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Original Article

Pancreatic Lesions Misdiagnosed as Adenocarcinoma Due to Imaging Findings

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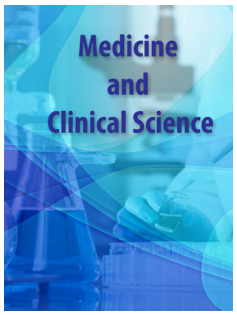

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Keywords

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Abstract

Purpose: *To present imaging investigation of neoplastic, inflammatory and benign pancreatic lesions as well as non-pancreatic processes that can simulate pancreatic adenocarcinoma.*

Materials and methods*: One hundred and forty five patients were examined by CT investigation in purpose to present pancreatic lesions witch previously suspected on other diagnostic methods of imaging.*

Results and discussions*: Adenocarcinoma of the pancreas (ACP) is one of the most aggressive malignances - leading cause of cancer-related deaths in the Western world. Focal fatty infiltration is usually most pronounced in the head of the pancreas and at contrast enhancement in CT usually appears as a region with reduced contrast material compared to normal pancreatic tissue simulating PA. Imaging of a hypoattenuating lesion in the head of the pancreas corresponds to adenocarcinoma in most cases.*

Conclusion: *However radiologists should be careful, because a false positive diagnosis can lead to unnecessary surgery, which is not without complications.*

Purpose

To present our experience and examination finding in literature of neoplastic, inflammatory and benign pancreatic as well as non-pancreatic processes that can simulate pancreatic adenocarcinoma (ACA).

Introduction

One of the most aggressive malignancies, the fourth leading cause of cancer-related deaths in the Western world, is adenocarcinoma of the pancreas (ACA). Timely and accurate diagnosis of adenocarcinoma is critical, as the disease has a high incidence and high mortality despite treatment measures. Tumor markers, mainly CA 19-9, and biopsy under imaging control (US or CT guided) can help make the correct diagnosis, but they also have several drawbacks. While CA 19-9 is elevated in 81% of cases of ACA, its absence cannot be used to rule out malignancies, and negative predictive value is very low (69%). EUS-FNA and CT-guided fine-needle biopsy have high accuracy but low sensitivity. EUS-FNA has a limited role in cases of duodenal stenosis and in lesions that are located in the uncinatum process or in the tail. CT-guided wide-needle biopsy has a limited role in small lesions. Both biopsy techniques cannot be performed in cases of blood vessel interposition.

These are the reasons why the guidelines indicate that when there is a high suspicion of malignancy of a solid lesion in the pancreas, histological evidence of ACA is not a reason for pancreatectomy. This fact inevitably leads to a high percentage of false positive pancreatectomies; 5% to 10% of pancreatectomies performed with a clinical diagnosis of ACA turn out to be pseudo tumors. Making an accurate diagnosis of PA with imaging is crucial to prevent unnecessary surgical procedures [1-4]. Many benign, congenital, chronic inflammatory and neoplastic diseases can mimic ACA and are likely to be a challenge for radiologists even experienced dealing with abdominal examinations [5-8].

The purpose of this presentation is to provide the key criteria that contribute to the correct diagnosis, mainly through the assessment of CT, which is the preferred method for imaging the pancreas.

Material and methods

One hundred and forty five patients were examined by MDCT in purpose to present pancreatic lesions with different imaging features. Some of them 79 have had clinical symptoms, but the others have not any compliance. They were suspected from imaging findings of other diagnostic methods (US, CT, MRI, Contrast investigation and biopsies under imaging control).

Resuts and discusions

Imaging findings and details of the selected cases

Sixty five years women with region with reduced contrast enhancement

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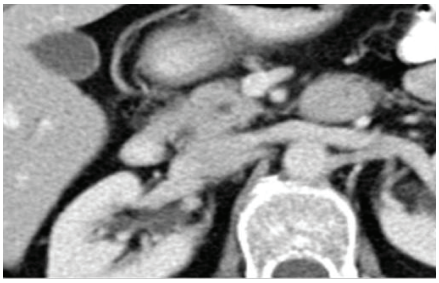

Figure 1. *CT of the pancreas- portal phase: Focal fatty infiltration*

Focal fatty infiltration

Fatty infiltration of the pancreas can be focal or diffuse. This is a benign change in the structure of the pancreas associated with diabetes, obesity, focal pancreatitis, steroid therapy and others conditions. Focal fatty infiltration is usually most pronounced in the head of the pancreas and at contrast enhancement in CT usually appears as a region with reduced contrast material enhancement compared to normal pancreatic tissue simulating ACA. The key finding that leads to a correct diagnosis is the presence of a fat density lesion in a non-contrast CT scan or a decrease in the signal in the opposite phase chemical shift in MRI. Additional findings in favor of focal fatty infiltration are - no enlargement of the pancreas or dilatation of the pancreatic duct and bile ducts - the lack of coverage of neighboring vessels, and the absence of lymphadenopathy (Figure 1).

Patients with hyper intensive lesion in the head of the pancreas

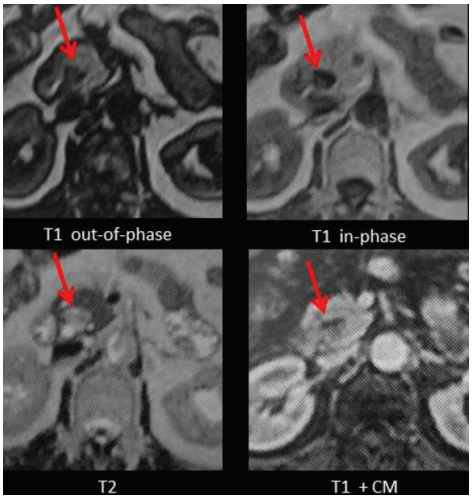

Figure 2. *MRI of the pancreas: Duodenal diverticulum*

Diverticulum of the duodenum

The duodenum is the second most common area of the gastrointestinal tract after the colon, where diverticula usually form in the periampullary region. They are usually present with a hydro aerial level or with the presence of an oral contrast agent in the lumen. However, sometimes diverticula are misdiagnosed as pancreatic tumors. The collapsed one a diverticulum or one filled with fluid may become a suspicious lesion of the pancreas (Figure 2). In such cases, endoscopy can contribute to a correct diagnosis. Cases of diverticulitis or rupture of diverticula are even more difficult to diagnose correctly [9,10].

Statistical analysis

Normal variations in the contour of the pancreatic head

Normal variations in the contour of the pancreatic head can sometimes mimic malignancy. When normal pancreatic tissue extends over 1 cm relative to the anterior superior pancreaticoduodenal artery (ASPD), it is considered as lobulation of the head of the pancreas. There are three types of parenchymal bulges: Types I, II and III refer to anterior, posterior and horizontal bulges relative to ASPD, respectively. Knowledge of these changes is important to overcome their misinterpretation, such as PA. The main finding, which proves the presence of normal variation of the pancreatic contour, is that this swelling has similar structures and behavior with the rest of the pancreatic parenchyma in all phases (non-contrast, pancreatic, portal and venous phases [20]. Coronary and sagittal image reformats can provide additional help in visualizing the lobular contour of the gland (Figure 3).

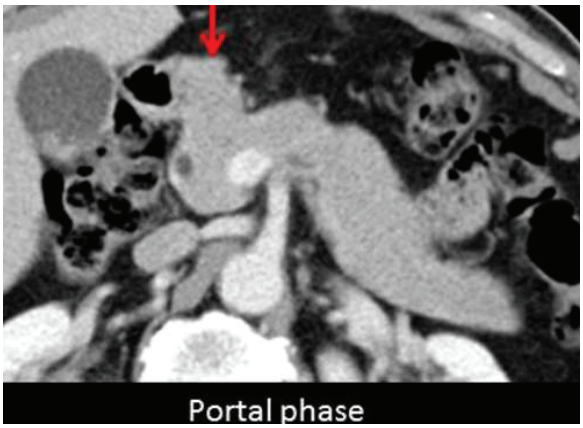

Figure 3. *CT images - Normal version of the contour of the pancreatic head*

Fifty four years old man with hypo attenuated lesion of the head of the pancreas.

Annular pancreas

The annular pancreas is a rare variant in which the pancreatic parenchyma bypasses the second part of the duodenum in whole or in part. When it is symptomatic in children, it usually presents with symptoms of stomach obstruction. In adults, this is often an accidental finding or occurs with symptoms of obstruction, peptic ulcers or pancreatitis [4,5]. Key finding in favor of the annular pancreas is the discovery of a Santorini canal in normal

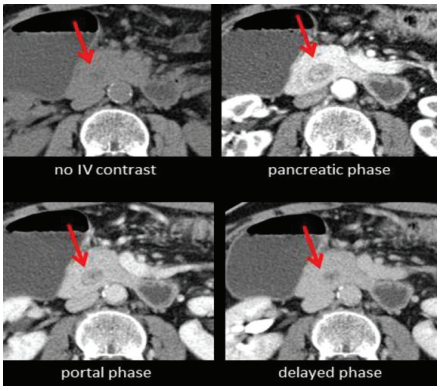

Figure 4. *CT images: Annular pancreas*

pancreatic tissue that surrounds the duodenum. In some cases, stenosis of the descending duodenum may be depicted. In uncertain cases, secretin contrast MRI can help us make the correct diagnosis (Figure 4).

Patient with contrast enhancement in inhomogeneous mass in the head of the pancreas

Focal chronic pancreatitis

On imaging, chronic pancreatitis is characterized by parenchymal atrophy, dilatation of the main pancreatic duct, and the presence of calcification. Nearly 20% of chronic cases of pancreatitis develop a focal form that can simulate ACA and is usually associated with increased alcohol consumption. In CT focal chronic pancreatitis manifests itself as a low-density mass that causes peripheral dilatation of the main pancreatic duct and atrophy of the peripheral pancreas parenchyma. Imaging of a penetrating pancreatic duct in a suspicious the lesion is indicative of an inflammatory pseudo tumor as well as the absence of involvement of the vessels in pancreatic zone. Diffusion-weighted MRI provides additional help in ambiguous cases, as it shows a lower diffusion coefficient (ADC) in PA compared to the rest of the pancreatic tissue, but no significant differences from the ADC values in focal chronic pancreatitis with the rest of the pancreas [8,9,12]. However, according to the guidelines, in patients with chronic pancreatitis and increased resemblance to PA, resection is recommended even without histological evidence (Figure 5).

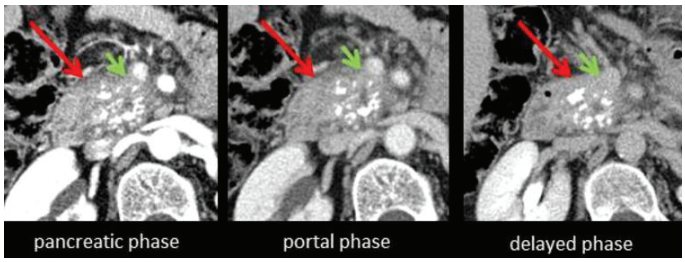

Figure 5: CT images - Focal chronic pancreatitis

Pancreatic mass with poor contrast saturation

Para duodenal pancreatitis

Para duodenal pancreatitis (PP) is another separate form of chronic pancreatitis critically discussed. Although the exact cause is not known, it is usually presented in middle-aged men with a history of alcohol consumption with persistent (3-6 months) episodes of jaundice and weight loss or with symptoms of acute pancreatitis. It is divided into two types: inflammatory tissue and fibrous change can affect either only the (clean) region of the groove or cover the head of the pancreas (segmental). On CT, the pure form usually appears as a parenchymal mass of soft tissue in the groove area, which is described as leaf-like tissue that shows late saturation due to fibrosis. Additional saturation of the pancreatic head occurs in the segmental form. Both types can mimic ACA and, unfortunately, even negative FNA results cannot rule out malignancy with absolute certainty. The specific location of the PP is an important indication for diagnosis, as is the displacement of the vascular system in the absence of obstruction. The CT characteristics of PP are a thickening of the duodenal wall and a slight heterogeneous saturation other than ACA, which usually contrasts homogeneously [5,9]. In addition, the smooth, prolonged narrowing of the pancreas and common bile duct favors the diagnosis of PP. Conversely, pronounced dilatation of the pancreatic ducts or abrupt rupture

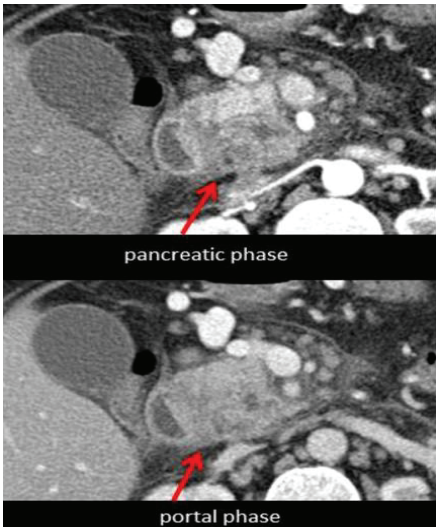

Figure 6: *CT images - Para duodenal pancreatitis*

of the pancreatic duct are suspicious data indicating the presence of malignancy (Figure 6).

Inhomogeneous mass with poor saturation in the head of the pancreas

Autoimmune pancreatitis

Autoimmune pancreatitis (AIP) is one of the most common misdiagnosis that leads to suspected pancreatic surgery. This is a different type of chronic pancreatitis, which is impressively affected by steroids and is divided into two types. Type 1 AIP is IgG4 associated with extra-pancreatic manifestations (sclerosing mesenteritis, Sjogren like syndrome, retroperitoneal fibrosis, interstitial nephritis), while AIP in Type 2 coexists with IBD in 30% of cases. Diffuse enlargement of the sausage-like parenchyma with obliteration of the lobular contour of the pancreas and capsule-like contouring with delayed contrast are typical radiological signs of autoimmune pancreatitis [13,14]. The findings of the image suggesting a focal AIP are appreciable inhomogeneous enhancement in the pancreatic phase and homogeneous improvement in the late phase, in contrast to PA, which shows a reduced magnification in both phases. Another differential feature with high AIP specificity is the "capsule-like" low saturation edge as opposed to the high contrast frame that surrounds PA in some cases. In addition, the segmental narrowing of the main pancreatic duct (MPD)

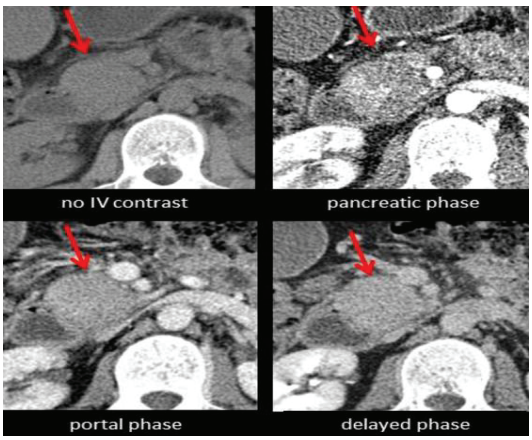

Figure 7: *CT images in different phases-Autoimmune pancreatitis*

is usually multifocal and milder in AIP, while dilatation of the MPD is more than 5 mm distal to the lesion, suggesting malignancy. The high suspicion of AIP should be confirmed by high serum IgG4 levels and by EU-targeted biopsy. In case of ambiguous biopsy results, 4-6 weeks of steroid treatment is administered and recommended for therapeutic and diagnostic purposes (Figure 7).

55 years old man with dense masses that are displayed in the arterial phase

Pancreatic neuroendocrine tumors

Pancreatic neuroendocrine tumors (PNETs) originate from well-differentiated endocrine pancreatic cells and are composed of proliferations ranging from benign to malignant of 5-10% of pancreatic tumors. PNETs are usually presented as dense masses that are displayed in the arterial phase. Unlike ACA, they are well labeled and do not cause dilatation of the pancreatic ducts, with the exception of small serotonin-secreting tumors, which tend to cause obstruction of the pancreatic duct due to the formation of fibrous tissue. In challenging cases with heterogeneous morphology or diagnosis of pancreatic steroid scintigraphy can help us make the correct diagnosis. In PNET, liver metastases are not uncommon and are usually hypervascular [4,15,16]. They are small and necrotic or hemorrhagic when larger. Although liver metastases from ACA are an absolute contraindication to surgery when it comes to PNET metastatic liver disease, the behavior is far different. Patients with PNET and liver metastases appear to benefit from primary resection and multimodal therapy of liver metastases (Figure 8).

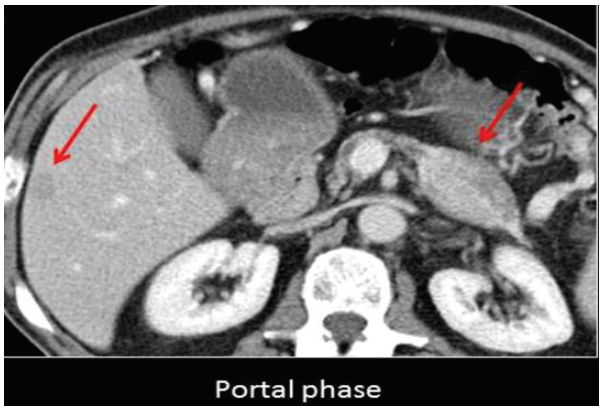

Figure 8: *CT image in the portal phase-pancreatic neuroendocrine tumor with liver metastases*

Patient with the presence of enlarged lymph nodes below the level of the renal veins

Lymphomas

Secondary involvement of the pancreas by lymphoma (mainly non-Hodgkin) is not uncommon and it is often part of the extra nodal involvement in 5-30% of patients. This can occur either by infiltration from adjacent perypancreatic lymph nodes or by hematogenous spread. Primary lymphoma of the pancreas is quite rare. The focal form of pancreatic lymphoma usually presents as a single, voluminous, homogeneous lesion with lower muscle attenuation and shows mild homogeneous saturation in contrast to enhanced CT [17,18]. Knowing the patient's history of lymphoma when secondary pancreatic lesions are detected and the presence of a bulk mass that does not cause significant dilatation of the pancreatic ducts makes the

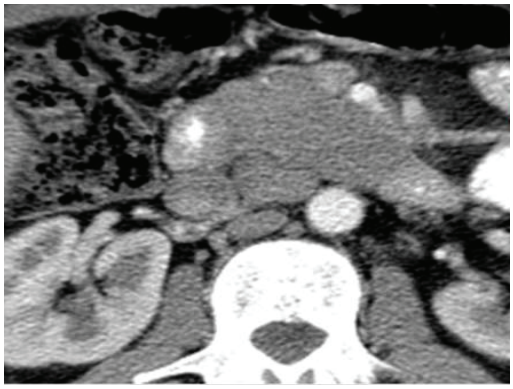

Figure 9: *CT image- Lymphoma*

diagnosis of lymphoma more favorable than ACA. In addition, lymphomatous involvement of the pancreas can cause a lining of the food vessel without invasion. Finally, the presence of enlarged lymph nodes below the level of the renal veins is another important image in favor of lymphoma (Figure 9).

Man with multifocal and usually well-defined lesions

Metastases

Pancreatic metastases are quite rare and represent 1-2% of all pancreatic neoplasms. The most common primary tumors that can metastasize to the pancreas are kidney tumor, lung cancer, breast cancer, melanoma, colon cancer, stomach cancer, ovarian cancer, and prostate cancer. Metastases are often multifocal and usually well defined, in contrast to ACA, which is usually solitary and tends to have unclear boundaries. In most cases of pancreatic metastases, the main pancreatic duct and the common bile duct are not dilated compared to PA [9,7,19]. Must be noted that hyper contrast lesions typically originate from a hyper vascular neoplasm, such as renal cancer, and hypo contrasted lesions originate from hypo vascular tumors, such as lung cancer (Figure 10).

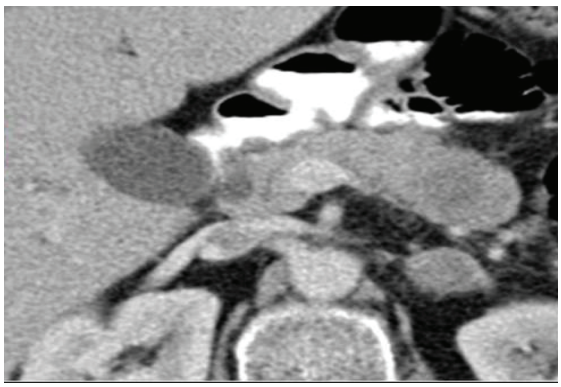

Figure 10: *CT images-Metastases*

Conclusion

Imaging of a hypoattenuating lesion in the head of the pancreas corresponds to adenocarcinoma in most cases. However, radiologists should be careful, because a false positive diagnosis can lead to unnecessary surgery, which is not without complications. Proper diagnosis of benign conditions or other types of malignancies beyond ACA with significantly better survival is important because it suggests alternative therapeutic approaches [2-4]. Radiologists should be familiar with these

attributed to the high concentration of hydrogen peroxide applied during professional treatments, ensuring uniform exposure while achieving more profound discoloration.

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