JOURNAL OF RADIOGRAPHY AND RADIATION SCIENCES

A CASE STUDY OF SITUS INVERSUS TOTALIS

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https://doi.org/10.48153/jrrs/2023/YKGL6124

Article info
First Submission
21st March 2023

Revised
7th June 2023

Accepted
28th June 2023

ABSTRACT
Situs solitus refers to a normal visceral structure, whereas situs ambiguous refers to a situation in which the pattern of arrangement cannot be determined. Major visceral organs are reversed from their natural locations in situs inversus, a congenital variation. It's called situs inversus totalis when it is associated with dextrocardia. We present a case of situs inversus totalis in a 43-year-old immunocompromised female patient referred to the Radiology Department of a military hospital in Makurdi, Benue State, in the North Central region of Nigeria. The patient was referred for a chest x-ray on suspicion of mitotic disease, but an abdominal ultrasound was done in addition after the discovery of dextrocardia. Abdominal ultrasound and chest radiographs revealed transposition of major visceral organs and dextrocardia, respectively. In this present case study, abdominal structures revealed reversed anatomy of visceral organs. The liver and gallbladder were found on the left side of the abdomen, while the stomach and spleen were found on the right side. An additional abdominal radiograph was obtained to further clarify organ distribution in the abdomen. This case demonstrates a typical case of situs inversus totalis and further underlines the relevance of multiple medical imaging techniques in diagnosis. An early identification of this condition has profound implications for the future care and comparative imaging of patients. Most individuals with situs inversus can live a normal life without symptoms or disability. Finally, the authors suggest that radio diagnostic professionals employ consistent use of universally accepted imaging protocols, annotations, and image orientation as an important means of correctly identifying situs inversus totalis.
Keywords: Situs inversus totalis, Case study, Medical Imaging Techniques

Introduction

Major visceral organs are reversed from their natural locations in situs inversus, a congenital variation [1]. 'Situs' means the position of the heart, especially the cardiac atria and viscera. When there is an occurrence of a mirror image, it is termed *Situs inversus* (mirror image of the organ as it is opposed to the normal position) [2]. It is called situs inversus totalis when it is associated with dextrocardia [1]. Dextrocardia with *situs inversus* is a condition that is characterized by abnormal positioning of the heart and other internal organs. Situs solitus refers to a normal visceral structure, whereas situs ambiguous refers to a situation in which the pattern of arrangement cannot be

determined [2]. This disorder is uncommon in clinical practise and can pose a diagnostic challenge for radiographers and physicians, particularly when viscera abnormalities or infections such as mitotic disease or appendicitis are suspected. Situs inversus totalis is frequently discovered by chance through medical imaging procedures such as abdominal x-rays and ultrasound, as seen in our case [4]. Many forms of imaging techniques like radiography, ultrasound, CT scan, and MRI are useful in the diagnosis and confirmation of situs inversus [5]. However, CT scanning is usually the preferred examination, especially for situs inversus totalis [6]. A chest x-ray and abdominal scan by accident led to the discovery of this fascinating situs inversus totalis case.

CASE PRESENTATION

A 43-year-old woman presented as an outpatient to the radiology department of a military hospital in Makurdi with a one-month history of high-grade fever associated with chills. The patient was clerked by a medical officer in the outpatient Department (OPD). There was an associated cough, which was worse at night and non-productive. No chest or abdominal pain was reported. She was chronically ill-looking, icteric, and neither pale nor cyanosed. The patient had a fever of 380 °C, a pulse rate of 100/min, and a blood pressure of 120/70 mmHg. Respiratory rate was 36/min with associated bronchial breath sound, harder in the middle lung zones. A suspicion of mitotic disease with a background of immunosuppression was raised. Further work-up included a request for a chest x-ray. A GE ceiling-suspended x-ray machine was used for a chest, which revealed dextrocardia. The patient was immediately considered for an abdominal ultrasound. A real-time ultrasound of the abdomen was performed using the GE LOGIC P9 PRO (2004) ultrasound system with a standard 3.5 MHz curvilinear probe, as it was the only technique available in the hospital when the present case was reported. Abdominal structures revealed the reverse anatomy of visceral organs. The liver and gallbladder were found on the left side of the abdomen (left hypochondria region), while the stomach and spleen were found on the right side. There was transposition of the internal loop, lodging of the ascending colon on the left, and complete transposition of major vessels (the abdominal aorta and inferior vena cava). No evidence of definite pathology was noted on the scan. Although an abdominal x-ray was also not part of the initial requests, an abdominal x-ray examination was immediately suggested as an additional inquiry. On the abdominal radiograph, similar signs of organ transpositions were identified. Furthermore, the chest radiograph revealed significant hilar lymph node engorgement consistent with infection.

Figure 1: Sonograph of the Liver in Relation to the Left Kidney

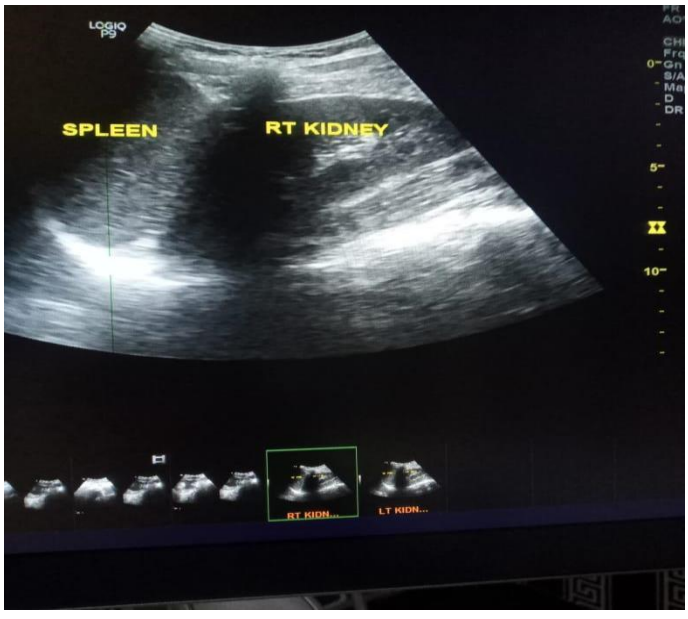

Figure 2: Sonograph of the Spleen in Relation to the Right Kidney

https://doi.org/10.48153/jrrs/2023/YKGL6124

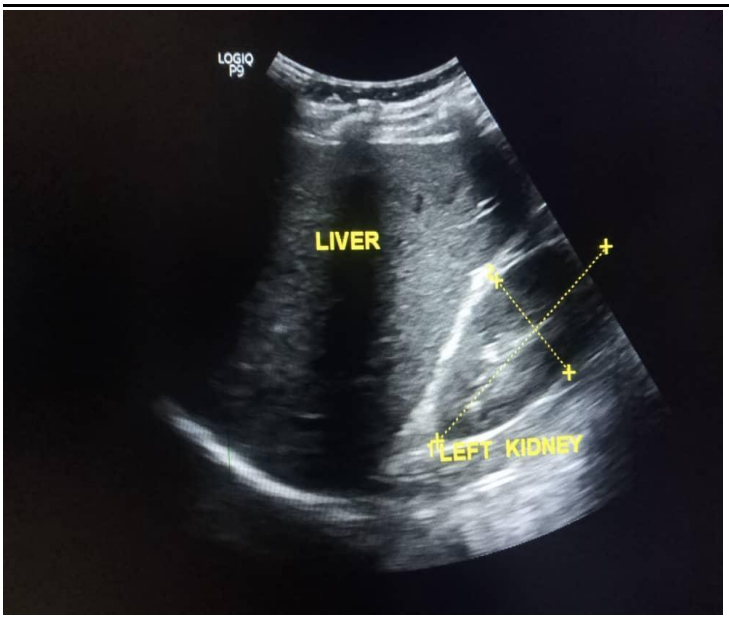

Figure 3: Sonograph of the Liver in Relation to the Measured Right Kidney

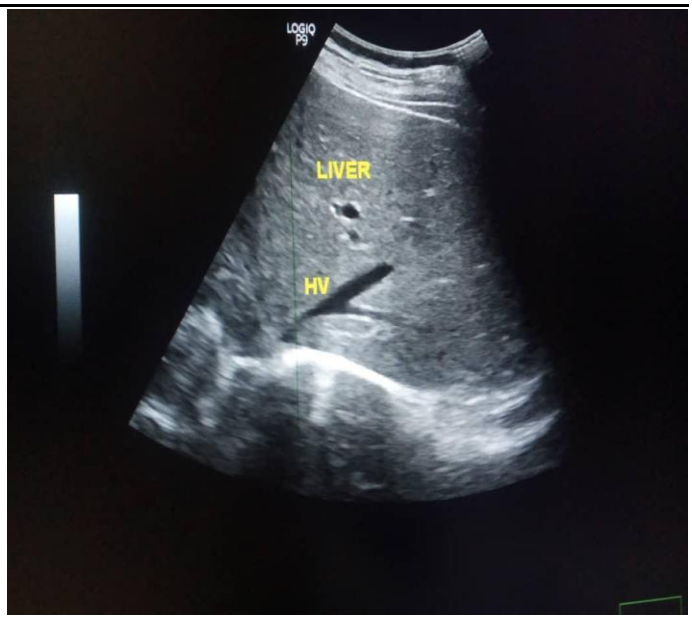

Figure 4: Sonograph of the Liver in Relation to the Hepatic Veins

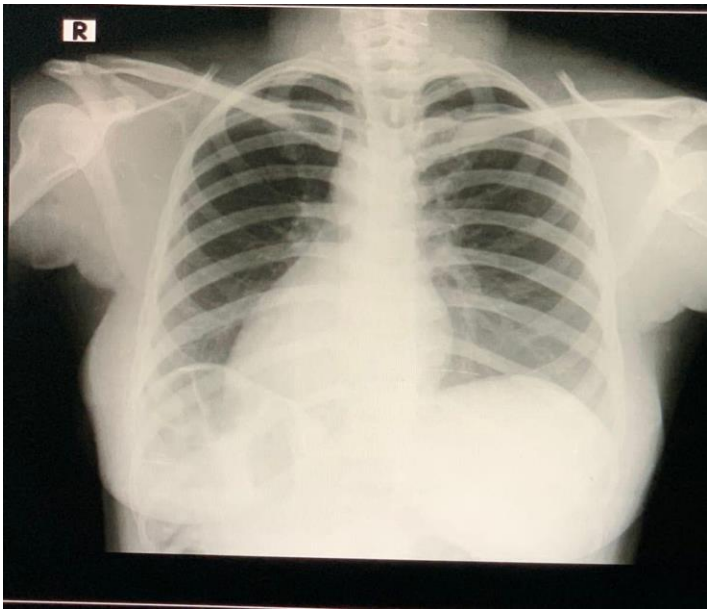

Figure 5: Patient's Chest X-ray Demonstrating Dextrocardia

Discussion:

The abdominal visceral organs are transposed in situs inversus, a positional abnormality. According to a set of studies, this anomaly is seldom recorded in Nigeria. The male-to-female incidence ratio is 3:2 [4]. Some patients with this abnormality are not aware of their situation until they are in their adult years, when accidental results during standard tests reveal their problems. Patients with situs inversus are more likely to be misdiagnosed due to either geometric issues caused by uneven organ distributions or a lapse in judgment caused by misidentification. With variant dextrocardia, medical imaging practitioners may misplace anatomical markers on a chest radiograph [5]. The finding from this study is like a case reported in previous studies [6], [7], where the stomach and spleen were located on the right side, while the right lobe of the liver was on the left side. The gallbladder was in the epigastric area, towards the left side. Although it has also been reported that typically, persons with *situs inversus* with dextrocardia may experience a shorter life expectancy, other sources have shown that they can have a normal life expectancy compared to other persons without congenital anomalies of the and also have a similar risk of getting acquired disease as that of other persons of same age and sex group [8].

It has been reported that 'Situs inversus' was once regarded as a contraindication to liver transplantation because of the technical difficulties associated with the unique vascular anatomy and concern about achieving accurate graft positioning [9] [10]. In the rare instances of cardiac anomalies, life expectancy is reduced, depending on the severity of the defect [11]. A radiographer, radiologist, physician, or surgeon may also mistakenly diagnose a left palpable mass as splenic when it is hepatic in nature. As a result, whenever a hint

of situs inversus is discovered, immediate attempts should be made to conduct further studies to determine the location of all major organs through medical imaging. Medical imaging techniques are still among the simplest and most reliable ways to confirm a diagnosis of situs inversus totalis. Ultrasound, chest x-rays, and abdominal x-rays are examples of such techniques [6].

Situs inversus has been shown to occur in association with other conditions such as Kartagener syndrome or primary ciliary dyskinesia [9] [12]. Situs inversus can also happen with duodenal atresia, biliary atresia, gastroschisis with malrotation, congenital coronary abnormalities, ventricular septal defect, and transposition of the great arteries [13]. Medical imaging practitioners should not make any assumptions about a patient's identification, including the correct use of anatomical markers or picture inversion, during investigations [14]. A high index of suspicion combined with appropriate evaluation is necessary for diagnosis and future operative planning, especially when situs inversus becomes complicated with other anomalies such as duodenal atresia [15] [16] [17]. It also suggests that if an imaging procedure provides a hint of such an aberration by chance, other tests should be used to confirm the diagnosis, preferably at no cost to the patient [18]. Economic constraints may frequently be an impediment to testing practises, particularly in private practises where profit margins are critical. In addition, when accessible, an MRI or CT scan as well as an ECG might be used for additional investigations to rule out underlying related lesions that may not appear in the same way as in the general population. CT scanning is the preferred examination for the definitive diagnosis of situs inversus with dextrocardia [16]. However, our patient could not benefit from advanced medical imaging modalities such as CT scan and MRI because of their unavailability in the hospital and the general environment at the time of this study. It has, however, been reported in a study with a similar case that the commonest diagnostic investigations for situs inversus were done using CT (abdominal and chest), radiography (chest and abdominal), and abdominal ultrasound, with prevalence of 49.3%, 22.7%, and 14.1%, respectively. MRI (6.4%), echocardiography (6.1%), and electrocardiography (9.5%) are important but less common diagnostic methods for situs inversus. MRI is usually reserved for difficult cases [16] Electrocardiography is useful in the diagnosis of dextrocardia because it shows an inversion of the electrical waves [9]. Echocardiography, as well as MRI, helps with diagnosing other congenital cardiac abnormalities associated with situs inversus [12], [16]. Furthermore, when a patient has situs inversus, radiographers, radiologists, and physicians should make efforts to connect with them and explain the situation in detail so that they are completely informed and are able to convey this information to their future health care providers in their own best interest [4]. This will help to avoid misinterpretation and misdiagnosis. Finally, we wish to emphasise the correct and consistent use of agreed methods, annotations, and image orientation as critical components in determining situs inversus totalis. Most individuals with situs inversus can live a normal life without symptoms or disability [1] [10]. However, there are a lot of comorbidities of varying frequency associated with situs inversus [1] [15]. Kartagener syndrome is a genetic condition characterised by a triad of situs inversus, bronchiectasis, and sinusitis, and 20% of patients who have situs inversus have Kartagener syndrome [16] [17].

CONCLUSION

Situs inversus totalis is a rare congenital anomaly that is compatible with life and may not be diagnosed until adulthood. It may, however, lead to misdiagnosis if careful investigations are not conducted. Therefore, it is necessary for clinicians and medical imaging practitioners to be diligent once a clue to this anomaly is noted. There is a need to employ additional diagnostic imaging modalities to ensure accuracy in locating organ positions and functions.

It is important to fully enlighten patients once ‘situs inversus totalis’ is discovered. This awareness about their own condition equips them to give information to their future health care providers, thereby preventing misdiagnosis or the wrong treatment.

Furthermore, an early establishment of 'situs inversus totalis' allows comparative imaging studies to be conducted in the future.

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