Case Report

Situs Inversus Partialis: An Incidental Discovery in a Young Patient with Obstructed Left Inguinal Hernia

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Cite as: Rugambwa JP, Kubwimana O, Nshimyiyera J, Gashegu J. Situs Inversus Partialis: An Incidental Discovery in a Young Patient with Obstructed Left Inguinal Hernia. Rwanda J Med Health Sci. 2026;9(1): 247-251. https://dx.doi.org/10.4314/rjmhs.v9i1.18.

Abstract

Background
Situs inversus is a rare condition that can create diagnostic and management challenges for clinicians.
Case presentation
We present a case of a young male patient who showed clinical and radiological signs of proximal bowel obstruction. During exploratory laparotomy, a viable small bowel loop was found trapped in the left inguinal canal. An incidental partial situs inversus was also discovered during the procedure. An appendectomy and left inguinal hernia repair were carried out using an intraperitoneal approach. The patient's postoperative course was uncomplicated, with no immediate or long-term complications reported. Follow-up assessment confirmed sustained recovery and well-being.
Conclusion
It is crucial to maintain a high index of suspicion for situs inversus partialis in patients with left-sided abdominal pain, along with comprehensive evaluation and surgical planning.
Rwanda J Med Health Sci 2026;9(1):247-251

Keywords: Partial situs inversus, inguinal hernia, levocardia, anatomical variation, case report

Introduction

Although the human body appears symmetrical on the outside, with both sides identical, its internal organs are arranged asymmetrically.[1] The term situs describes the anatomical positioning of the atria and abdominal organs in relation to the body's midline. It may be classified as situs solitus, situs inversus, or situs ambiguous. Situs solitus represents the normal organ arrangement, with right-sided structures including the right atrium, liver, gallbladder, trilobed lung, and inferior vena cava, and left-sided structures including the left atrium, stomach, spleen, bilobed lung, and descending aorta. Situs inversus totalis denotes a complete mirror-image reversal of this normal anatomy, and situs ambiguous, also known as heterotaxia, is characterized by an irregular arrangement of internal organs and is commonly associated with splenic anomalies and congenital heart defects.[2]

Situs inversus totalis is a rare condition that affects about 1 in 10,000 people.[1] The thoracic and abdominal organs are normally arranged in situs solitus. Situs inversus, which is the opposite of this typical asymmetrical organ arrangement, is believed to be caused by the abdominal and thoracic viscera malrotating during embryonic development.[3]

Early in fetal development, a series of genes and signal molecules establishes and controls laterality. Notably, serotonin (5HT), a neurotransmitter, is also essential in this signaling cascade that determines laterality. A gene cascade involving FGF-8, Nodal, Lefty-1, Lefty-2, Pitx-2, and Sonic Hedgehog (SHH) controls Left–right asymmetry, which is established during gastrulation. Partial reversal of left-right asymmetry is more often associated with other abnormalities than total asymmetry.[1]

Both partial and complete situs inversus are possible. The viscera of the abdominal cavity or thorax may be inverted in partialis, but all are inverted in totalis. When levocardia is present, the cardiac apex stays on the left side.[4] Physicians may encounter difficulties during investigations and management stages of patients with situs inversus, as they often lack experience with such rare conditions.[1]

We report a case of left obstructed inguinal hernia with partial situs inversus. In addition to being reported for academic purposes, this case is also reported to increase awareness of this difference among medical professionals, particularly surgeons.

Case presentation

On March 25, 2024, a previously healthy 28-year-old male consulted the Accident and Emergency Department at The University Teaching Hospital of Butare (CHUB), a national referral hospital with a capacity of 449 beds, situated in Huye District, Southern Province of Rwanda. It is located in close proximity to the University of Rwanda, Huye Campus. He presented with 4 days of colicky abdominal pain, mild abdominal distension, and emesis, complicated with gas and stool arrest.

A general surgeon reviewed the patient. The patient presented with tachycardia, mildly distended abdomen, abdominal tenderness, increased bowel sounds, a non-reducible left inguinal bulge, and no peritoneal signs. A digital rectal examination revealed an empty rectal vault. We requested pre-operative laboratory tests: full blood count, electrolytes, renal function tests, and glycaemia, all came with unremarkable results. Erect abdominal and chest x-rays (Figure 1) were done and displayed air-fluid level indicative of proximal bowel obstruction. A diagnosis of complete intestinal obstruction on the left obstructing inguinal hernia was made.

After optimization, the patient underwent a laparotomy. During surgery, we identified dilated bowel loops with an entrapped small bowel loop in the left inguinal canal, and cautious small bowel reduction revealed viable bowels. We incidentally found intra-abdominal organs (Figure 2) in inverted locations: cecum, appendix,

ascending colon in left iliac fossa; liver and gallbladder in the left hypochondrium; the spleen in the right hypochondrium; the descending colon and sigmoid in the right lower quadrant, respectively.

After reduction, the bowel was warmed for approximately ten minutes, then regained normal coloration and intact continuity. An appendectomy and left inguinal hernia repair were performed via an intraperitoneal approach without repositioning the surgeon on the patient's right side, as both the appendix and hernia defect were visible from the surgeon's position. Peritoneal lavage with warm normal saline was done, and after confirming correct gauze counts, the abdomen was closed in layers.

Postoperatively, chest radiography demonstrated a normal cardiac silhouette with the apex located in the left hemithorax, consistent with levocardia. In the presence of left-sided cardiac positioning and reversed abdominal viscera, the diagnosis of a left obstructed inguinal hernia associated with partial situs inversus (situs inversus with levocardia) was made. This finding excluded dextrocardia, a rare congenital anomaly characterized by right-sided cardiac positioning, which would have warranted further imaging to assess for asymptomatic situs inversus totalis. The figures illustrating pre- and post-operative findings are below.

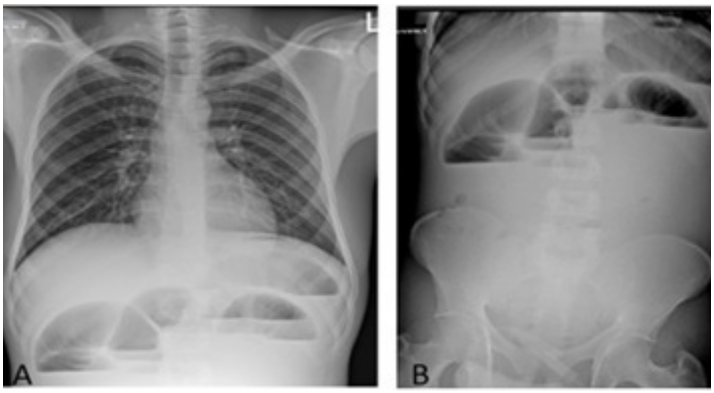

Figure 1. Preoperative chest x-ray and erect abdominal x-ray

A: The Chest x-ray shows a normal chest x-ray with heart borders visible, and the apex of the heart in the left chest. B: The erect abdominal radiograph demonstrates air–fluid levels.

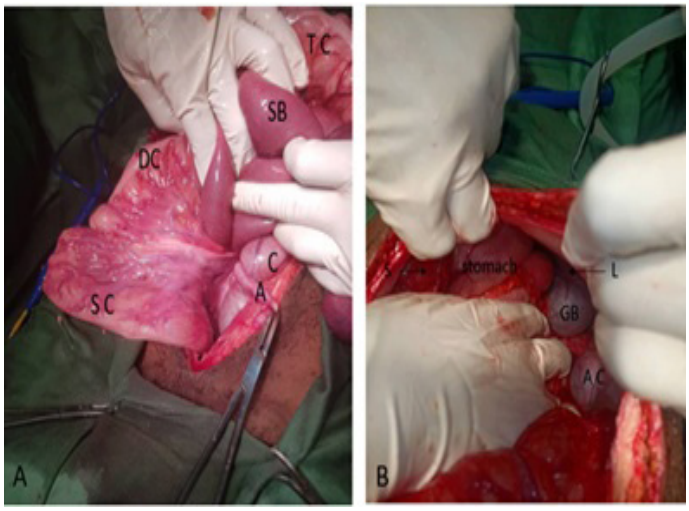

Figure 2. Incidental intra-abdominal findings

A: Appendix; C: caecum; DC: descending colon; SB: small bowel; SC: sigmoid colon; TC: transverse colon; AC: Ascending colon; GB: gall bladder; L: liver; S: spleen

After recovery, and in line with routine practice and patient's rights; The patient was informed about the intraoperative findings and the performed procedures. We explained the rare anatomical configuration of his intra-abdominal organs and its clinical relevance, as such variations may lead to atypical presentations of conditions such as appendicitis or cholecystitis.

On the first postoperative day, he was able to tolerate a regular diet, and on the fourth postoperative day, he went home. After four weeks, the patient returned for follow-up and had fully recovered. At the first postoperative follow-up visit, the patient was advised to seek prompt medical review should any concerns arise.

Discussion

Different mechanisms are triggered during embryogenesis to create the organs that make up the human anatomy and to ensure they are properly positioned in a highly organized, nonrandom process that results in clear left-right asymmetry.[6]The ciliary movements of the primitive node control asymmetry throughout embryonic development. The primitive node contains both motile and immotile monocilia.

The motile ones are centrally located, while the immotile monocilia are positioned on the periphery of the node, containing calcium channels (Ca2+) Polycystin. The clockwise movement of these cilia causes the initial right-left asymmetry in the organism. The ciliary motion activates the nodal gene, which increases Ca2+ entry through calcium channels (Ca2+) Polycystin 2. This signal triggers the processes that lead to the asymmetrical arrangement of organs in the human body.[5]

Therefore, in normal conditions, some organs are located on the left side while others are located on the right side. In case of abnormal location of an organ, if the organ is diseased, it may be difficult to healthcare personnel to recognize the actual pathology. For example, the diagnosis of acute appendicitis in the left iliac fossa can be difficult and often missed because of its unusual clinical appearance. Even though about one-third of patients with acute appendicitis experience pain in areas other than the right iliac fossa, acute appendicitis is rarely diagnosed when left iliac fossa pain is present.[6] A lengthy appendix in right lower abdomen that extends into the left lower quadrant or a movable and redundant caecum may lead to left-sided appendicitis in an atypical form.[7] Furthermore, situs inversus and midgut malrotation are two types of birth defects that can be associated with atypical, left sided appendicitis.[8] In this case, due to partial situs inversus, our finding fell in the category of the congenital left-sided appendix, which would lead to left lower abdominal pain in case of acute appendicitis. Although the appendix is typically located in the right lower quadrant, in rare conditions such as situs inversus or intestinal malrotation, it may be found in the left lower abdominal quadrant. This atypical location can pose diagnostic challenges, as several other conditions may present with left lower abdominal pain, including sigmoid diverticulitis, abdominal aortic dissection,cystitis, renal colic, prostatitis, testicular torsion, intestinal obstruction, incarcerated hernia, and psoas abscess.[7]

Direct abdominal radiography, ultrasonography, computed tomography, and magnetic resonance imaging are commonly used as adjunctive diagnostic imaging modalities.[1] In our patient, direct chest radiography revealed levocardia despite the presence of abdominal situs inversus. No additional imaging was performed postoperatively, as the patient had been previously asymptomatic and the chest radiograph did not demonstrate dextrocardia, which would have prompted further imaging investigations.

The present case had all intraabdominal organ inverted: the cecum, appendix, and ascending colon in the left iliac fossa; the liver and gallbladder in the left hypochondrium; the spleen in the right hypochondrium; the descending colon and sigmoid in the right lower quadrant. Observing our case, where the gallbladder was identified in the left upper abdomen, the patient would present with left upper quadrant pain when cholecystitis/ cholelithiasis is present. For conditions like cholecystitis or cholelithiasis, in the case of situs inversus, the symptoms' anatomical location will be inverted, making it more difficult to diagnose these conditions quickly. [9] For such cases, the unusual location of the gallbladder will affect both the diagnosis and approach considerations during the surgical intervention, whether it is open or laparoscopic. Under these circumstances, it is imperative to exercise caution and to consider the leading surgeon's handedness. [1]

The limitation of this case report is the absence of comprehensive preoperative imaging investigations, specifically abdominal ultrasound, computed tomography, or magnetic resonance imaging. This lack of detailed imaging, limited to abdominal and chest X-rays, hindered accurate preoperative diagnosis and effective surgical planning. Consequently, the final diagnosis was made intraoperatively, potentially affecting the initial diagnostic strategy and surgical decision-making.

Conclusion

Despite the rarity of the situs inversus condition, maintaining a high index of suspicion may aid in the early detection of conditions such as left-sided cholecystitis or left-sided acute appendicitis. This vigilance can prompt timely intervention and prevent further complications that could arise from delayed diagnosis and management.

Conflicts of interest

The authors declare no conflicts of interest

Ethical consideration

We obtained informed consent from the patient for publication. We preserved the confidentiality and anonymity throughout the report. According to our institutional policy, ethical approval was not required for the publication of a single case report.

Authors' contribution

R JP: Conceptualization and writing the draft of manuscript. All authors reviewed the manuscript, provided insightful criticism, and agreed on the publication of the case report.

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