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Agenesis of Abdominal Organs: A Radiological Case Series

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ABSTRACT

Aim of Study: To evaluate the radiological findings, clinical presentations, and compensatory mechanisms associated with congenital anomalies such as left liver lobe agenesis, dorsal pancreatic agenesis, gallbladder agenesis, and duplex collecting system with ectopic ureter insertion in adult patients. **Introduction:** Congenital anomalies of the liver, pancreas, and gallbladder are rare but clinically significant due to their variable presentations and impact on organ function. These anomalies are often undetected until adulthood and typically discovered incidentally during radiological evaluations. **Case Descriptions:** Case 1: A 35-year-old female with urinary incontinence was referred for radiological evaluation and had no significant medical history. Case 2: A 45-year-old female with recurrent diffuse abdominal pain for one year sought consultation. She had occasional abdominal discomfort but no other systemic symptoms. Case 3: A 40-year-old female with right upper quadrant pain, dyspepsia, and bloating presented with no prior surgeries, incisional scars, or family history of congenital anomalies. Physical examination revealed no jaundice or pallor. The patient exhibited mild tenderness in the right hypochondrium without any signs of guarding. Laboratory investigations, including liver function tests, were normal. **Clinical Significance:** This report highlights the clinical importance of recognizing rare congenital anomalies like left liver lobe agenesis, dorsal pancreatic agenesis, and gallbladder agenesis, which can mimic common conditions and complicate diagnosis. These anomalies, often detected incidentally, require careful imaging interpretation (CT, ultrasound) to avoid misdiagnosis and unnecessary procedures. Early detection and accurate imaging improve diagnosis and patient care. **Conclusion:** Advanced imaging techniques are essential for accurate diagnosis and management, aiding in differentiating congenital agenesis from other pathologies and understanding compen satory organ adaptations.

INTRODUCTION

Congenital anomalies of the liver, pancreas, and urinary systems are rare but can have significant clinical implications due to their varied presentations and potential impact on organ function [1]. These anomalies may often go undetected until adulthood, where they present as incidental findings during radiological evaluations for unrelated symptoms [2]. Understanding these anomalies is crucial for accurate diagnosis, management, and avoidance of unnecessary interventions.

Among the rare congenital conditions, left liver lobe agenesis dorsal pancreatic agenesis, gall bladder agenesis and anomalies of the urinary collecting system such as duplex systems with ectopic ureter insertion stand out due to their infrequent occurrence and the compensatory mechanisms the body employs in response to their absence [3]. These congenital anomalies can lead to varied symptoms ranging from urinary incontinence, recurrent abdominal pain, and dyspeptic issues to more serious complications if left undetected [4].

The role of radiological imaging is paramount in identifying these anomalies, as physical examination and initial clinical assess ments may not always provide definitive answers [6]. Advanced imaging techniques such as ultrasonography (USG), computed tomography (CT), and magnetic resonance imaging (MRI) enable precise identification of these anomalies, allowing clinicians to differentiate between congenital agenesis and other pathological conditions such as organ atrophy [6].

This preset study aims to evaluate the radiological findings and clinical presentations associated with congenital anomalies such as left lobe liver agenesis, dorsal pancreatic agenesis, gall bladder agenesis and duplex collecting system with ectopic ureter insertion in adult patients. Additionally, it seeks to document the compensatory mechanisms of adjacent organs, which play a significant role in mitigating the functional impact of these anomalies. By exploring the clinical and radiological features of these conditions, this study aims to contribute to the understanding of their diagnosis, management, and potential long-term health implications. This aim of present case study to evaluate the radiological findings, clinical presentations, and compe nsatory mechanisms associated with congenital anomalies such as left lobe liver agenesis, dorsal pancreatic agenesis, gall bladder agenesis and duplex collecting system with ectopic ureter insertion in adult patients.

Case Description

Case 1:

A 35-year-old female patient presented to the Surgery Department at MLB Medical College with complaints of urinary incontinence. She was subsequently referred to the . Department of Radiodiagnosis for further evaluation. The patient had no prior history of surgery, hospitalization, or known illnesses.

CT scan imaging

On CT there is non-visualization of any hepatic tissue on the left side of the gallbladder (segments 2, 3, 4), Only the right branch of the portal vein was visualized, with the left branch of the portal vein absent and also there is a Compensatory hypertrophy of the right lobe of the liver was noted. Additionally, CT urography revealed a duplex collecting system with ureter duplication on the left side. The upper moiety showed a severely dilated ureter with ectopic insertion into the vagina, with no contrast excretion on delayed images. Marked focal parenchymal atrophic changes were observed in the upper pole of the left kidney, while the lower moiety exhibited normal features.

This case highlights the congenital nature of the anomaly and the compensatory mechanisms the body utilizes to adapt to the absence of the left hepatic lobe

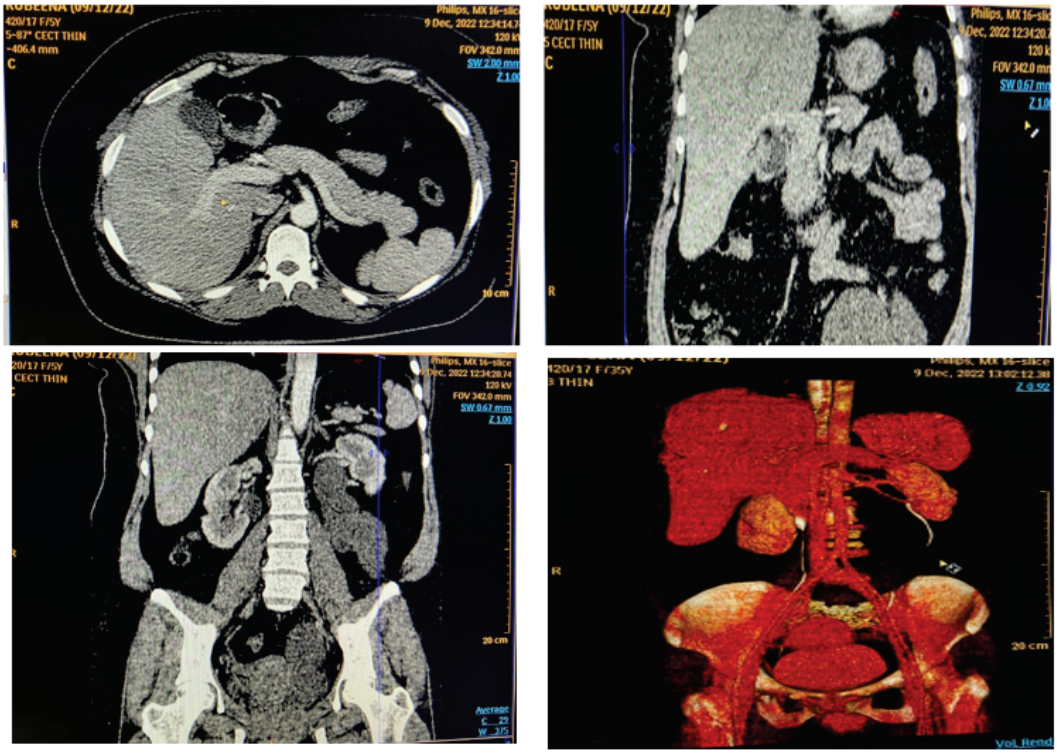


Figure 1: The CT scan in **[A]** and **[B]** shows the absence of hepatic tissue on the left side of the gallbladder, specifically affecting liver segments 2, 3, and 4, with compensatory hypertrophy of the right lobe and an absent left branch of the portal vein. **[C]** depicts CT urography findings of a duplex collecting system with ureteral duplication on the left side, where the upper moiety exhibits a severely dilated ureter with ectopic insertion into the vagina, leading to chronic hydroureter and megaureter, along with focal renal parenchymal atrophy at the upper pole. **[D]** presents a 3D volume image showing the absence of hepatic tissue on the left side of the gallbladder, with missing liver segments 2, 3, and 4, and compensatory hypertrophy of the right lobe.

Case 2

A 45-year-old female patient, presenting with a history of recurrent diffuse abdominal pain for the past one year, was referred to the Department of Radiology at Maharani Laxmi Bai Medical College, Jhansi. The patient reported no significant past medical history apart from occasional abdominal discomfort, and no other systemic complaints were noted.

Ultrasonography

On USG examination the pancreatic head and uncinate process were visualized and appeared normal. However, there was no visualization of the pancreatic neck, body, and tail suggesting the possibility of dorsal pancreatic agenesis. Additionally, a large cystic lesion with internal echoes was identified in the left iliac fossa, measuring approximately 7x3x9 cm. on CECT scan confirmed the diagnosis of dorsalpancreatic agenesis with normal appearance of the head and uncinate process. There was no visualization of the pancreatic body and tail, consistent with dorsal pancreatic agenesis. Also a large mesenteric cyst measuring 7x3x9 cm was also observed in the left iliac fossa. The patient was otherwise asymptomatic apart from her abdominal pain, and her laboratory investigations did not indicate hyperglycemia or other abnormalities commonly associated with this congenital anomaly.

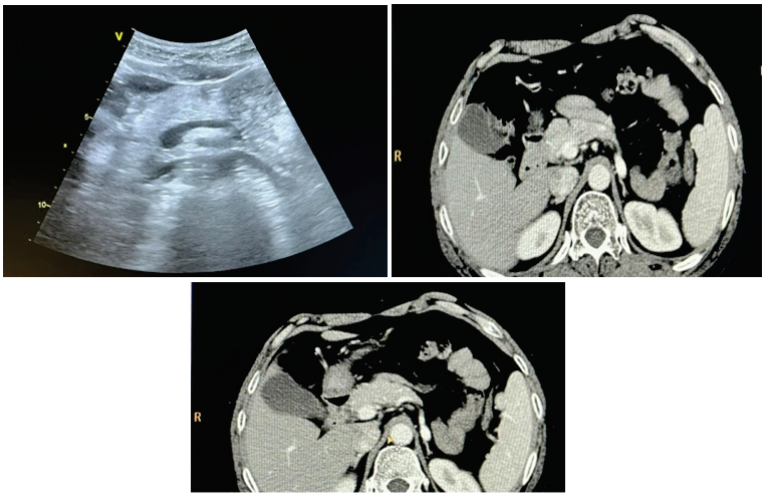


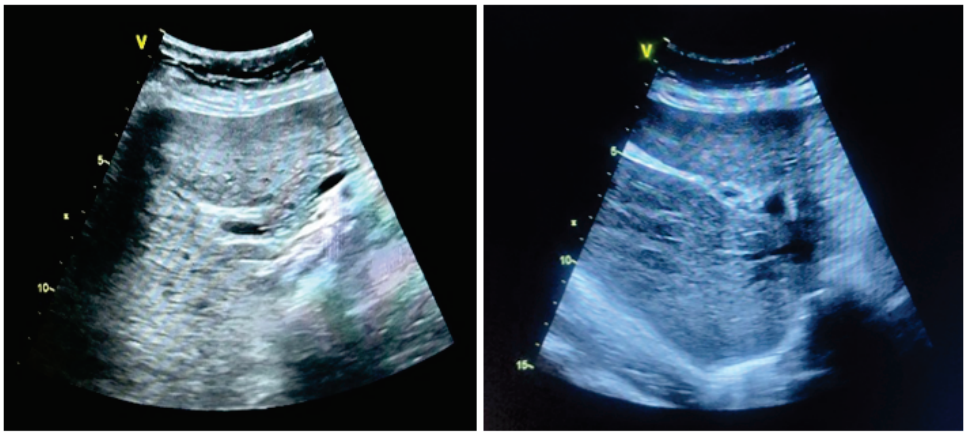
Figure 2: [A] shows a short, rounded pancreatic head adjacent to the duodenum, with the absence of the pancreatic neck, body, and tail, indicating a possible anatomical anomaly or pathology**. [B]** is an CECT section image that highlights the head and uncinate process of the pancreas in detail. Similarly, **[C]** presents another CECT section image, also focusing on the pancreatic head and uncinate process, further emphasizing the absence of the neck, body, and tail.

Case 3

The patient, a 40-year-old female, presented to the radiology department with complaints of right upper quadrant discomfort, recurrent dyspeptic symptoms, and bloating. Notably, she had no prior surgical history and no incisional scars were observed. Additionally, there was no family history of congenital anomalies or syndromes. on physical examination, no signs of jaundice or pallor were noted. The patient exhibited mild tenderness in the right hypochondrium without any signs of guarding. Laboratory investigations, including liver function tests, were normal.

Ultrasonography

USG whole abdomen was performed, which revealed normal echotexture of the solid abdominal organs. However, the gallbladder was not visualized in the gallbladder fossa. Even after overnight fasting, intended to aid visualization of the gallbladder, it remained non-visible on repeat ultrasound examination. CECT abdomen was done to further evaluate the condition, which confirmed the absence of the gallb ladder in the gallbladder fossa, with no evidence of stones or inflammation in the pericholecystic region. The common bile duct, hepatic duct, and other biliary structures appeared normal, and there was no dilation of the biliary tree or choledocholithiasis. Additionally, the pancreatic paren - chyma and duct appeared normal, and no signs of inflammation or fluid accumulation were noted in the peritoneal cavity.



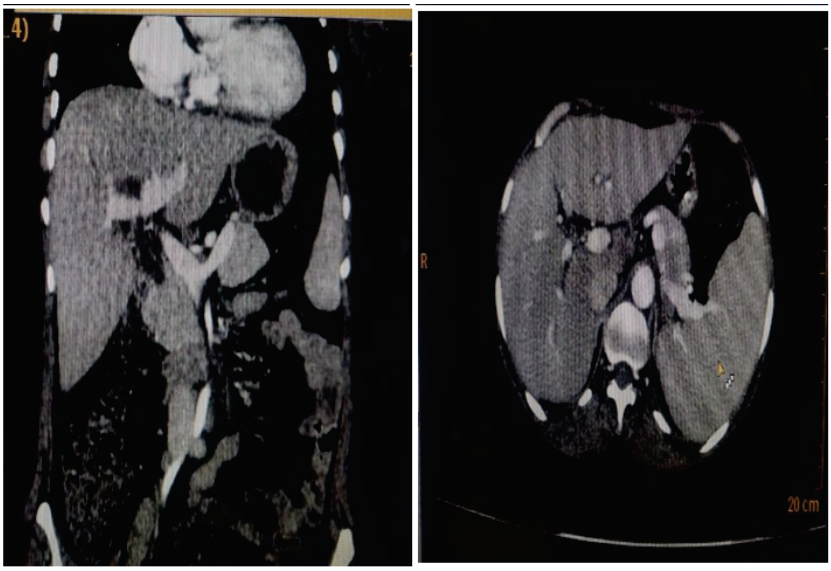


Figure 3: [A] A longitudinal ultrasound (USG) reveals the non-visualization of the gallbladder (GB) with a normal common bile duct (CBD). **[B]** A transverse USG confirms the absence of the GB in the GB fossa. **[C] and [D]** The contrast-enhanced computed tomography (CECT) of the abdomen demonstrates the complete absence of the gallbladder.

DISCUSSION

The case report on left liver lobe agenesis highlights a rare congenital anomaly, which has significant implications for patient management, especially in clinical settings where differential diagnosis plays a crucial role. Left liver lobe agenesis is an uncommon condition, with very few cases documented in the literature. The case at hand reinforces the necessity of understanding this anomaly in detail to avoid misdiagnosis with liver atrophy, which can present similarly on imaging [7].

The pathogenesis, as supported by the first case, points toward embryonic developmental anomalies, possibly due to defects in the umbilical vein, portal venous segment abnormalities, or thrombosis [8]. While most patients with hepatic lobe agenesis are asymptomatic, this case underlines the importance of incidental findings during imaging, as the patient initially presented with urinary incontinence—a symptom unrelated to liver pathology, yet critical in leading to the diagnosis of liver agenesis [9]. This reflects the unpredictable presentation of such congenital anomalies, making it necessary for clinicians to consider broader differential diagnoses when encountering atypical imaging findings. The imaging results, particularly from CT clearly demonstrated the absence of liver tissue on the left side of the gallbladder fossa, a classic sign of hepatic lobe agenesis. The non-visualization of the left branch of the portal vein further supports the diagnosis, while compensatory hypertrophy of the right lobe provides an adaptive physiological response to the anomaly [10]. The radiological differentiation between atrophy and agenesis, as achieved in this case, becomes particularly significant when deciding on patient manage - ment strategies, as atrophy may indicate ongoing liver disease, whereas agenesis is a static congenital condition. Additionally, the association of hepatic agenesis with other congenital anomalies, such as the duplex collecting system and ureter duplication noted in this case, underscores the importance of a comprehensive anatomical evaluation in patients with one congenital defect [11]. This aligns with literature suggesting that congenital anomalies tend to cluster within organ systems, which can complicate clinical presentations but also provides opportunities for early detection and management of otherwise asymptomatic conditions.

In the second case of dorsal pancreatic agenesis is an exceptionally rare congenital anomaly caused by the failure of the dorsal pancreatic bud to develop during embryo - genesis [12]. This defect leads to the absence of the pancreatic neck, body, and tail. The condition was first described in 1911, and since then, approximately 100 cases have been reported in medical literature [13]. Most cases are incidentally discovered during imaging for unrelated complaints, as was the case with our patient, a 45-year-old female who presented with recurrent abdominal pain [14]. Patients with dorsal pancreatic agenesis may be asympto - matic or may present with non-specific symptoms such as abdominal discomfort, as seen in our patient. While dorsal pancreatic agenesis can be associated with diabetes mellitus and chronic pancreatitis due to the reduction in functional pancreatic tissue, our patient exhibited no signs of hyperg - lycemia or pancreatitis, making this case more unusual [15].

Imaging plays a crucial role in diagnosing this condi tion. In our case, ultrasonography (USG) revealed the absence of the pancreatic neck, body, and tail, prompting further investigation. The subsequent contrast-enhanced CT (CECT) scan confirmed the diagnosis of dorsal pancreatic agenesis. Additionally, a large mesenteric cyst was noted in the left iliac fossa, which, though asymptomatic, is a rare association with this congenital anomaly. The cyst measured

7x3x9 cm and was identified as a mesenteric cyst, a lesion of uncertain origin that could have resulted from lymphatic malformation or mesothelial proliferation. The management of asymptomatic cases of dorsal pancreatic agenesis with mesenteric cysts typically involves observation and regular follow-up [16]. However, intervention may be required if the patient becomes symptomatic or if the cyst demonstrates signs of infection, rapid growth, or other complications. In symptomatic cases or those complicated by pancreatitis, surgical resection or drainage may be warranted. Our patient remains under observation, and given her relatively stable condition, no immediate intervention has been pursued.

In third case of gallbladder agenesis is a rare congenital anomaly with an incidence of less than 0.1%, more commonly seen in females [17]. Its presentation often mimics common biliary conditions like cholecystitis or gallstone disease, making diagnosis challenging. In this case, a 40-year-old female presented with symptoms suggestive of chronic cholecystitis, but imaging revealed the absence of a gallbladder. Ultrasound and CECT confirmed the diagnosis of gallbladder agenesis, ruling out other possibilities such as stones or inflammation. This diagnosis was crucial as it prevented unnecessary surgical intervention [18]. Gallbladder agenesis can be associated with other congenital anomalies, but this patient did not present with such conditions. Awareness of gallbladder agenesis and thorough imaging are essential for accurate diagnosis [19]. This case highlights the importance of considering congenital anomalies in the differential diagnosis of biliary symptoms, as timely diagnosis avoids the risks of unnecessary surgery.

Clinical Significance

This case report underscores the critical clinical importance of recognizing rare congenital anomalies such as left liver lobe agenesis, dorsal pancreatic agenesis, and gallbladder agenesis, which can present diagnostic challenges by mimicking more common conditions. These anomalies, often discovered incidentally, highlight the need for clinicians to broaden their differential diagnoses, particularly when imaging reveals atypical findings. Accurate interpretation of imaging, including CT and ultrasound, is key in differentiating congenital agenesis from acquired conditions like liver atrophy or chronic chole cystitis, thus preventing unnecessary procedures or mismana gement. The presence of associated anomalies, such as the duplex urinary system and mesenteric cysts, emphasizes the importance of comprehensive anatomical evaluation in patients with congenital defects, as they often cluster within organ systems. This case also illustrates the value of a tailored, conservative management approach, with observation being the preferred strategy for asymptomatic patients. Overall, the report reinforces the need for heigh tened awareness of these rare congenital anomalies, as early detection and appropriate imaging can lead to accurate diagnoses, avoid overtreatment, and enhance patient care.

CONCLUSION

Left liver lobe agenesis highlights the need for vigi-lance in diagnosing rare congenital anomalies, emphasizing the importance of distinguishing it from liver atrophy for proper management. Early detection can prevent misdia - gnosis and improve outcomes. Dorsal pancreatic agenesis, often seen in patients with nonspecific abdominal pain and normal lab results, requires ultrasonography and contrast-enhanced CT for diagnosis. A large mesenteric cyst, though rare, warrants further investigation. Gallbladder agenesis, a rare anomaly often mimicking chronic cholecystitis, underscores the need for accurate preoperative diagnosis to prevent unnecessary surgery. Timely imaging and follow-up are essential for effective management.

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Definition of intellectual content, Literature survey, Prepared first draft of manus cript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article, Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision, Design of study, statistical Analysis and Interpretation, Review Manuscript, Review Manuscript, Literature survey, Coord - ination and Manuscript revision

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