominently the liver, spleen, and stomach, which would not occur in these conditions.

In addition, the left lower quadrant demonstrated a dilated fluid-filled appendix measuring approximately 13 mm in diameter with peri-appendiceal stranding and 1.5 cm appendicolith at the base of the appendix (Figure 1). There was no evidence of drainage collection/abscess or free air to suggest perforation. The remainder of the small and large bowel was grossly unremarkable and without obstruction. Hepatomegaly was noted without focal abnormality. The abdominal vasculature (including the aorta), spleen, pancreas, gallbladder, adrenal glands, kidneys, and bladder were normal with age-appropriate prostate and seminal vesicles. Musculoskeletal structures were intact, and lung bases were clear, with no evidence of
abdominal ascites, free air, or adenopathy. Since the physical, laboratory, and radiological findings suggested early acute appendicitis with no evidence of complications, emergent surgical management with laparoscopic appendectomy was indicated.

A senior surgeon with more than 30 years of experience in laparoscopic procedures conducted the entire operation. After gaining access into the abdomen, a left-sided cecum and appendix were visualized, confirming SIT. Acute appendicitis without perforation, gangrene, or abscess was noted. The appendix was then grasped with Babcock forceps and elevated, exposing the base of the appendix, which appeared normal and uninvolved. An endoscopic linear cutting stapler was then used to divide and staple the base of the appendix. The stapler was reloaded with a vascular cartridge and then used to separate the mesoappendix similarly. The appendix was placed into an endoscopic retrieval bag and removed via the 10-mm port site.

Upon gross examination, the excised appendix measured 7.2×1.0 cm with minimal mesoappendix attached. Finely congested blood vessels were noted on the serosal surface, which was focally covered with a white exudate. A small (0.2-0.3) full-thickness disruption consistent with the rupture site was identified in the middle of the appendix. The appendix tip was bisected, and no fecolith was identified on sectioning. The mucosal surface was red tan. Suppurative appendicitis, focally necrotizing, with acute serositis, meso-appendiceal acute inflammation, and focal gross full-thickness opening were confirmed. The histopathological photomicrographs confirming acute appendicitis are presented in Figure 2.

Figure 1. Axial (A) and coronal (B) view computed tomography images showing situs inversus totalis, with enlarged left-sided appendix (white arrows). Laparoscopic image (C) showing left-sided liver, confirming situs inversus totalis.
On the first postoperative day, the patient was stable, ambulatory, tolerating a regular diet, and passing gas. The patient was discharged after confirming normal vitals and a physical exam on the second postoperative day. The patient was well at the 3-week follow-up with normalized white blood cell count ($6.00 \times 10^3$ cells/mcl) and controlled blood glucose (82 mg/dL).

**Discussion**

In line with earlier research [10,12,13,15,16], SIT and left-sided non-perforated acute appendicitis were diagnosed by chance encounter in our patient and successfully managed by laparoscopic appendectomy, without complications. Only 1 case report noted a patient aware of his SIT during the presentation to the Emergency Department with left lower quadrant abdominal pain [14]. Incidentally, among the available case reports, only this patient had perforated appendicitis but was successfully managed with laparoscopic appendectomy with an uneventful postoperative course [14].

Therefore, the current case report underscores the need to include left-sided acute appendicitis in the differential diagnosis of abdominal pain in the left lower quadrant, given that SIT in adults is often only diagnosed during a chance clinical encounter. This is especially relevant given the growing body of case reports [2] on acute appendicitis in patients with SIT. In addition, our study also contributes to the literature on adaptations such as ideal port placements for laparoscopy triangulation, resection/ligation of the mesoappendix, and monitor placement on the left instead of the right of the patient with the surgeon on the right [12,14,15]. This placement may be required for the procedural convenience of the surgeon during laparoscopic appendectomy for left-sided acute appendicitis.

One of the key challenges with the diagnosis of left-sided acute appendicitis is its atypical symptom presentation. Abdominal pain is one of the most common symptoms among adults [17]. Differential diagnosis of pain in the left lower quadrant most commonly includes left primary epiploic appendagitis or left acute colonic diverticulitis, with few patients concomitantly presenting with other symptoms such as rebound tenderness (14%), palpable mass (3.6%), nausea/vomiting (7.1%), or fever (7.1%) [18]. In male patients, abdominal pain in the left lower quadrant can also be indicative of herpes zoster, muscle strain, and hernia after excluding renal conditions such as nephrolithiasis and pyelonephritis [17]. On the other hand, abdominal pain in the right lower quadrant is typically indicative of appendicitis, colitis, diverticulitis, inflammatory bowel disease, and irritable bowel syndrome [19]. Therefore, the atypical symptomatology of pain in the left lower quadrant due to acute appendicitis in SIT patients can be misleading, potentially causing delays in diagnosing left-sided acute appendicitis, thereby contributing to appendicitis-associated morbidity and mortality.

It is also intriguing that this is the first reported case of left-sided acute appendicitis in a Hispanic patient. Appendicitis is the most common cause of surgical emergencies globally and may even be more prevalent in Hispanic populations [1]. An analysis of the United States National Inpatient Sample database showed that the Hispanic population had a higher rate of acute appendicitis-related hospitalizations (9.5 per 10,000 population) than White (6.9 per 10,000 population), Black (3.5 per 10,000 population), Asian (4.6 per 10,000 population) or Native American (5.9 per 10,000 population) populations during 2005-2008. The proportion of Hispanic patients with simple (70.3%) and complex (29.7%) appendicitis, however, was comparable to the proportions in other racial or ethnic groups [20]. Moreover, the occurrence of SIT in the
Hispanic population may not be all that different from that of other racial or ethnic groups [3,4,21-25]. There is also no evidence that Hispanic patients are at risk of delayed treatment, as they have the highest utilization of laparoscopic appendectomy in the United States [26] and similar odds of appendix perforation as White, Black, or Asian patients [27,28].

**Conclusions**

This report highlights that SIT may remain undiagnosed into adulthood and poses a challenge in the diagnosis of left-side appendicitis due to atypical symptom presentation, supporting the findings of previous case reports. Therefore, the inclusion of left-sided acute appendicitis in the differential diagnosis of abdominal pain in the left lower quadrant is warranted.

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