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CT and pathologic correlation in acute and chronic pancreatitis

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Abstract
Introduction and Background: Acute and chronic pancreatitis are common inflammatory conditions of the pancreas that are characterized by different clinical, radiologic, and pathologic manifestations. In order to properly diagnose and treat acute pancreatitis (AP), it is crucial to distinguish it from chronic pancreatitis (CP). When it comes to diagnosing, staging, and monitoring pancreatitis, computed tomography (CT) is indispensable. In this study, we will look at patients with acute and chronic pancreatitis to see how well CT imaging correlates with histologic findings from a radiologic-pathologic perspective.
Materials and Methods: This observational study looked back at 60 patients diagnosed with pancreatitis at Department of Pathology, Gouri Devi Institute of Medical Sciences and Hospital, West Bengal, India from January 2019 to December 2019. All of them had contrast-enhanced CT (CECT) scans and then received histopathologic examination using surgical materials or biopsy. Along with 30 cases of chronic pancreatitis, there were also 30 cases of acute pancreatitis in the cohort. Radiology results evaluated gland dimensions, shape, and pattern of enhancement, presence of necrosis, calcifications, ductal dilatation, pseudocysts, and inflammation around the pancreas. Inflammatory cell infiltration, acinar cell necrosis, fibrosis, ductal alterations, and calcification were the main foci of the pathologic assessment.
Results: Overall, 86.7% concordance was found between CT findings and histopathologic diagnosis in 52 of the 60 individuals examined. There was a high degree of agreement between CT and histology in 27 out of 30 cases of acute pancreatitis (90% concordance). The most common symptoms were enlargement of the glands, several types of enhancement, necrosis in 12 individuals, and stranding of fat around the pancreas. Images showed parenchymal atrophy, calcifications (n=18), ductal dilatation (n=22), and pseudocysts (n=7) in 25 individuals with chronic pancreatitis (n=30), for a radiologic-pathologic association of 83.3% concordance. The main reasons for the 8 cases that did not match up were poor histologic sample or overlapping features in recurring acute and early chronic diseases.
Conclusion: The diagnostic accuracy of CT imaging in distinguishing acute from chronic pancreatitis, when combined with histology, is quite high. While there are limits at early or overlapping stages, the study suggests that CT is useful for assessing disease severity and consequences. Obtaining a conclusive diagnosis and formulating a treatment plan still requires a multidisciplinary approach that takes into account clinical, radiologic, and pathologic data.

Keywords: Acute pancreatitis, chronic pancreatitis, ct imaging, histopathology, radiologic-pathologic correlation, pancreatic inflammation

Introduction

Inflammation of the pancreas can manifest as acute pancreatitis (AP) or develop into chronic pancreatitis (CP), making pancreatitis a clinically relevant and commonly encountered pancreatic condition. In terms of cause, pathogenesis, imaging results, and prognosis, the two types are very different. On the other hand, their radiologic and clinical characteristics often overlap, making diagnosis and treatment choices more difficult [1, 2].

Autodigestion, interstitial edema, pancreatic necrosis, and pseudocyst formation are the usual symptoms of acute pancreatitis, which is caused by damage to acinar cells. Hypertriglyceridemia, gallstones, and alcoholism are the most common causes. Patients typically exhibit symptoms such as systemic inflammation, increased pancreas enzymes, and abrupt epigastric discomfort. Chronic pancreatitis, in contrast, is an ongoing inflammatory disorder that damages the pancreas's exocrine and endocrine functioning irreparably and causes pancreatic fibrosis, atrophy, and calcifications. Chronic alcoholism, hereditary variables, and repeated episodes of severe pancreatitis are common causes. Malabsorption,

diabetes mellitus, pancreatic insufficiency, and chronic stomach pain are some of the symptoms that patients may experience [3-5].

When diagnosing and treating pancreatitis, imaging is crucial, both in the short and long term. The imaging method that is most commonly used is contrast-enhanced computed tomography (CECT). It is fast, easy to obtain, and provides detailed images of the pancreatic morphology, parenchymal enhancement, ductal anatomy, and peripancreatic problems. Using CT criteria, signs of CP such calcifications, ductal dilatation, and pseudocyst formation can be identified, and scoring systems like the Modified CT Severity Index can be used to grade the severity of AP [6-8].

On the other hand, overlapping characteristics in early CP and resolving AP can restrict CT's diagnostic accuracy. In addition, there is no guarantee that imaging results will reflect the true extent of the disease, particularly in unusual or developing instances. This emphasizes the significance of radiologic-pathologic correlation in enhancing diagnostic certainty, validating radiologic criteria, and refining CT picture interpretation. Our goal in this study is to examine and contrast the CT results with the histopathologic diagnoses in a group of sixty patients with pancreatitis, split evenly between those with acute and chronic forms. Finding important imaging features with high predictive value, assessing the degree of connection between imaging and pathology, and contributing to improved diagnostic techniques in pancreatic inflammatory disorders are the goals [9-11].

Materials and Methods

This retrospective observational study involved 60 patients with clinically diagnosed pancreatitis who received contrast-enhanced computed tomography (CECT) and subsequent histopathological assessment using surgical specimens or biopsy at Department of Pathology, Gouri Devi Institute of Medical Sciences and Hospital, West Bengal, India from January 2019 to December 2019. The sample comprised 30 instances of acute pancreatitis and 30 instances of chronic pancreatitis. The evaluated radiologic findings encompassed gland size, contour, enhancing pattern, presence of necrosis, calcifications, ductal dilation, pseudocysts, and peripancreatic inflammation. The pathological assessment concentrated on inflammatory cell infiltration, acinar cell necrosis, fibrosis, ductal alterations, and calcification.

Inclusion Criteria

- Patients aged 18-75 years with clinical symptoms suggestive of pancreatitis.
- Availability of CT imaging within 7 days of symptom onset (for acute cases).
- Histopathologic confirmation of pancreatic inflammation or fibrosis.

Exclusion Criteria

- Patients with pancreatic neoplasms or autoimmune pancreatitis.
- Inadequate imaging or histopathologic samples.
- Prior pancreatic surgery.

Statistical Analysis

Descriptive statistics were employed to encapsulate the data. The concordance between CT results and histopathologic diagnosis was evaluated by sensitivity, specificity, and total accuracy. Kappa statistics were employed to evaluate interobserver agreement. A p-value less than 0.05 was deemed statistically significant.

Results

The research comprised 60 individuals, 30 of whom had acute pancreatitis (AP) and 30 of whom had chronic pancreatitis (CP). There were 2.3 times as many males as females among the patients, and their average age was 47.3 ± 12.6 years. Analyses were conducted on all cases using clinical, radiologic, and histopathologic data.

Table 1: CT Findings in Acute and Chronic Pancreatitis

CT Feature	Acute Pancreatitis (n=30)	Chronic Pancreatitis (n=30)
Glandular enlargement	26 (86.7%)	4 (13.3%)
Parenchymal necrosis	12 (40%)	0 (0%)
Peripancreatic fat stranding	22 (73.3%)	6 (20%)
Pseudocyst formation	6 (20%)	7 (23.3%)
Calcifications	0 (0%)	18 (60%)
Ductal dilatation or irregularity	3 (10%)	22 (73.3%)

While calcifications and ductal abnormalities were typically seen in CP CT scans, glandular growth, necrosis, and fat stranding were prominent in AP scans. Both circumstances showed the presence of pseudocysts.

Table 2: Histopathologic Findings in Acute and Chronic Pancreatitis

Histopathologic Feature	Acute Pancreatitis (n=30)	Chronic Pancreatitis (n=30)
Acinar cell necrosis	18 (60%)	2 (6.7%)
Interstitial inflammation	27 (90%)	19 (63.3%)
Fibrosis	4 (13.3%)	28 (93.3%)
Ductal dilatation/changes	5 (16.7%)	25 (83.3%)
Calcifications (microscopic)	0 (0%)	16 (53.3%)

In AP, histology revealed widespread inflammation and necrosis, while in CP, it revealed significant fibrosis along with ductal changes. The CT findings in CP were corroborated by the microscopic calcifications.

Table 3: Radiologic-Pathologic Correlation

Category	Acute Pancreatitis (n=30)	Chronic Pancreatitis (n=30)
Concordant cases	27 (90%)	25 (83.3%)
Discordant cases	3 (10%)	5 (16.7%)
Overall concordance	-	52/60 (86.7%)

The results from CT and pathology were consistent in 86.7% of instances. The fundamental reason for the discrepancy in cases was that recurring AP and early CP shared many characteristics.

Table 4: Diagnostic Accuracy of CT Imaging

Parameter	Acute Pancreatitis	Chronic Pancreatitis
Sensitivity (%)	93.3	86.7
Specificity (%)	90.0	80.0
Positive Predictive Value (%)	90.0	83.3
Negative Predictive Value (%)	93.1	84.2
Diagnostic Accuracy (%)	91.7	83.3

CT had excellent sensitivity and specificity for AP and CP diagnoses, with marginally higher performance for acute pathology detection.

Table 5: Interobserver Agreement on CT Interpretation

Feature Evaluated	Kappa Value (κ)	Agreement Strength
Parenchymal necrosis	0.84	Almost perfect
Calcifications	0.92	Almost perfect
Ductal dilatation/irregularity	0.78	Substantial
Glandular enlargement	0.81	Almost perfect
Fat stranding	0.75	Substantial

Results from CT scans of pancreatitis were reproducible, with good levels of agreement amongst observers for the majority of imaging characteristics and especially for calcifications and necrosis.

Discussion

This study compared the diagnostic accuracy of histopathology-based diagnosis of acute pancreatitis (AP) and chronic pancreatitis (CP) with contrast-enhanced computed tomography (CECT). With an impressive radiologic-pathologic concordance rate of 86.7%, our data confirm CT's reliability and non-invasiveness in assessing pancreatic inflammation and structural damage [12-14]. The diagnostic accuracy of CT in acute pancreatitis was 91.7%, and it was especially sensitive in identifying glandular expansion, parenchymal necrosis, and peripancreatic fat stranding. This confirms the results of previous research by Balthazar *et al*. and Mortele *et al*., which found that CT had a comparable predictive value in determining the degree and extent of inflammation. Significantly, histological observations of necrosis were found in 60% of acute cases, which closely matched CT findings of 40%, further demonstrating the importance of imaging in guiding severity categorization [15-17].

Although CT had a somewhat lower overall accuracy (83.3%), it successfully revealed classical characteristics such as calcifications, ductal dilatation, and atrophic alterations in chronic pancreatitis. Given that fibrosis and inflammatory characteristics may coexist in both early CP and recurrent AP, this highlights the difficulty of making the distinction between the two [18-20]. In most long-term instances, imaging findings corroborated histopathologic evidence of fibrosis and ductal alterations, echoing. Pancreatitis is a progressive and changeable disease; the occurrence of pseudocysts in both chronic and acute instances further supports this. Although the fluid collections were effectively detected by CT, the cystic lesions made histology less helpful. It was also observed that early calcific alterations may predate radiographic appearance, as evidenced by microscopic calcifications identified in more than 50% of CP specimens [21-23].

The CT interpretation was highly reproducible, with kappa values over 0.8, indicating significant interobserver agreement across important imaging parameters, especially for calcifications and necrosis [24, 25]. These results demonstrate that CT is useful for more than just diagnosis; it can also track the course of disease and how well a patient is responding to treatment. Discordant instances were reported in 10% of AP and 16.7% of CP, despite the promising outcomes. This was mostly because of overlapping characteristics or early-stage disease with minor structural changes. In circumstances when CT results are uncertain, these results highlight the possible supplementary use of magnetic resonance imaging (MRI) and endoscopic ultrasound (EUS) [26-28].

This study has a few caveats: it's retrospective, it only included cases that were confirmed by histopathology, so it could be skewed toward individuals who had more serious conditions or who had surgery to correct them. Additionally, it only included cases from one center, which could lead to selection bias. Furthermore, when there was a time lag between procedures, imaging and histologic findings might have been slightly different due to dynamic changes in the illness course [29-32].

Conclusion

Computed tomography (CT) is an essential technique for the diagnosis and management of acute and chronic pancreatitis due to its excellent diagnostic accuracy and good connection with histopathologic findings. To help evaluate the severity of acute pancreatitis and make informed clinical decisions, CT is useful for identifying hallmarks such as parenchymal necrosis, glandular expansion, and peripancreatic inflammation. The CT findings of ductal abnormalities, parenchymal atrophy, and calcifications in chronic pancreatitis are consistent with those of histologic fibrosis and ductal modifications, respectively. Integrating CT with other clinical, laboratory, and histopathologic data is crucial, especially in early or unusual cases, but CT is still an important part of the diagnostic process overall. Further evidence of the repeatability and dependability of CT results in pancreatitis is the great interobserver agreement. To sum up, CT is a great non-invasive tool for diagnosing acute pancreatitis from chronic pancreatitis and directing the right treatment at the right time. To improve diagnostic precision and prognostic assessment, future research should use longitudinal follow-up in conjunction with cutting-edge imaging methods.

Conflict of Interest

None

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