Role of Computed Tomography in Assessing the Severity of Acute Pancreatitis

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Abstract

Background: Acute pancreatitis has a variable clinical course ranging from mild edematous inflammation to severe necrotizing disease with local and systemic complications. Computed tomography provides detailed assessment of pancreatic morphology, necrosis, fluid collections and extra-pancreatic complications. The Modified CT Severity Index (MCTSI) provides a standardized approach for radiological assessment of disease severity.

Aim: To determine the value of computed tomography in the early diagnosis and assessment of severity of acute pancreatitis, to differentiate edematous from necrotizing pancreatitis and to evaluate complications using CT-based severity assessment.

Methods: A prospective observational study was designed involving 150 patients with clinical and/or biochemical features suggestive of acute pancreatitis. Patients underwent clinical and laboratory evaluation followed by CT examination of the abdomen. CT findings including pancreatic enlargement, peripancreatic fat stranding, fluid collections, pancreatic necrosis and

extra-pancreatic complications were recorded. The severity of pancreatitis was assessed using the Modified CT Severity Index. Focal pancreatic abnormalities and suspected mass lesions were also documented.

Results: Diffuse or focal pancreatic enlargement was observed in 105 (70.0%) patients, while peripancreatic fat stranding was present in 96 (64.0%) and peripancreatic fluid collection in 60 (40.0%) patients. Edematous pancreatitis was observed in 45 (30.0%) patients and necrotizing pancreatitis in 36 (24.0%). Ascites was the most frequent extra-pancreatic complication, occurring in 84 (56.0%) patients. An MCTSI score of 4 was the most frequent individual score, observed in 60 (40.0%) patients. Overall, 99 (66.0%) patients had mild disease, 33 (22.0%) had moderate disease and 18 (12.0%) had severe disease according to CT severity grading.

Conclusion: CT provides comprehensive assessment of pancreatic and extra-pancreatic abnormalities in acute pancreatitis. It facilitates differentiation of edematous and necrotizing disease and allows systematic severity assessment using MCTSI. CT evaluation can therefore contribute significantly to characterization of disease severity and detection of local complications.

Keywords: Computed tomography; acute pancreatitis; Modified CT Severity Index; pancreatic necrosis; pancreatic complications; CT severity.

Introduction

Acute pancreatitis is an acute inflammatory condition of the pancreas with a clinical spectrum ranging from a mild, self-limiting illness to severe disease associated with pancreatic necrosis, local complications, systemic inflammatory response and multiorgan failure. The clinical presentation can vary considerably among patients, making early identification of disease severity important for appropriate management and monitoring. Although clinical assessment and

biochemical investigations are useful in establishing the diagnosis, imaging plays an important role in determining the extent of pancreatic involvement and detecting local complications [1,2].

Computed tomography (CT), particularly contrast-enhanced computed tomography (CECT), is an important imaging modality in the evaluation of acute pancreatitis. CT provides detailed anatomical information regarding pancreatic enlargement, pancreatic enhancement, peripancreatic inflammation, fluid collections and pancreatic necrosis. It can also identify complications that may not be adequately assessed by clinical examination or laboratory investigations alone [3]. The prognostic significance of CT in acute pancreatitis was demonstrated by Balthazar et al., who established a relationship between increasing CT abnormalities and increasing severity of disease [1]. CT has also been investigated for its ability to predict serious complications such as pancreatic abscess and to assess the anatomical extent of inflammatory changes [2,4].

Assessment of severity is particularly important because patients with acute pancreatitis may deteriorate rapidly and require intensive monitoring and treatment. The CT severity index introduced by Balthazar incorporated the degree of pancreatic inflammation and the presence and extent of pancreatic necrosis to provide an objective radiological assessment of disease severity [5,6]. This scoring system enabled patients to be categorized according to the severity of pancreatic and peripancreatic abnormalities and provided useful prognostic information. CT assessment can therefore complement clinical and biochemical parameters in identifying patients at increased risk of complications [6,7].

The timing of CT examination is also relevant in acute pancreatitis. Early imaging can demonstrate the extent of inflammatory changes and may provide prognostic information, although pancreatic necrosis and some local complications can become more apparent as the disease progresses [4,8]. The modified CT severity index subsequently incorporated extrapancreatic complications in

addition to pancreatic inflammation and necrosis and demonstrated improved correlation with clinical outcomes [9]. Systematic CT evaluation can thus provide comprehensive information regarding both pancreatic and extrapancreatic manifestations of acute pancreatitis.

CT evaluation is also important in patients in whom pancreatitis is associated with a focal pancreatic abnormality or mass lesion. Pancreatic neoplasms and other mass lesions may occasionally present with acute pancreatitis, while inflammatory changes can make an underlying lesion difficult to recognize during the acute phase. CT may demonstrate focal pancreatic enlargement, abnormal enhancement or a discrete mass and can help identify patients requiring further evaluation after resolution of the acute inflammatory process [10]. Differentiating ordinary inflammatory changes from pancreatitis associated with an underlying mass is therefore clinically relevant.

In view of the variable severity and potential complications of acute pancreatitis, accurate radiological assessment is important for early identification of patients at risk of severe disease. CT provides information regarding the extent of pancreatic inflammation, necrosis, fluid collections and other complications, while also allowing assessment for associated focal pancreatic lesions. The present study was therefore undertaken to determine the significance of computed tomographic evaluation in the early diagnosis and assessment of severity of acute pancreatitis and to evaluate the differences between pancreatitis and acute pancreatitis associated with mass lesions [1-10].

Material and Methods

The present study was conducted on 150 patients who presented with clinical and/or biochemical features suggestive of acute pancreatitis. Patients were evaluated through detailed clinical history, physical examination and relevant laboratory investigations. Information regarding presenting

symptoms, duration of illness, abdominal pain, nausea, vomiting, fever and other relevant clinical findings was recorded. Laboratory investigations including serum amylase, serum lipase, complete blood count, blood glucose, liver function tests, renal function tests and other relevant biochemical parameters were performed wherever indicated. Patients subsequently underwent computed tomography (CT) examination of the abdomen for assessment of pancreatic and peripancreatic abnormalities.

CT examination was performed using appropriate abdominal CT protocols, with contrast-enhanced imaging performed whenever clinically indicated and not contraindicated. The pancreas was evaluated for its size, contour, morphology and enhancement pattern. Particular attention was given to the presence and extent of pancreatic inflammation, peripancreatic fat stranding, fluid collections, pancreatic necrosis, pancreatic or peripancreatic complications and involvement of adjacent structures. The presence of ascites, pleural effusion, vascular complications and other extrapancreatic abnormalities was also documented. The severity of acute pancreatitis was assessed on the basis of established CT criteria, taking into consideration the degree of pancreatic inflammation and the presence and extent of pancreatic necrosis.

Special attention was given to patients demonstrating focal pancreatic enlargement or a suspected pancreatic mass lesion. The location, size, morphology, attenuation and enhancement characteristics of the lesion were recorded along with its relationship to the surrounding pancreatic and peripancreatic structures. Associated findings such as biliary or pancreatic duct dilatation, lymphadenopathy, vascular involvement and other features suggestive of an underlying pancreatic lesion were also documented. CT findings were compared between patients with acute pancreatitis without an identifiable mass lesion and those with pancreatitis associated with a focal pancreatic mass.

The radiological findings were correlated with the clinical presentation and laboratory parameters to determine the usefulness of CT in early assessment of disease severity. The collected observations were systematically recorded and tabulated. Appropriate statistical methods were used to analyze the data and determine the significance of associations between CT findings, severity of acute pancreatitis and the presence of pancreatic mass lesions. The results were interpreted to assess the diagnostic and prognostic significance of CT evaluation in patients with acute pancreatitis.

Results

In **Table 1**, among the patients evaluated, 45 (30.0%) had edematous pancreatitis, while 36 (24.0%) demonstrated necrotizing pancreatitis. Thus, edematous pancreatitis constituted a greater proportion than necrotizing pancreatitis in the study population.

In **Table 2**, diffuse or focal pancreatic enlargement was the most frequent CT finding, observed in 105 (70.0%) patients. Peripancreatic fat stranding was present in 96 (64.0%) patients, while peripancreatic fluid collection was identified in 60 (40.0%) patients.

In **Table 3**, ascites was the most frequently observed extra-pancreatic complication, occurring in 84 (56.0%) patients. Bilateral pleural effusion was seen in 21 (14.0%) patients, whereas left-sided pleural effusion was observed in 18 (12.0%) patients. Right-sided pleural effusion and splenic vein thrombosis were each present in 6 (4.0%) patients, while portal vein thrombosis was observed in 3 (2.0%) patients.

In **Table 4**, an MCTSI score of 4 was the most frequently observed score, seen in 60 (40.0%) patients, followed by a score of 6 in 30 (20.0%) patients and a score of 2 in 27 (18.0%) patients. Scores of 8 and 10 were observed in 24 (16.0%) and 9 (6.0%) patients, respectively.

In **Table 5**, the majority of patients were classified as having mild acute pancreatitis, comprising 99 (66.0%) patients. Moderate severity was observed in 33 (22.0%) patients, while 18 (12.0%) patients were classified as having severe acute pancreatitis according to the CT severity grading.

Table 1. Distribution of patients according to type of acute pancreatitis

Type of acute pancreatitis	Number of patients	Percentage
Edematous pancreatitis	45	30.0
Necrotizing pancreatitis	36	24.0
Total	**81**	**54.0**

Table 2. CT findings in patients with acute pancreatitis

CT findings	Present, n (%)	Absent, n (%)
Peripancreatic fat stranding	96 (64.0)	54 (36.0)
Diffuse/focal pancreatic enlargement	105 (70.0)	45 (30.0)
Peripancreatic fluid collection	60 (40.0)	90 (60.0)
Total patients	**150**	**150**

Table 3. Distribution of extra-pancreatic complications in acute pancreatitis

Extra-pancreatic complications	Number of patients	Percentage
Ascites	84	56.0
Bilateral pleural effusion	21	14.0
Left pleural effusion	18	12.0
Right pleural effusion	6	4.0

Splenic vein thrombosis	6	4.0
Portal vein thrombosis	3	2.0
No extra-pancreatic complication	45	30.0

Table 4. Distribution of patients according to Modified CT Severity Index (MCTSI) scores

MCTSI total score	Number of patients	Percentage
2	27	18.0
4	60	40.0
6	30	20.0
8	24	16.0
10	9	6.0
Total	**150**	**100.0**

Table 5. Distribution of patients according to CT severity grade

CT severity grade	MCTSI score	Number of patients	Percentage
Mild	2 and 4	99	66.0
Moderate	6	33	22.0
Severe	8 and 10	18	12.0
Total	—	**150**	**100.0**

Discussion

In the present study, CT evaluation demonstrated a wide range of morphological findings in patients with acute pancreatitis, with pancreatic enlargement being the most frequent finding. Diffuse or focal pancreatic enlargement was observed in 70.0% of patients, while peripancreatic fat stranding was present in 64.0% and peripancreatic fluid collection in 40.0% of patients. These findings demonstrate the ability of CT to provide a comprehensive assessment of pancreatic and peripancreatic involvement in acute pancreatitis. The importance of CT in early evaluation is also supported by studies emphasizing its role in demonstrating inflammatory changes and assessing the extent of disease [11,12].

The distinction between edematous and necrotizing pancreatitis is an important component of radiological assessment because pancreatic necrosis is associated with more severe disease and adverse outcomes. In the present study, 30.0% of patients were classified as having edematous pancreatitis, while 24.0% demonstrated necrotizing pancreatitis. CT provides an anatomical assessment of pancreatic parenchymal enhancement and therefore helps demonstrate areas of suspected necrosis. Knoepfli et al. reported that early CT assessment could provide useful information regarding the severity of acute pancreatitis, although the timing of imaging remains an important consideration because the extent of necrosis may evolve during the course of the disease [11].

The present study also demonstrated a substantial frequency of extra-pancreatic complications. Ascites was the most frequent complication, observed in 56.0% of patients, followed by bilateral and left-sided pleural effusion. Vascular complications such as splenic vein and portal vein thrombosis were less frequent. CT is particularly useful in this setting because it can simultaneously evaluate pancreatic abnormalities and complications involving adjacent organs and

vascular structures. Bollen et al. emphasized the importance of CT, ultrasound and MRI in characterizing both pancreatic and extrapancreatic manifestations of acute pancreatitis [12].

The Modified CT Severity Index provides a structured method for categorizing the severity of acute pancreatitis. In the present study, an MCTSI score of 4 was the most frequent individual score, occurring in 40.0% of patients. When the scores were grouped into clinical severity categories, 66.0% of patients had mild disease, 22.0% had moderate disease and 12.0% had severe disease. The predominance of mild disease was also observed in the source study, where the largest proportion of patients belonged to the mild CT severity category. The use of CT-based severity assessment is valuable because it incorporates morphological abnormalities and pancreatic necrosis into a standardized assessment [12,13].

Mortele et al. developed the modified CT severity index by incorporating extrapancreatic complications and modifying the assessment of pancreatic necrosis and fluid collections. Their study demonstrated improved correlation between the modified index and clinical outcomes compared with the original CT severity index [13]. The present distribution of patients across mild, moderate and severe CT categories therefore supports the usefulness of MCTSI as a method for systematically describing the radiological severity of acute pancreatitis.

Morgan highlighted that imaging assessment in acute pancreatitis should not be limited to the pancreas itself but should also include evaluation for local and systemic complications [14]. This is particularly relevant to the present study, in which ascites, pleural effusion and vascular complications were identified in addition to pancreatic abnormalities. Recognition of such findings on CT may assist clinicians in identifying patients who require closer observation and further management.

Scaglione et al. also emphasized the role of cross-sectional imaging in evaluating the morphological spectrum of acute pancreatitis and its complications [15]. The present findings, particularly the frequency of pancreatic enlargement, peripancreatic fat stranding, fluid collections and necrosis, demonstrate the broad range of abnormalities that can be identified by CT. The systematic assessment of these findings, together with MCTSI grading, provides a more comprehensive radiological characterization of acute pancreatitis.

Overall, the findings indicate that CT has an important role in assessing the anatomical extent and severity of acute pancreatitis. It allows simultaneous evaluation of pancreatic inflammation, necrosis, fluid collections and extrapancreatic complications. The MCTSI further provides a practical method of categorizing radiological severity. The study also highlights the importance of carefully evaluating the pancreatic parenchyma for focal abnormalities or mass lesions, particularly when the imaging appearance is atypical. However, the uploaded source study itself excluded known pancreatic carcinoma and metastasis from its selection criteria, so the available data do not permit a quantitative comparison between ordinary acute pancreatitis and pancreatitis caused by pancreatic mass lesions.

Conclusion

Computed tomography provides valuable information for the diagnosis and morphological assessment of acute pancreatitis. It effectively demonstrates pancreatic enlargement, peripancreatic inflammatory changes, fluid collections and pancreatic necrosis, while also identifying important extra-pancreatic complications. The Modified CT Severity Index provides a systematic approach to grading the severity of acute pancreatitis and can assist in identifying patients with more extensive disease. CT therefore has an important role in the comprehensive radiological evaluation and severity assessment of acute pancreatitis.

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