Radiological aspects of intra-pancreatic spleen

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Abstract

The spleen, an accessory organ located within the pancreatic parenchyma, is a congenital anomaly of the splenic tissue with morphological and histological characteristics resembling a normal spleen, usually in the tail of the pancreas. The intra-pancreatic accessory spleen (IPAS) is mainly a benign lesion, being usually asymptomatic and found on imaging studies on an incidental basis, but which often raises concern about malignancy and may be radiographically indistinguishable from neuroendocrine tumors, pancreatic tumors, and adenocarcinomas. Therefore, the present study aims to report a case of IPAS using computed tomography (CT) and magnetic resonance (MR) imaging, in addition to correlating the radiographic findings of the case report with other radiological methods in the literature review. Information was obtained by reviewing medical records, conducting interviews with the patient, and using diagnostic photographs and laboratory data. In this context, the case report is of a male patient with previous history of renal cell carcinoma who had undergone total left nephrectomy and resection of retroperitoneal lymph nodes. Post-operative followed-up exams showed a nodular image in the pancreatic tail suggestive of metastasis, but whose correct diagnosis was possible by CT and MR studies as only an asymptomatic benign affection was shown, meaning that only a conservative intervention was necessary.

Keywords: Spleen, Neoplasms, Pancreas, Magnetic resonance imaging, Tomography.

INTRODUCTION

The spleen is an oval-shaped mass weighing about 150g, in general of a purplish color, with a fresh consistency and the size and shape of a closed hand. It is relatively delicate and considered the most vulnerable abdominal organ. The spleen is located in the upper lateral part of the upper left abdominal quadrant or hypochondrium, where it is also protected by the lower part of the thoracic chest, in addition to having diaphragmatic and visceral surfaces[1].

The spleen belongs to the mononuclear phagocytic system and is a secondary lymphoid organ playing an important role in organic defense through its filtration and phagocytic mechanisms, in addition to producing complementary and immunoglobulin factors, especially immunoglobulin M (IgM)[2].

Concerning the formation of the spleen, it is known that congenital alterations may occur during its embryonic development, such as the formation of accessory spleens, which are morphologically and functionally identical to the main spleen. These accessory spleens arise from the failure in the fusion of the splenic anlage, that is, they are splenic tissue separated from the main body of the organ, giving origin to the so-called accessory spleen (AS)[3].

In general, AS is found alone when recognized, but it may be linked to the spleen through thin bands of similar tissue. Although AS typically appears alone, other splenic foci may be found spread throughout the abdomen[3]. AS is frequently located in the splenic hilum or pancreatic tail, presenting as a solid mass measuring 1.5 to 3.0 cm surrounded by a well-defined fibrotic capsule separating it from the normal pancreatic tissue and whose shape may range from round to oval[2,4-6].

On the other hand, the intra-pancreatic accessory spleen (IPAS) is a type of accessory spleen located within the pancreatic parenchyma. IPAS is a benign lesion that is usually asymptomatic and incidentally found by imaging studies but which causes concern about malignancy because its radiological presentation may be almost indistinguishable from that of neuroendocrine tumors, pancreatic tumors, and adenocarcinomas[7].

About its incidence, IPAS is not a rare affection as it is usually underdiagnosed because its radiological diagnosis is difficult. According

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https://doi.org/10.11606/issn.2176-7262.rmrp.2023.188854

to a study reviewing the necropsy results of patients with the suspension of pancreatic lesions, 364 cases of accessory spleens were observed among the 2,700 patients evaluated, of which 16.75% were located in the pancreatic tail. Another study estimated that AB affects 10-30% of the general population, mostly located in the splenic area above the left renal vein in about 75% of the cases. Nevertheless, this tissue is located in the caudal segment of the pancreas in 16% of the cases, in addition to being found on the walls of the stomach and intestine, mesentery, omentum, and even at distant sites such as the pelvis and testicular pocket[8,9].

Many patients are submitted to pancreatectomy unnecessarily because of incidental findings suggestive of malignancy, after which histopathological examination shows that the tissue was actually similar to that of the spleen. In view of this problem, this study is aimed at describing the CT and MR imaging features of a case of IPAS. As the intra-pancreatic splenic tissue still represents a disease of difficult radiographic diagnosis, it is also difficult to perform studies with a great number of cases. In this way, case report studies like the present one can contribute to the literature and thus improve the understanding of the radiological characteristics of this condition.

METHODS

This study aims to report a case of the intra-pancreatic accessory spleen in which quantitative and qualitative data collected from real situations were used as a research method to explain, explore or describe current phenomena in their context.

For this, the patient's medical record was analyzed, the patient was interviewed, and the CT and MR images of the patient were evaluated.

This study meets the requirements set by the Helsinki Declaration and the National Health Council according to resolution 196/96, in which the patient's anonymity and the information obtained in the present study, are guaranteed. Also, it should be emphasized that this project was approved by the Research Ethics Committee of the Faculty of Human, Economic and Health Sciences of Araguaína (*FAHESA/ITPAC*) according to the protocol numbers CAAE 28978820.9.0000.0014 and 4.061.123. Therefore, data were analyzed only after approval of the study in order to ensure that all requirements for human research have been met accordingly.

CASE REPORT

A 72-year-old male patient born in the town of Luis Correia, State of Piauí, sought medical care for left lumbar pain, weakness, and weight loss, including macroscopic hematuria, in the past three months. Physical exam showed a palpable mass with hard consistency on the left side and well adhered to the deep planes. A radiological investigation was performed using computed tomography (CT) with heterogeneous contrast impregnation, which showed an extensive lesion affecting the left kidney, including signs of invasion of the collecting system suggestive of renal cell carcinoma.

The patient was referred to the Getúlio Vargas Hospital in Teresina for a total left nephrectomy and resection of retroperitoneal lymph nodes. Anatomopathological analysis revealed a subtype of clear cells with free margins and lymph nodes, thus indicating a grade-3 malignancy according to Fuhrman's grading system.

There was no complication after the surgical procedure, and no adjuvant treatment was necessary either. A new CT examination of the abdomen and routine laboratory exams were performed. The CT results revealed no evidence of the disease, but a nodular image in the adjacent pancreatic tail measuring about 1.9 cm and with an enhancement similar to that of the spleen was observed in all phases of the study. (Figure 1 – Before infusion of contrast material; Figure 2 – Portal phase; and Figure 3 – Arterial phase).

Given the suspicion of IPAS after the tomographic analysis, a magnetic resonance examination of the whole abdomen at T1 and T2 (Figures 4 and 5, respectively) was performed, and the diagnostic impression was of a nodular image in the pancreatic tail with signal and enhancement patterns similar to those of the spleen, thus indicating the presence of IPAS.

The evolution control of the pancreatic lesion was performed after six months employing a new MR examination of the upper abdomen (Figure 6), which showed no change in its dimensions and characteristics, thus confirming the suspicion of IPAS.

DISCUSSION

The tomographic pattern of the IPAS depends on the phases used in triphasic tomography. Using the contrast medium uptake in the arterial, pancreatic,

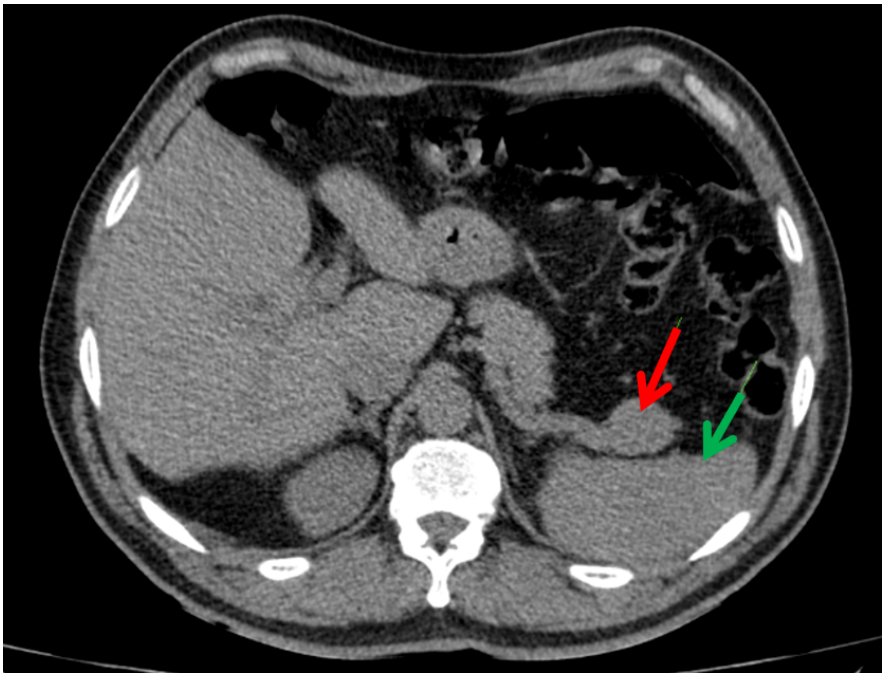

Figure 1: CT of the upper abdomen in the axial plane before contrast infusion showing a nodular image (red arrow) in the adjacent pancreatic tail measuring about 1.9 cm with iso-attenuation compared to pancreas and spleen (green arrow).

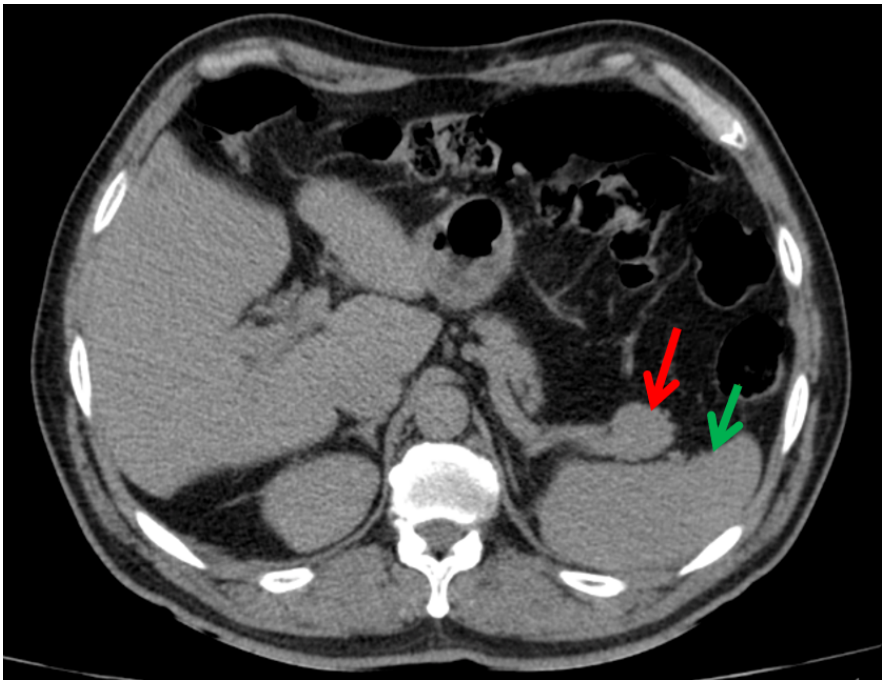

Figure 2: CT of the upper abdomen in the axial plane after contrast infusion in the portal phase showing a nodular image (red arrow) in the adjacent pancreatic tail with enhancement similar to that of the spleen (green arrow) and high attenuation compared to the pancreas.

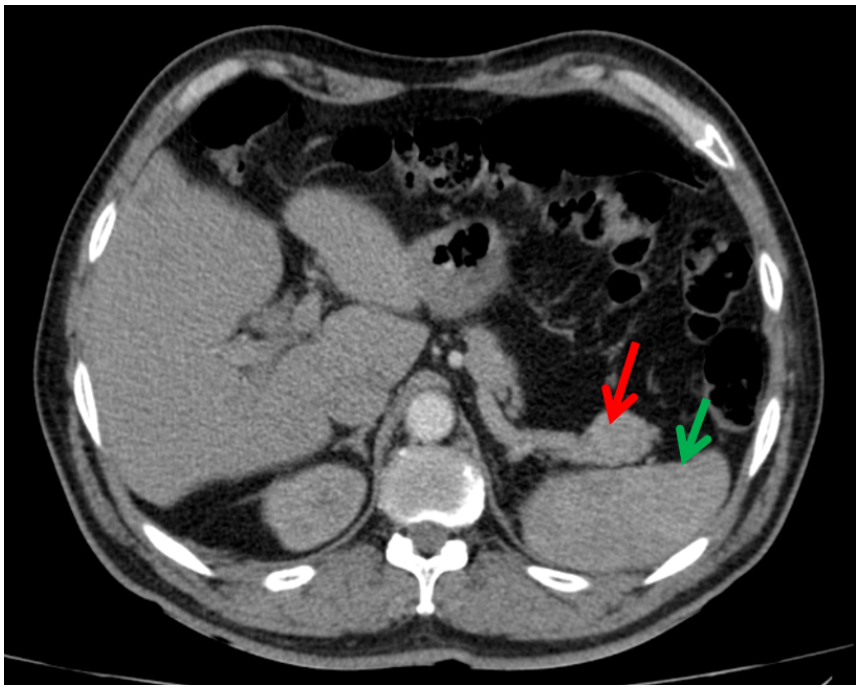

Figure 3: CT of the upper abdomen in the axial plane after contrast infusion in the arterial phase showing a nodular image in the adjacent pancreatic tail (red arrow) with enhancement similar to that of the spleen (green arrow) and high attenuation compared to the pancreas.

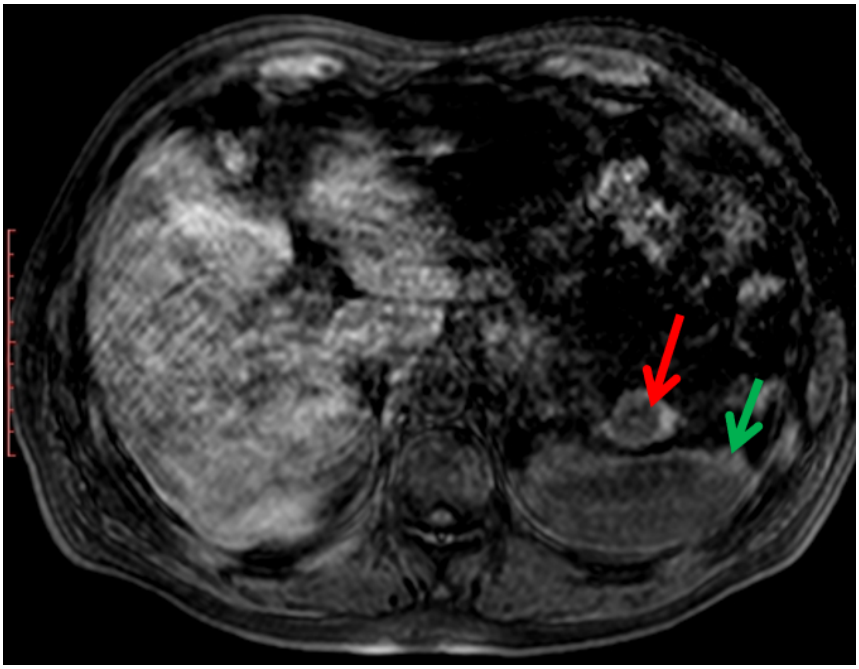

Figure 4: T1-weighted magnetic resonance (MR) examination, without contrast material, revealed a nodular image in the pancreatic tail (red arrow) and showed signal and enhancement patterns similar to those of the spleen (green arrow) and hypo-intensity compared to the pancreatic parenchyma.

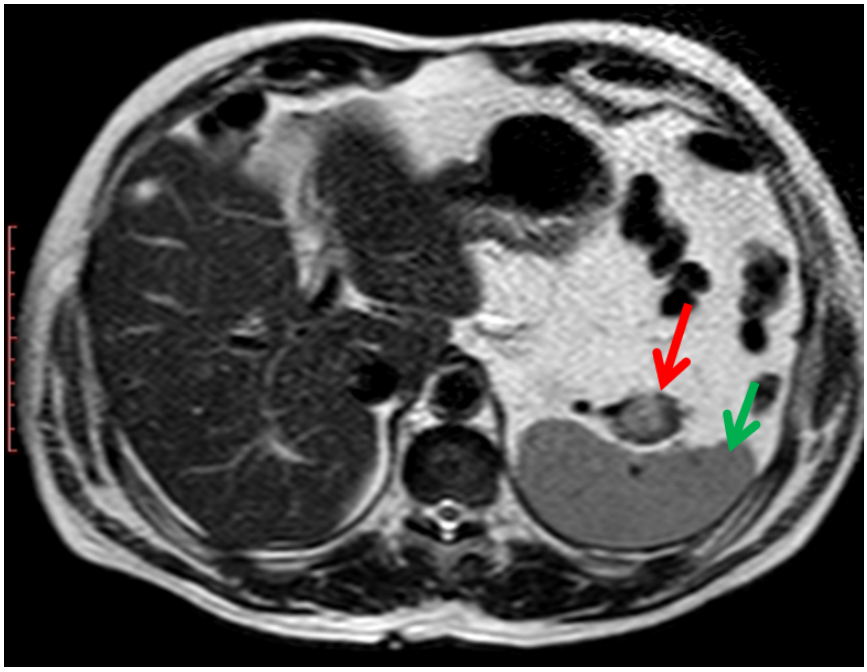

Figure 5: T2-weighted magnetic resonance (MR) examination, with contrast material, revealing a nodular image in the pancreatic tail (red arrow) and showing signal and enhancement patterns similar to those of the spleen (green arrow), moderately heterogeneous hyperintensity compared to the pancreas, which is more probably related to IPAS.

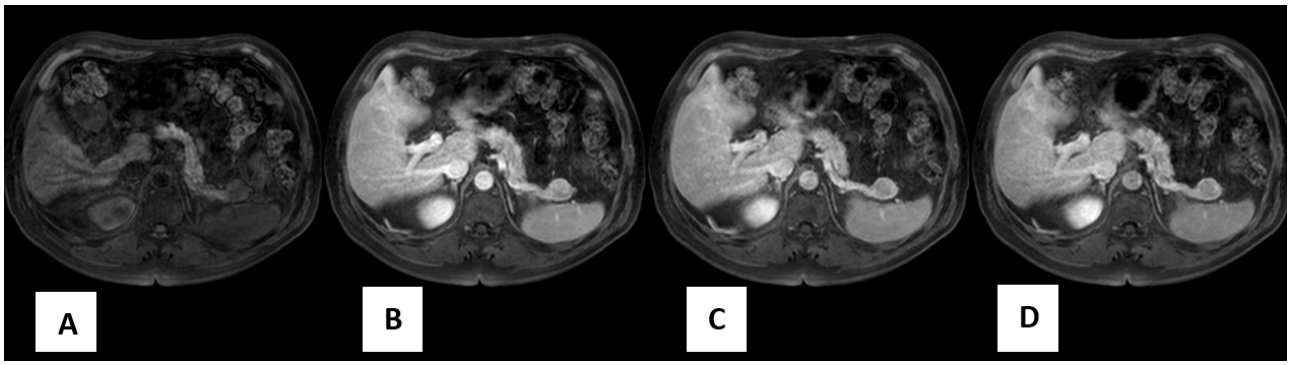

Figure 6: MR of the upper abdomen with contrast material in the axial plane before contrast infusion (A) and in the arterial phase (B), portal phase (C), and late phase (D), revealing that there was no change in the dimensions and characteristics of the pancreatic nodule, thus confirming the benignity of the lesion, that is, an IPAS.

and portal phases one can evaluate the differentiation of this benign lesion from other pancreatic masses[4].

Baugh et al. developed a multidisciplinary algorithm for the evaluation of incidental pancreatic lesions, and they emphasized that the use of CT is important in these investigations because all pancreatic masses should be evaluated with a triphasic CT, meaning that tomographic analysis was the first modality to be used in the pancreatic imaging protocol[10].

IPAS was described as a well-circumscribed mass characterized by heterogeneous enhancement or zebra-stripe pattern in the initial phase due to the different flow rates through the red and white pulp elements. Another CT examination showed that the presence of this tomographic aspect in the arterial phase in association with an increase in the serpiginous heterogeneous aspect of the normal spleen provides a significant diagnostic value for confirmation of IPAS[6, 11].

Bhutani et al. conducted a retrospective study of seven patients diagnosed with IPAS and confirmed that the radiological presentation of the disease in the arterial phase of contrast CT is, in the majority

of cases, of a uniformly hypervascular lesion in the distal pancreas with radiodensity comparable to that of the spleen, which may be associated with a negative biopsy for malignant cells. In view of these findings, therefore, the authors concluded that the radiological diagnosis of IPAS should be strongly considered by surgeons and radiologists[12].

Considering other CT examinations in the venous and excretory phases, Ding et al. added that there was a homogeneous enhancement in the orthotopic spleen as well as a heterogeneous increase concerning the surrounding pancreatic tissue in the venous phase and a reduced enhancement in the excretory phase[13].

Therefore, the tomographic pattern is repeatedly described in the studies as a lesion in the pancreatic tail with high attenuation concerning the pancreas in all phases but with the same enhancement pattern in relation to the normal splenic tissue[13]. The above-cited tomographic findings are briefly listed in Table I.

Nuclear magnetic resonance (NMR) is another imaging modality commonly used to characterize pancreatic masses[10]. In this modality, IPAS had the same signal intensity of the spleen in all sequences, thus representing an important pattern for diagnosis. T1-weighted images without contrast showed that IPAS has a hypointense signal concerning the adjacent pancreatic parenchyma. In contrast, the T2-weighted sequences with contrast or without fat saturation showed an isointense or hyperintense aspect of the pancreas[14].

Trindade et al. reported using gadolinium as an auxiliary alternative to NMR, which works analogously to the above-cited imaging methods to show that IPAS has an enhancement pattern equal to that of the spleen and a non-homogeneous enhancement in the arterial phase[15].

In a study using only NMR to analyze five cases of IPAS, superparamagnetic iron oxide contrast medium was shown to be an important tool for this imaging modality because of their preferential uptake in hepatic and splenic tissues due to their reticuloendothelial composition [16]. MR associated with an iron oxide contrast medium can be used to localize ectopic splenic tissue in any part of the body[17].

Table 1

Tomographic findings regarding IPAS as reported in the literature.

ARTICLES	TOMOGRAPHIC ASPECTS OF IPAS
Intrapancreatic Accessory Spleen: Findings on MR Imaging, CT, US and Scintigraphy, and the Pathologic Analysis	Contrast CT shows IPAS as a lesion with high attenuation compared to the pancreas in all phases and iso-attenuation compared to the spleen.
Pancreatic Incidentalomas: A Management Algorithm for Identifying Ectopic Spleens	The attenuation of the accessory splenic tissue is similar to that of the spleen in the arterial and venous phases.
A Pattern-oriented Approach to Splenic Imaging in Infants and Children	Well-circumscribed mass characterized by heterogeneous enhancement or zebra-stripe pattern in the initial phase of the contrast CT.
Significance of Imaging Findings in the Diagnosis of Heterotopic Spleen: An Intrapancreatic Accessory Spleen (IPAS)	Round/oval mass with clear limits and homogeneous enhancement pattern similar to that of the spleen.
Intrapancreatic Accessory Spleen (IPAS): A Single-Institution Experience and Review of the Literature	Contrast CT in the arterial phase showing uniformly hypervascular lesion in the distal pancreas with radiodensity comparable to the spleen.
Intrapancreatic Accessory Spleen: Evaluation with CT and MRI.	In most cases, the enhancement patterns of IPAS were consistent with those of the orthotopic or normal spleen and the enhancement degree was higher than that of the pancreas in the three dynamic phases.

In addition to the above-mentioned, Bhutani et al. emphasized the importance of NMR among the other imaging modalities by concluding that pre-operative nuclear scanning was proven to be more sensitive and specific in the diagnosis of IPAS[12]. In sum, the radiological aspects of IPAS using NMR are described in Table II.

Lastly, we warn that many patients are still being submitted to surgical procedures unnecessarily because of incidental findings suggestive of malignancy, which is then found to be a tissue resembling the spleen after histopathological analysis[9]. Therefore, studies like ours can contribute to the literature as the intra-pancreatic splenic tissue still represents a pathology of difficult radiological diagnosis.

Table 2

Radiological aspects of IPAS using NMR as reported in the literature.

ARTICLES	RADIOLOGICAL ASPECTS OF IPAS USING NMR
Pancreatic Incidentalomas: A Management Algorithm for Identifying Ectopic Spleens	IPAS appeared with hypo-enhancement on T1-weighted images (compared to pancreatic parenchyma) and hyper-enhancement on T2-weighted images.
Intrapancreatic Accessory Spleen: Findings on MR Imaging, CT, US and Scintigraphy, and the Pathologic Analysis	IPAS was darker than the adjacent pancreatic parenchyma on T1-weighted images and brighter than the pancreas on T2-weighted images.
Intrapancreatic Accessory Spleen: Imaging Findings	A lesion with an enhancement pattern equal to that of the spleen and non-homogeneous enhancement occurring in the arterial phase.
Intrapancreatic Accessory Spleen (IPAS): A Single-Institution Experience and Review of the Literature	Contrast enhancement lesion, which is well-circumscribed and hypervascular. The study considered NMR the most sensitive and specific imaging method for the diagnosis of IPAS, but it was not found to be useful alone, suggesting further studies.

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Financing:

This study was funded by the authors.

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Editor:
Prof. Dr. Paulo Henrique Manso

Received: jul 26, 2021
Approved: sep 23, 2022