

Imaging Techniques for Acute Necrotizing Pancreatitis: Multidetector Computed Tomography

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In clinical practice, it is important to establish the severity of acute pancreatitis as soon as possible. At present, the assessment of the severity of acute pancreatitis is defined according to the Atlanta clinical criteria [1]. From the clinical point of view we know that the severity of acute pancreatitis is related to the age of patients, the male sex, and the alcoholic and idiopathic etiology of the illness [2]. Furthermore, from a microbiological point of view, the infection of the necrosis reaches a peak in the third week from the onset of an acute attack of pancreatitis [3]. Imaging plays an important role in answering the clinical question: is the pancreatitis mild or severe? The best way to answer to this question is to determine the presence of pulmonary or pleuric alterations at chest X-ray, associated or not with an increase in

serum creatinine greater than 2 mg/dL. This simple severity assessment has already been demonstrated in clinical practice and a multicenter Italian study was published in 1999 [4]. The authors demonstrated that in 539 acute pancreatitis patients, 163 of whom (30.2%) had necrotizing pancreatitis, the presence of pulmonary or pleural alterations with or without a creatinine concentration greater than 2 mg/dL had a sensitivity of 60% and a specificity of 88% in evaluating the presence of necrosis, a sensitivity of 73% and a specificity of 75% in evaluating the presence of infected necrosis, and a sensitivity of 90% and a specificity of 76% in evaluating the mortality rate. However, computed tomography (CT) and the recently introduced multidetector CT (MDCT) had an important role in defining not only the presence of

Table 1. Modified CT severity index [6].

	Points
Pancreatic inflammation	
Normal pancreas	0
Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat	2
Pancreatic or peripancreatic fluid collection or peripancreatic fat necrosis	4
Pancreatic necrosis	
None	0
=30%	2
>30%	4
Extrapancreatic complications	
Presence of one or more of pleural effusion, ascites, vascular complications, parenchymal complications, or gastrointestinal tract involvement	2

Table 2. Comparison of the Balthazar and Mortelet severity scores with the variables length of hospital stay, surgery or interventional radiological procedures and infections [6].

	Balthazar CT severity index	Mortelet CT severity index
Length of hospital stay	P=0.0052	P=0.0054
Surgery or interventional radiological procedures	P=0.0324	P=0.0112
Infections	P<0.0001	P<0.0001



Figure 1. Multidetector computed tomography scan: edema of the pancreas.

pancreatic alterations but also the presence of associated extrapancreatic involvement; in fact, the MDCT permits us to confirm the clinical diagnosis of acute pancreatitis, to establish the etiology of the illness, to weigh the necrosis, and to evaluate the follow-up of the pancreatic and extra-pancreatic complications. Even if the MDCT is a more sensitive technique than a traditional spiral CT, the timing of the appearance of necrosis using this technique was not changed; in fact, the presence of necrosis is well-visualized

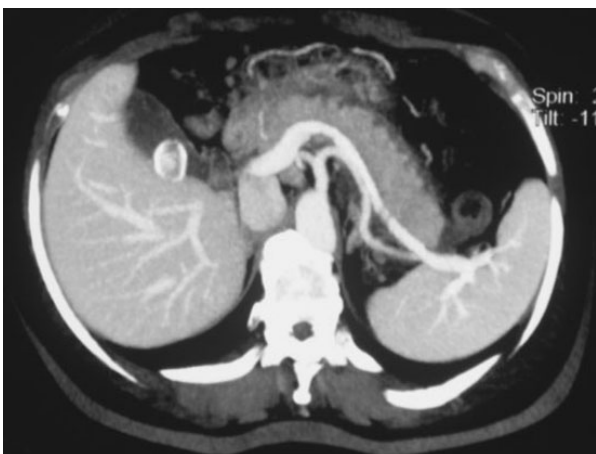


Figure 2. Multidetector computed tomography scan: stranding during an acute pancreatic inflammation.



Figure 3. Multidetector computed tomography scan: fluid collections.

after 48-72 hours from the onset of acute pancreatitis. The MDCT has changed the traditional Balthazar score [5] in assessing the severity of acute pancreatitis. With this technique, which is faster than the traditional spiral CT, we can obtain more information about the involvement of peri- and extra-pancreatic organ involvement; more information may be obtained regarding involvement of the portal vein, the mesenteric superior vein, the mesenteric superior artery

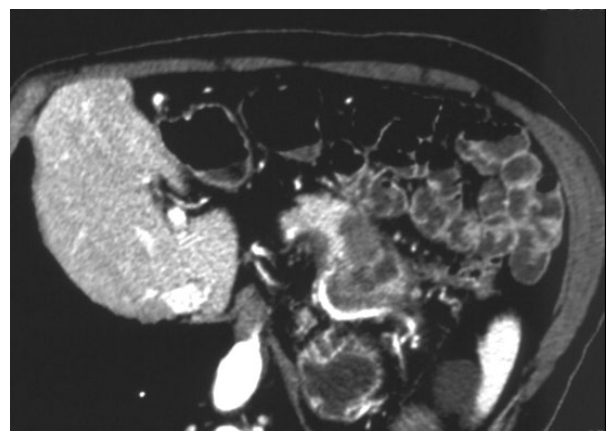


Figure 4. Multidetector computed tomography scan: pancreatic necrosis.



Figure 5. Multidetector computed tomography scan: peripancreatic fat necrosis.



Figure 6. Multidetector computed tomography scan: pancreatic infected necrosis.

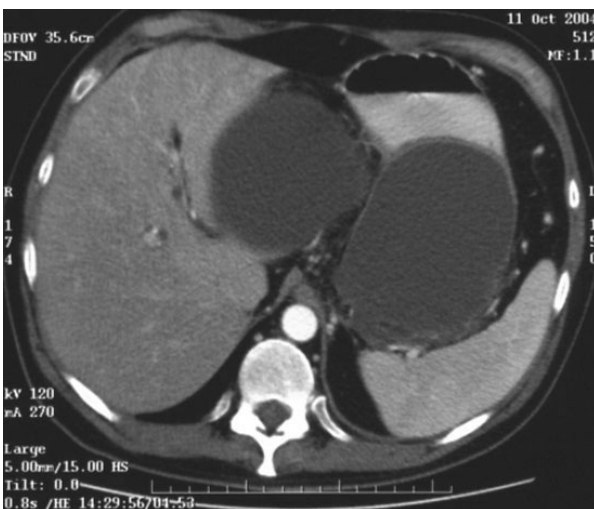


Figure 7. Multidetector computed tomography scan: pancreatic pseudocyst.



Figure 8. Multidetector computed tomography scan: link between pancreatic pseudocyst and the Wirsung duct.

and celiac trunk. Furthermore, we can also obtain information about pleural and pulmonary alterations. Thus, a new CT severity index has been proposed by Mortelet *et al.* [6]. These authors have reported that the MDCT severity index (Table 1) was highly related to hospital stay, surgery or interventional radiological-related procedures and the presence of infection (Table 2).

What does MDCT add to what is already known about the imaging of acute pancreatitis? The first important point is that MDCT is able to exactly define the pancreatic involvement: the edema (Figure 1), stranding (Figure 2), fluid collections (Figure 3), necrosis of the gland (Figure 4), and peripancreatic fat (Figure 5) is easily recognized with this technique. MDCT is also able to reveal the presence of infection of the necrosis with high resolution (Figure 6), the development of pseudocysts (Figure 7), and the possible link between the pseudocysts and the pancreatic ducts (Figure 8).

However, as reported above, the advantage of this new technique is the diagnosis of extra-pancreatic alterations. MDCT is highly sensitive in evaluating the presence of pleural and pulmonary lesions as pleural effusions (Figure 9), pulmonary infiltrates and acute distress respiratory syndrome (ARDS; Figure 10). Using “ad hoc” software, MDCT is also

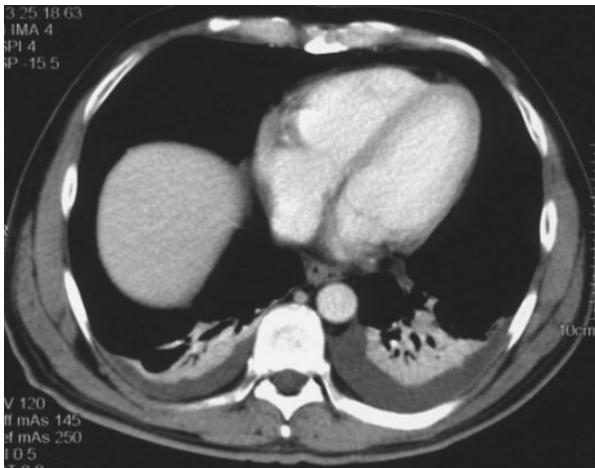


Figure 9. Multidetector computed tomography scan: pleural effusion.

able to demonstrate the multiplanar reconstruction for the study of the vascular system and the pancreatic ducts to evaluate the presence of spleen involvement (Figure 11), the transient hepatic attenuation difference (THAD) (Figure 12), the presence

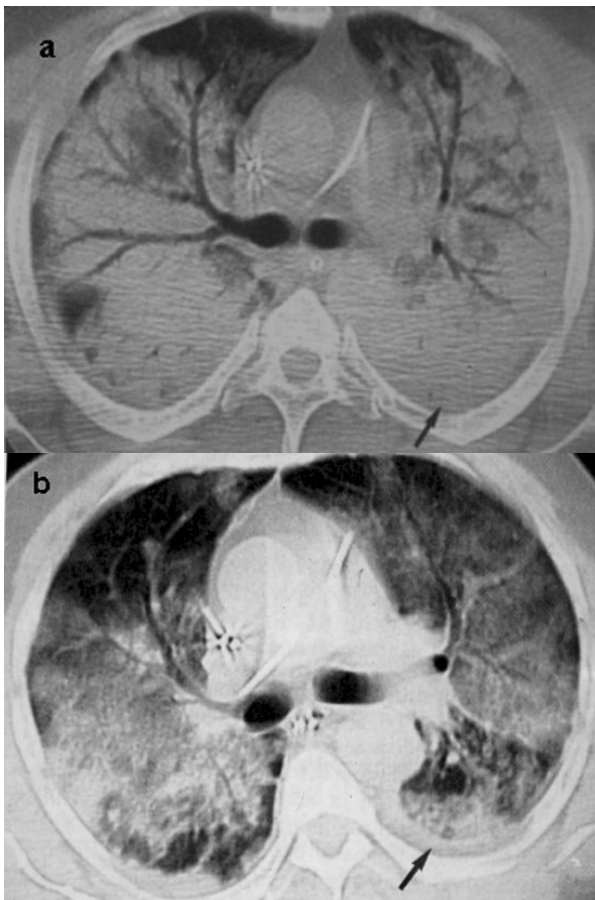


Figure 10. Multidetector computed tomography scan: pulmonary infiltrates (a.) and acute respiratory distress syndrome (b.).

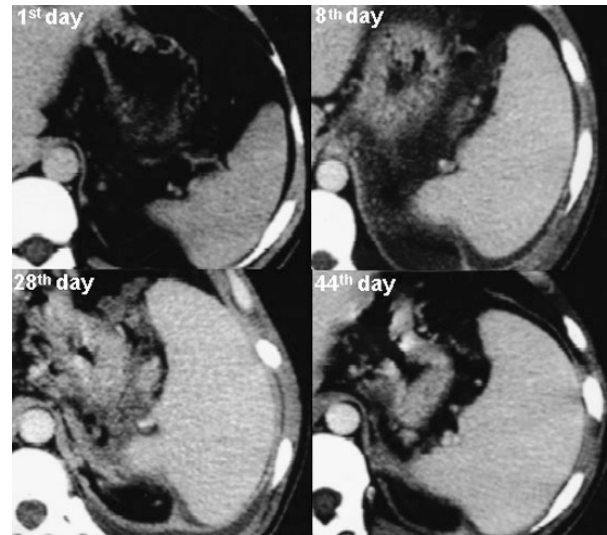


Figure 11. Multidetector computed tomography scan: spleen involvement.

of pseudoaneurisms (Figure 13) or thrombosis of the splenic vein (Figure 14). MDCT recognizes small lesions such as the presence of small pancreatic cancers which may be associated with a mild acute pancreatitis in about 6% of the cases [7] (Figure 15).

This technique is of assistance to clinicians with interventional radiological procedures such as the sampling of the necrosis for microbiological assessment (Figure 16), and the percutaneous treatment of fluid collections and pseudocysts in high risk patients.

Keywords Pancreatitis; Pancreatitis, Acute Necrotizing; Pancreatitis, Alcoholic; Diagnostic Imaging; Tomography, X-Ray Computed

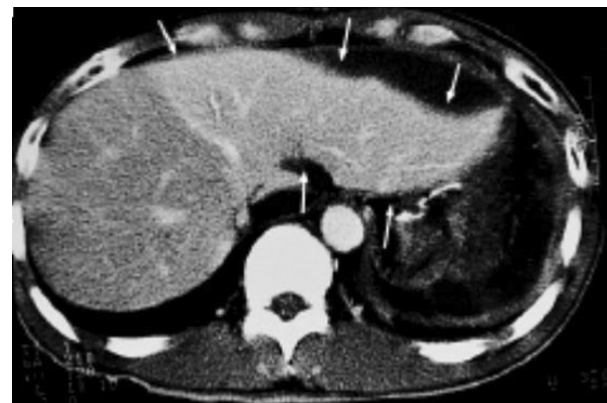


Figure 12. Multidetector computed tomography scan: transient hepatic attenuation difference.



Figure 13. Multidetector computed tomography scan: pseudoaneurism.

Abbreviations ARDS acute distress respiratory syndrome; CT: computed tomography; MDCT: multidetector computed tomography; THAD: transient hepatic attenuation difference

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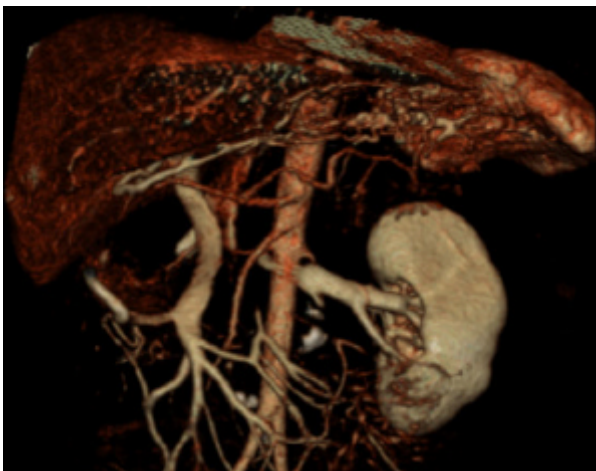


Figure 14. Multidetector computed tomography scan: thrombosis of the splenic vein.

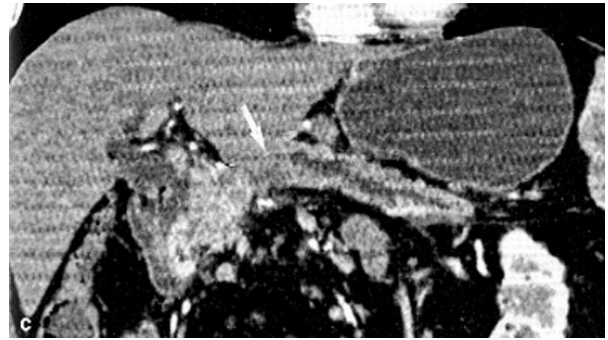


Figure 15. Multidetector computed tomography scan: small pancreatic cancer in a patient with mild acute pancreatitis.

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Figure 16. Multidetector computed tomography scan: Interventional procedure in a patient with necrotizing pancreatitis.

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