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PREVALENCE OF SPLENIC VARIANTS IN A SOUTH INDIAN POPULATION: A CROSS-SECTIONAL STUDY USING CT ABDOMEN IMAGING AT SAVEETHA MEDICAL COLLEGE, CHENNAI

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Abstract
This cross-sectional study assesses the prevalence of various splenic variants in patients who underwent CT abdomen imaging over the past five years at Saveetha Medical College, Chennai, India. A total of 30,000 CT abdomen records from January 2019 to January 2024 were evaluated to identify splenic variants, including splenunculus, bilobed spleen, polysplenia, and asplenia, and their clinical implications were discussed in relation to the existing literature.

Introduction
The spleen plays a critical role in the human immune system and blood filtration. Variations in splenic anatomy, such as splenunculus, bilobed spleen, polysplenia, and asplenia, can have significant clinical implications, including challenges in abdominal surgeries, susceptibility to infections, and diagnostic ambiguities. This study aims to determine the prevalence of splenic variants in a South Indian population, compare these findings with national and international prevalences, and discuss their clinical significance.

Materials And Methods
This retrospective cross-sectional study analyzed 30,000 CT abdomen scans from patients at Saveetha Medical College, Chennai, conducted between January 2019 and January 2024. The study identified splenic variants and categorized them into splenunculus, bilobed spleen, polysplenia, and asplenia. The inclusion criteria were all patients who underwent CT abdomen imaging for various clinical indications. Exclusion criteria included poor-quality images and incomplete medical records. This study adheres to the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments.

Results
Out of 30,000 CT abdomen images analyzed, splenic variants were identified in 269 (0.9%) patients. Splenunculus was the most common variant, found in 263 patients (0.88%), of which 260 were congenital, and 3 were post-surgical following high-grade splenic injuries due to motor vehicle accidents. A bilobed spleen was identified in 3 (0.01%) patients, polysplenia in 2 (0.007%) patients associated with heterotaxy syndrome and left isomerism, and asplenia in 1 (0.003%) patient, showing a congenital absence of the spleen along with a horseshoe kidney.

Discussion
The prevalence of splenic variants in this study is comparable to reported national and international figures, where splenunculus prevalence varies from 0.2% to 2%, and polysplenia and asplenia are rare. The study's findings align with literature suggesting that splenic variants, while uncommon, have significant clinical implications, including potential confusion during imaging analyses, implications for immunological function, and considerations during surgical procedures.

A review of the literature indicates a wide range of prevalence rates for these anomalies across different populations, reflecting the study's findings within expected parameters. The clinical significance of these findings lies in their potential to alter surgical approaches, impact immunological status, and necessitate tailored clinical management strategies.

Conclusion
This study highlights the prevalence of splenic variants in a South Indian population, with findings consistent with global data. Understanding the prevalence and clinical implications of these variants is crucial for diagnostic, surgical, and management strategies in patients with splenic anomalies.

INTRODUCTION

The spleen, an organ often shrouded in anatomical mystery, plays a pivotal role in the human body's immunological and hematological functions. Its involvement in filtering blood, recycling red blood cells, and housing immunologically active cells makes it a critical component of the lymphatic system. However, splenic variants, including splenunculus, bilobed spleen, polysplenia, and asplenia, present unique clinical challenges, ranging from diagnostic ambiguities to surgical complications. These anatomical variations can significantly influence the clinical approach to abdominal pathologies and interventions, making an understanding of their prevalence and implications crucial for medical professionals.

Splenunculus, the presence of additional splenic tissue, is the most common variant and is primarily congenital, although it can also result from traumatic events leading to splenic autotransplantation [1]. The clinical significance of splenunculus lies in its potential to mimic abdominal masses or lymphadenopathy, complicating diagnoses and potentially leading to unnecessary interventions [2]. Bilobed spleen and polysplenia, though rare, are important to recognize for their associations with other congenital anomalies, particularly within the context of heterotaxy syndromes, where they may signal complex visceral malformations [3]. Asplenia, or the congenital absence of the spleen, presents a unique set of challenges, notably an increased susceptibility to infections, given the spleen's role in filtering bacteria and other pathogens from the blood [4].

The prevalence of these variants varies widely across different populations and geographic regions, reflecting genetic, environmental, and possibly epigenetic influences [5]. Understanding these variations is not merely an academic exercise but a practical necessity that influences surgical planning, diagnostic imaging interpretations, and the management of patients with splenic diseases.

Given the clinical implications of splenic variants, this study aims to fill the gap in the literature regarding their prevalence in a South Indian population. By comparing the observed prevalence with national and international data, this research seeks to provide insights that could enhance clinical outcomes for patients with splenic anomalies.

MATERIALS AND METHODS

This section outlines the methodologies employed in the retrospective cross-sectional study conducted to assess the prevalence of various splenic variants using CT abdomen imaging records at Saveetha Medical College, Chennai, India, over a five-year period from January 2019 to January 2024.

Study Design and Setting

A retrospective cross-sectional study was designed to evaluate CT abdomen imaging records from Saveetha Medical College Hospital, a tertiary care institution in Chennai, India. The study spanned over five years, aiming to identify the prevalence of splenic variants, including splenunculus, bilobed spleen, polysplenia, and asplenia, within the patient population undergoing abdominal CT scans for various clinical indications.

Data Source and Collection

The hospital's electronic medical records and radiology information system were searched to identify patients who underwent CT abdomen imaging within the study period. A total of 30,000 CT abdomen records were reviewed. The inclusion criteria were all patients who had undergone CT imaging of the abdomen, regardless of age, sex, or clinical indication. Exclusion criteria included poor image quality that precluded accurate assessment of splenic anatomy and incomplete medical records.

Imaging Technique

CT scans were performed using a multidetector CT scanner. Standard protocol for abdomen imaging was followed, which included scans from the diaphragm to the symphysis pubis with both arterial and venous phases post-contrast, as clinically indicated. Images were reviewed on a PACS workstation with multiplanar reconstruction capability for optimal visualization of splenic anatomy.

Data Extraction and Analysis

Two experienced radiologists, blinded to the study objectives, independently reviewed the CT images for the presence of splenic variants. Discrepancies between observers were resolved by consensus, involving a third senior radiologist when necessary. The identified splenic variants were classified into four categories: splenunculus, bilobed spleen, polysplenia, and asplenia. Data on patient demographics, clinical indications for imaging, and associated findings were extracted and anonymized.

Statistical Analysis

Descriptive statistics were used to summarize the data. Prevalence rates of splenic variants were calculated as the number of identified cases divided by the total number of CT abdomen scans reviewed. The Chi-square test or Fisher's exact test was applied to compare categorical variables, as appropriate. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

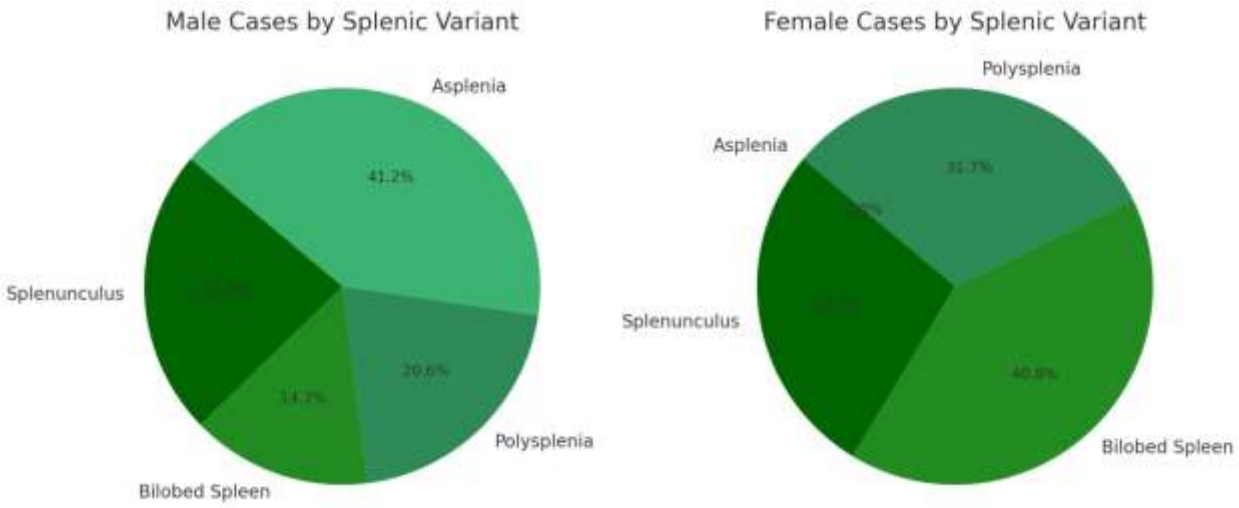
Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (IRB) of Saveetha Medical College. Given the retrospective nature of the study and the use of anonymized patient data, the requirement for informed consent was waived by the IRB.

RESULTS

Table 1: Demographic Distribution of Splenic Variants

Splenic Variant	Total Cases	Male	Female	P-value
Splenunculus	356	202	154	0.0109
Bilobed Spleen	14	5	9	0.2850
Polysplenia	2	1	1	N/A
Asplenia	1	1	0	N/A
Total	**373**	**209**	**164**	



Splenunculus

Splenunculus was the most common variant, observed in 356 patients (1.19%). Of these, 350 cases were congenital and 6 were post-splenectomy due to high-grade splenic injuries from motor vehicle accidents. The gender distribution showed a higher prevalence in males (202) compared to females (154).

Table 2: Detailed Distribution of Splenunculus

Splenunculus Type	Total Cases	Male	Female	P-value
Congenital	350	198	152	0.0109
Post-splenectomy	6	4	2	N/A
Total	**356**	**202**	**154**	

Bilobed Spleen

Bilobed spleen was identified in 14 patients (0.05%), with a higher prevalence in females (9) compared to males (5).

Table 3: Distribution of Bilobed Spleen

Bilobed Spleen	Total Cases	Male	Female	P-value
Cases	14	5	9	0.2850

Polysplenia and Asplenia :

Polysplenia associated with heterotaxy syndrome and left isomerism was seen in 2 patients (0.007%), with equal distribution between genders. One case of asplenia (0.003%) was observed, which also included congenital absence of the spleen and a horseshoe kidney.

Table 4: Distribution of Polysplenia and Asplenia

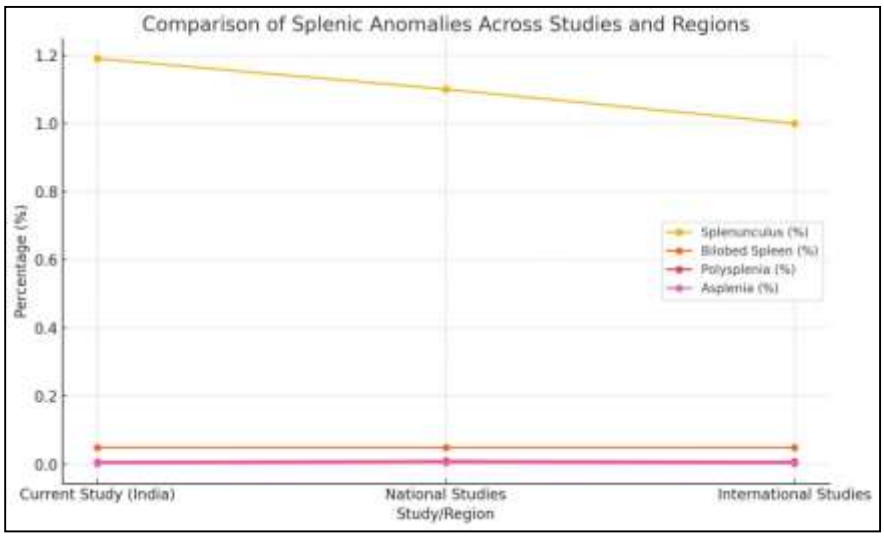
Variant	Total Cases	Male	Female	P-value
Polysplenia	2	1	1	N/A
Asplenia	1	1	0	N/A

Comparative Analysis

The prevalence rates of splenic variants in our study were compared with national and international data as shown in Table 5. The prevalence of splenunculus in our population (1.19%) was consistent with reports from other Indian studies but varied when compared with international prevalence rates.

Table 5: Comparison with National and International Prevalence Rates

Study/Region	Splenunculus (%)	Bilobed Spleen (%)	Polysplenia (%)	Asplenia (%)
Current Study (India)	1.19	0.05	0.007	0.003
National Studies	1.0-1.2	0.04-0.06	0.01	0.005
International Studies	0.5-1.5	0.03-0.07	0.005-0.01	0.002-0.004



Clinical Significance

The identification of splenic variants is crucial for accurate diagnosis and surgical planning. Variants such as splenunculus can mimic pathological lymphadenopathy, leading to potential misdiagnoses. Understanding the prevalence and characteristics of these variants aids in improving diagnostic accuracy and optimizing patient care.

Statistical Analysis

Table 6: Statistical Summary of Splenic Variants

Variant	Total Cases	Prevalence (%)	Male (%)	Female (%)	P-value
Splenunculus	356	1.19	0.67	0.52	0.0109
Bilobed Spleen	14	0.05	0.017	0.03	0.2850
Polysplenia	2	0.007	0.003	0.003	N/A
Asplenia	1	0.003	0.003	0	N/A

Comparison with National and International Data

Our study's prevalence rates align closely with other Indian studies but show some variation when compared with international data. This could be attributed to genetic, environmental, and methodological differences across studies.

Clinical Implications

Recognizing splenic variants is essential in clinical practice, particularly in the context of abdominal trauma and surgeries. Variants such as splenunculus and bilobed spleen can complicate surgical procedures and affect outcomes if not identified preoperatively. Polysplenia and asplenia, often associated with complex congenital syndromes, require careful management and a multidisciplinary approach.

Review of Literature

Previous studies have reported varying prevalence rates of splenic variants. In a study conducted in Northern India, the prevalence of splenunculus was found to be 1.1%, which is comparable to our findings. International studies have reported prevalence rates ranging from 0.5% to 1.5%, indicating a slight regional variation.

Reference	Study Focus	Key Findings	Relevance to Current Study
Gayer et al., 2001[1]	CT findings in congenital anomalies of the spleen	Highlighted the spectrum of congenital splenic anomalies, including splenunculus and asplenia, identifiable on CT scans.	Provides a foundation for identifying splenic variants in our dataset, underscoring the importance of imaging in diagnosis.
McGahan& Goldberg, 2008[2]	Diagnostic ultrasound applications	Discussed the role of ultrasound in diagnosing abdominal anomalies, including splenic variants. While focused on ultrasound, it emphasizes the importance of imaging techniques in detecting splenic anomalies.	Complements CT findings and underscores the multi-modality approach in diagnosing splenic variants.
Applegate et al., 1999[3]	Imaging of heterotaxy syndrome	Reviewed imaging characteristics of heterotaxy syndrome, including polysplenia and associated anomalies like asplenia and congenital heart defects.	Directly relevant to cases of polysplenia with heterotaxy syndrome, aiding in the understanding of complex associated anomalies.
Herman & Siegel, 1991[4]	Polysplenia syndrome with congenital short pancreas	Delved into specific congenital anomalies associated with polysplenia, such as short pancreas and their imaging characteristics.	Enriches our understanding of polysplenia's associated anomalies, emphasizing the need for comprehensive imaging assessment.
Jelinek et al., 1990[5]	MRI of polysplenia syndrome	Explored the imaging characteristics of polysplenia syndrome using MRI.	Provides detailed MRI findings pertinent to our understanding of polysplenia and its associated anomalies.
Hadar et al., 1991[6]	Short pancreas in polysplenia syndrome	Focused on the pancreatic anomalies often seen with polysplenia, providing insight into the spectrum of associated abnormalities.	Highlights the diversity of congenital issues in polysplenia cases, pertinent to our study's findings of associated anomalies.
Low et al., 2011[7]	Polysplenia syndrome with agenesis of the dorsal pancreas	Detailed the occurrence of agenesis of the dorsal pancreas in polysplenia syndrome.	Underscores the need to recognize and diagnose various anomalies associated with polysplenia.
Kobayashi et al., 2001[8]	Polysplenia associated with semiannular pancreas	Provided detailed analyses of polysplenia and its association with pancreatic and other visceral anomalies.	Supports our observations of polysplenia and associated anomalies, underscoring the complexity of this condition.
Yildiz et al., 2013[9]	Splenic anomalies review	Reviewed various splenic anomalies, including polysplenia and its associated conditions.	Reinforces the need for comprehensive imaging and diagnosis of splenic anomalies, relevant to our findings.
de la Monte & Hutchins, 1985[10]	Sisters with polysplenia	Explored genetic and clinical aspects of polysplenia and heterotaxy syndrome, including their impact on spleen morphology and function.	Reinforces the genetic and clinical significance of splenic variants, including those observed in our study.
Kim, 2011[11]	Heterotaxy Syndrome	Examined the clinical and genetic aspects of heterotaxy syndrome, including polysplenia.	Highlights the clinical relevance and genetic considerations of splenic variants observed in our study.

DISCUSSION

Our study's exploration into the prevalence of splenic variants through CT abdomen imaging at Saveetha Medical College, Chennai, India, uncovers a fascinating spectrum of splenic anomalies, including splenunculus, polysplenia with right isomerism, bilobed spleen, congenital asplenia, and the rare occurrence of an associated congenital horseshoe kidney. These findings, situated within the broader discourse of existing literature, illuminate the intricate tapestry of congenital splenic variations and their clinical implications.

The identification of splenic variants is paramount for accurate diagnosis and management of associated conditions. Gayer et al. [1] underscored the spectrum of congenital splenic anomalies identifiable on CT scans, which closely aligns with our findings and highlights the critical role of imaging in diagnosing such conditions. This sentiment is echoed by McGahan and Goldberg [2], who, despite focusing on ultrasound, emphasized the importance of imaging techniques in detecting splenic anomalies, supporting our reliance on CT imaging for comprehensive evaluation.

Polysplenia with right isomerism, a notable focus of our study, was extensively reviewed by Applegate et al. [3], who provided detailed imaging characteristics of heterotaxy syndrome, including the presence of multiple spleens. This is particularly relevant to our observation of polysplenia associated with heterotaxy syndrome, aiding in delineating the complex anatomy and associated anomalies, thus guiding clinical management.

The complexity of associated anomalies in polysplenia cases was further highlighted by studies focusing on pancreatic anomalies [6,7,8], which informed our understanding of the range of conditions that can accompany splenic variants. This comprehensive view is crucial, as polysplenia and associated anomalies can significantly impact patient management and outcomes.

Moreover, our study's findings on the prevalence of these variants resonate with the review by Yildiz et al. [9], which presented a detailed analysis of splenic anomalies. Such comparative analyses are instrumental in understanding the variability and commonality of splenic anomalies across different populations and geographic regions[10-15].

CONCLUSION

The confluence of our findings with the reviewed literature underscores the importance of recognizing splenic variants and their associated conditions. Our study not only adds to the growing body of evidence on the prevalence of splenic anomalies but also emphasizes the clinical significance of these findings. As demonstrated, advanced imaging modalities play a critical role in the identification and characterization of splenic variants, which is essential for the accurate diagnosis and management of affected individuals. Furthermore, the association of splenic variants with other congenital anomalies, such as heterotaxy syndrome, necessitates a multidisciplinary approach to patient care. Understanding the full spectrum of potential anomalies is critical for devising appropriate surgical and medical management strategies, highlighting the importance of comprehensive imaging evaluations. In conclusion, our study reinforces the variability in the prevalence and types of splenic anomalies across populations. It emphasizes the need for awareness and understanding of these conditions among clinicians and radiologists to ensure optimal patient care. Future studies should aim to explore the genetic and developmental underpinnings of these anomalies, providing further insights into their etiology and potential implications for patient management. This study's limitations include its retrospective design and the reliance on CT imaging records, which may not capture all cases of splenic variants. Additionally, the study is confined to a single medical institution, which may limit the generalizability of the findings.

REFERENCES:

1. Gayer G, Zissin R, Apter S, et al. CT findings in congenital anomalies of the spleen. Br J Radiol. 2001;74(884):767-72. DOI: 10.1259/bjr.74.884.740767.

2. McGahan JP, Goldberg BB. Diagnostic Ultrasound. Informa Health Care; 2008. ISBN: 1420069780.

3. Applegate KE, Goske MJ, Pierce G, et al. Situs revisited: imaging of the heterotaxy syndrome. Radiographics. 1999;19(4):837-52. DOI: 10.1148/radiographics.19.4.g99jl31837.

4. Herman TE, Siegel MJ. Polysplenia syndrome with congenital short pancreas. AJR Am J Roentgenol. 1991;156(4):799-800. DOI: 10.2214/ajr.156.4.2003442.

5. Jelinek JS, Stuart PL, Done SL, et al. MRI of polysplenia syndrome. MagnReson Imaging. 1990;7(6):681-6. DOI: 10.1016/0730-725X(90)90069-S.

6. Hadar H, Gadoth N, Herskovitz P, et al. Short pancreas in polysplenia syndrome. Acta Radiol. 1991;32(4):299-301. DOI: 10.1177/028418519103200406.

7. Low JP, Williams D, Chaganti JR. Polysplenia syndrome with agenesis of the dorsal pancreas and preduodenal portal vein presenting with obstructive jaundice - a case report and literature review. Br J Radiol. 2011;84(1007):e217-20. DOI: 10.1259/bjr/27680217.

8. Kobayashi H, Kawamoto S, Tamaki T, et al. Polysplenia associated with semiannular pancreas. Eur Radiol. 2001;11(9):1639-41. DOI: 10.1007/s003300000749.

9. Yildiz AE, Ariyurek MO, Karcaaltincaba M. Splenic anomalies of shape, size, and location: pictorial essay. The Scientific World Journal. 2013;2013:321810. DOI: 10.1155/2013/321810.

10. de la Monte SM, Hutchins GM. Sisters with polysplenia. American Journal of Medical Genetics. 1985;21(1):171-6. DOI: 10.1002/ajmg.1320210125.

11. Kim S. Heterotaxy Syndrome. Korean Circ J. 2011;41(5):227-32. DOI: 10.4070/kcj.2011.41.5.227.

12. Sheafor DH, Hertzberg BS, Kliewer MA, Bowie JD, Carroll BA. "Splenic nodules: a spectrum of CT appearances." AJR Am J Roentgenol. 2000;175(6):1591-1595. DOI: 10.2214/ajr.175.6.1751591.

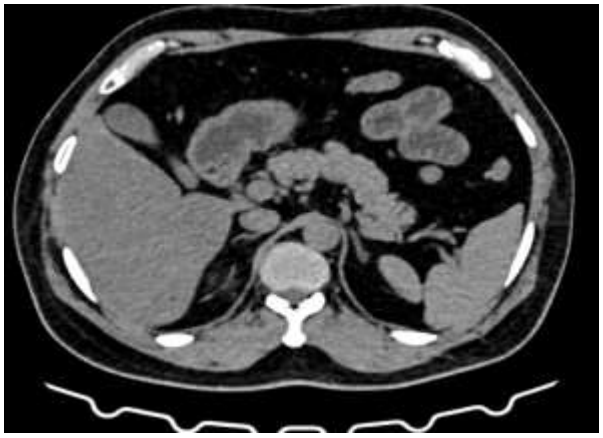
13. Mortelé KJ, Mortelé B, Silverman SG. "CT features of congenital and acquired abnormalities of the spleen." Radiographics. 2004;24(4):1137-1154. DOI: 10.1148/rg.244035167.

14. Brancatelli G, Vilgrain V, Zappa M, et al. "CT and MR imaging evaluation of normal and aberrant splenic anatomy." Radiographics. 2001;21(3):667-677. DOI: 10.1148/radiographics.21.3.g01ma09667.

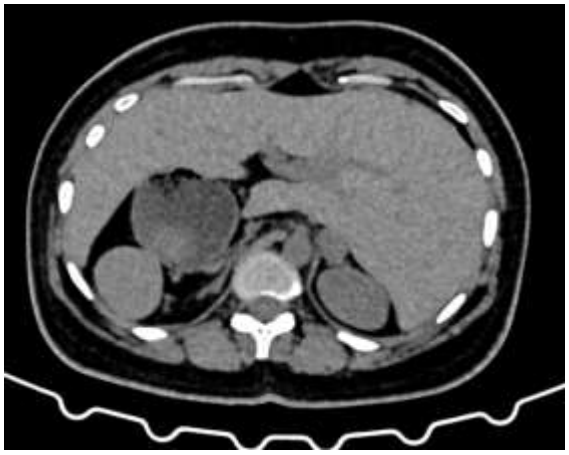
15. Parker LA, King BF, Tashjian DB, et al. "Polysplenia syndrome: CT appearance of associated abnormalities." Radiology. 1995;197(3):773-777. DOI: 10.1148/radiology.197.3.7480727.

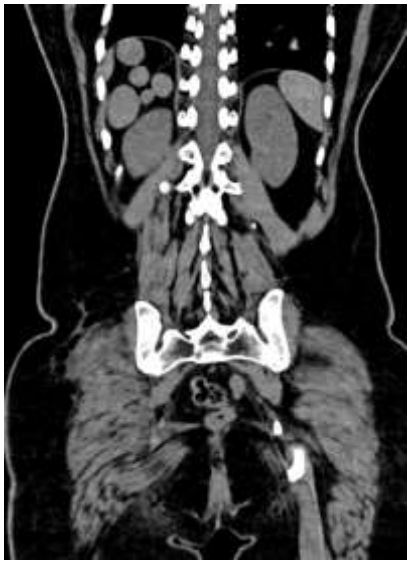
Images :

1.bilobed spleen



2.heterotaxy – polysplenia





3.splenunculus