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Original Research Article

A Comparative Study of Ultrasonography and Computed Tomography for Diagnosing Acute Pancreatitis in A Tertiary Care Center in Tripura

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Abstract

Introduction: Pancreatitis is a significant medical concern, characterized by inflammation of the pancreas and presenting as acute or chronic forms. Understanding its severity and classifying complications is crucial for effective management. Diagnostic modalities such as ultrasound (USG) and computed tomography (CT) play vital roles in assessing pancreatitis. While USG offers non-invasive imaging, CT provides precise lesion definition. This study aims to evaluate the efficacy of USG in diagnosing pancreatitis and compare findings with CT.

Materials and Methods: Study was conducted at Agartala Government Medical College, this observational study included 50 patients over two years. Ethical clearance was obtained, and written consent was acquired. Patients underwent both USG and CT examinations using appropriate equipment. Data analysis employed statistical tools for comparison and presentation.

Results: Among the 50 patients, the majority fell within the 30-to-50-year age group, with a higher prevalence in males. USG visualized the pancreas in 88% of cases, predominantly showing hypoechoic patterns and duct dilatation. CT successfully visualized the pancreas in all cases, detecting hypodensity in 98% and duct dilatation in 12%. Extra-pancreatic findings were observed in 26% of cases, including fluid collections, ascites, and pleural effusions.

Conclusion: In diagnosing pancreatitis, both USG and CT are valuable tools, with CT offering superior visualization and assessment of pancreatic pathologies. While USG remains non-invasive and widely available, CT provides more detailed information, particularly in detecting extra-pancreatic complications. A combination of both modalities enhances diagnostic accuracy and patient care.

Introduction

Pancreatitis represents a significant health concern, leading to illness and death among patients who present with acute abdomen. It is characterized by inflammation of the pancreas and can manifest as either acute or chronic forms based on clinical and morphological characteristics. The causes of acute pancreatitis are multiple, with gallstones and alcohol responsible for approximately 90% of cases [1-2]

It's crucial to classify the severity of acute pancreatitis to ensure appropriate management. The severity is determined by the presence of transient or persistent organ failure and local or systemic complications, resulting in three degrees: mild, moderately severe, and severe acute pancreatitis.

The Atlanta classification (2012) divides acute pancreatitis into interstitial edematous pancreatitis (IEP) and necrotizing pancreatitis. Pancreatic and peripancreatic collections are further classified into acute peripancreatic fluid collection (APFC), pancreatic pseudocyst, acute necrotic collection (ANC), and walled-off necrosis (WON), based on location (pancreatic or peripancreatic), content nature (liquid, solid, gas), and presence of wall. [6-10]

Complications of acute pancreatitis are categorized into three main types: (1) organ failure, (2) systemic complications, and (3) local complications. Chronic pancreatitis is classified into large-duct and small-duct types based on the diameter of the main pancreatic duct (MPD). The most common clinical symptom is abdominal pain, which can be accompanied by nausea, vomiting, fever, and pain radiating to the back. Patients may also present with additional complications such as pseudocysts, vascular thrombosis, or obstruction of adjacent

organs, as well as symptoms indicating endocrine or exocrine pancreatic failure, or both. [8-10]

Ultrasonography (USG) plays a vital role in diagnosing and evaluating the imaging of organs and soft tissue structures. Its non-invasive nature and ongoing enhancements in imaging quality have increasingly positioned ultrasound as a valuable tool in assessing the pancreas. It not only helps diagnose pancreatitis but also rules out other causes of abdominal pain. With growing expertise among operators and technological advancements, USG can effectively assess pancreatitis in the majority of cases. However, it's worth noting that USG's effectiveness can be limited in overweight individuals and those with significant bowel gas. Contrast-enhanced ultrasound (CEUS) can be an additional option for diagnosing severe acute pancreatitis. [6,12]

Computed tomography (CT) is a dependable imaging technique that offers precise definition of lesions and enables comprehensive visualization of the entire spectrum of pancreatic pathology. When there's diagnostic uncertainty in ultrasonography (USG) for pancreatitis, CT evaluation can provide further clarification. Advanced multiplanar three-dimensional reconstruction methods, such as volume rendering, maximum intensity projection (MIP), and shaded surface display, offer detailed information about the interactions and potential involvement of vascular structures, as well as demonstrating local extension of pathology.[14,15]

The wide availability and high-quality images make CT a commonly used imaging technique. However, it is expensive, exposes patients to ionizing radiation, and may struggle to define fat planes in lean patients.[13] Despite pancreatitis being one of the most common conditions presented in clinical emergencies, there is a lack of radiological literature evaluating pancreatitis using USG. This study aims to assess the efficacy of USG in diagnosing pancreatitis and compare the findings with those obtained from CT.

Materials And Methods

The study was conducted as a observational study in the Department of Radiodiagnosis at Agartala government medical college and research center, Agartala, Tripura, involving 50 patients over a span of 2 years from October 2021 to October 2023. Ethical clearance was obtained from the Institutional Ethical Committee, and informed written consent was obtained from all patients prior to undergoing both ultrasound (USG) and computed tomography (CT) examinations.

Ultrasound equipment used included the Mindray DC70 with a curvilinear transducer, high-frequency linear array transducer, and Doppler probe. Computed tomography was performed using a SEIMENS 128 SLICE machine.

Methodology:

Study Population: The study included patients referred to the Department of Radiology at AGMC, with acute abdominal symptoms suggestive of acute pancreatitis, who were subsequently evaluated with contrast-enhanced computed tomography (CECT) after undergoing ultrasound examination during the study period.

Study Period: The study spanned 2 years, from October 2021 to October 2023, following clearance from the Institutional Ethical Committee.

Sampling Methods: Patients were selected randomly based on inclusion and exclusion criteria.

Inclusion Criteria: Patients of all age groups referred for abdominal ultrasound, in whom pancreatic pathology was being suspected

Exclusion Criteria: Excluded patients included those who were pregnant or expecting a pregnancy, those unwilling to participate in the study, and others ineligible for CT due to factors such as previous hypersensitivity reactions, bronchial asthma, or impaired renal function that would prevent contrast examination.

Statistical analysis: The data was entered into Microsoft Excel and analysed using SPSS (Statistical Package for Social Sciences) package 26.0 for relevant statistical comparisons. Results will be presented in the form of tables and graphs.

Table 1: Sex distribution

Male	Frequency	Percentage
Male	43	86.0
Female	7	14.0
Total	50	100.0

Table 2: Size and echotexture on USG

	Frequency	Percentage
Normal	14	28.0
Enlarged and altered	36	72.0
Total	50	100.0

Table 3: Size and shape on CT

	Frequency	Percentage
Normal	1	2.0
Enlarged and altered	49	98.0
Total	50	100.0

Table 4: Density on CT

	Frequency	Percentage
Normal	1	2.0
Heterogenous density	42	84.0
Parenchymal necrosis	7	14.0
Total	50	100.0

Table 5: Extrapancreatic features present

	Frequency	Percentage
No	37	74.0
Yes	13	26.0
Total	50	100.0

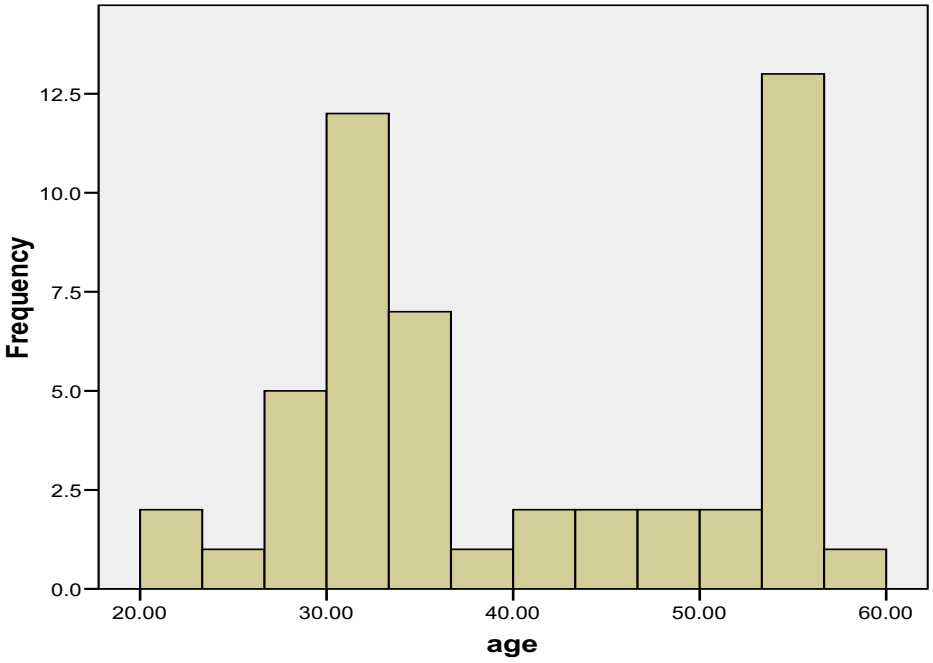

Figure 1: Showing age distribution of pancreatitis.

Results

Age profile of patients with acute pancreatitis: Study group included 50 patients selected from the patients sent for ultrasonography having probable acute pancreatitis. Patients of all age groups were imaged using USG, out of which 31 - 40 years of age patients peaked

Sex distribution of pancreatic lesions: Of the 50 patients selected in our study without sex distribution, male patients (43) outnumbered females (7) totalling 86% of cases.

Based on visualization: Among 44 of the 50 patients in whom pancreas was visualized, echotexture of each acute pancreatitis was individually tabulated. 95% of the cases which equals to 38 cases showed hypoechogenecity and 6 cases had duct dilatation

Based on size: Size of the pancreas was measured and assessed in 44 patients in whom pancreas was visualized in USG, out of which, 38 cases appeared enlarged and remaining 6 appeared normal in size.

Computed tomography appearance of acute pancreatits: Pancreas was visualized 100% in all the cases evaluated by computed tomography plain and contrast study. 92% of cases showed hypodensity in plain and contrast CT and 6 cases equalling 12% showed main pancreatic duct dilatation of more than 2.5mm

CT appearance of extra pancreatic findings: Extra pancreatic findings including gall stones, calcification, ascites, pleural effusion, peripancreatic fluid collections and inflamed peripancreatic fat were found in 13 cases.

Abdominal pain and vomiting were the most common presenting symptoms, with alcoholism being the leading etiology followed by gallstones and other idiopathic causes. In some cases, multiple etiologies were suspected, but the primary cause was considered for evaluation purposes.

Discussion

In our study, the age distribution of patients with acute pancreatitis revealed that the majority fell within the 31 to 50-year age group, constituting over 50% of the total acute pancreatitis cases. Interestingly, we found that females diagnosed with acute pancreatitis tended to be older compared to males, whereas the opposite trend was observed in cases of chronic pancreatitis.

This observation aligns with previous research by Silverstein et al. [1], which also noted that males with acute pancreatitis tended to be older (with a mean age of 41 years) compared to females (with a mean age of 32 years). Similarly, studies by Luetmer, Stephens, and Ward, as well as by Alpern et al., reported similar findings, with the mean age of male patients with chronic pancreatitis being higher than that of female patients.

Regarding the presentation of acute pancreatitis in our study, a significant proportion of patients had a history of alcohol consumption, with 29 out of 50 patients reporting alcohol use, and 5 patients reporting an alcoholic binge preceding the onset of symptoms. Cholelithiasis was another notable cause, present in 9 patients.

Changes in size were more accurately assessed using CT imaging. In our study, 49 out of 50 patients with acute pancreatitis (98%) exhibited a bulky pancreas on CT scans, while the remaining 1 patient had a normal-sized pancreas. However, ultrasound was sufficient for visualization in all patients, and the identification of a dilated pancreatic duct and an atrophic pancreas was indicative of chronic pancreatic pathology. Therefore, in line with the recommendation by L. Bolondi et al., ultrasound should be the initial diagnostic step when pancreatic disease is suspected.

As emphasized in the study by SJ Hessel et al. [4], a negative ultrasound result does not rule out significant, and potentially life-threatening, pancreatic disease. Ultrasound can provide a definitive diagnosis and visualize complications associated with pancreatitis. Ultimately, the most accurate assessment of pancreatitis involves a combination of clinical evaluation, including symptoms and pancreatic function tests, and radiological examination to define ductal and parenchymal changes.

Furthermore, serum and/or ascitic fluid amylase levels were elevated in all instances of acute pancreatitis, while none of the cases of chronic pancreatitis exhibited elevated levels, further supporting the diagnostic differentiation between acute and chronic pancreatitis.

In our study, ultrasound was performed on all patients. The pancreas was visualized in 44 patients but obscured in the remaining 6 cases, much better than the findings from a study by Calleja and JS Barkin, which reported that bowel gas disturbances could obscure the pancreas in 40% of acute pancreatitis patients.[5]

USG Findings: The enlargement of the pancreas is attributed to interstitial edema within the pancreatic parenchyma. In our study, a bulky pancreas was observed in 38 out of 50 patients (76%), which is a higher prevalence compared to findings reported by R. B. Jeffery Jr,[2] where only a third of patients with acute oedematous pancreatitis exhibited an enlarged gland.

The presence of duct dilatation in pancreatic pathologies varies greatly and can be influenced by factors such as compression due to edema or increased visibility caused by a hypoechoic pancreas. In our study, duct dilatation was observed in almost 6 patients (14%), with 2 cases being diagnosed as acute on chronic pancreatitis. A bulky, hypoechoic pancreas is characteristic of oedematous pancreatitis, although one series reported this finding in only a third of patients with oedematous pancreatitis.

In our study, a hypoechoic pancreas was observed in 37 patients (76%), consistent with the typical presentation of oedematous pancreatitis.

CT Findings: CT imaging of the pancreas was successfully performed in all 50 patients (100%) in our study, as it was not hindered by interference from overlying bowel gas. CT provides detailed information about the size of the pancreas without being affected by gas or fat, making it the most reliable sign in detecting pancreatic pathologies.[9]

The incidence of abnormal main pancreatic duct varies, typically occurring in 10% to 15% of cases. In our study, this finding, along with calcifications or calculi, was the most common, observed in 6 patients (12%). Focal intra pancreatic lesions were identified in 07 patients (18%), in line with findings reported by EJ Balthazer, where 18% of patients were noted to have focal lesions.

Extra pancreatic findings such as fluid collections were seen in 13 patients (26%) with acute pancreatitis on CT. Thickening of Gerota's fascia was noted in 13 patients. Free intraperitoneal fluid

indicative of ascites was detected in 10 patients (20%) in our study, which was a higher incidence compared to that reported by EJ Balthazar [16] (7%). Pleural effusions were observed in 10 patients (20%) in our study, also surpassing the reported incidence by EJ Balthazar.

The comparison between ultrasound (USG) and contrast-enhanced computed tomography (CECT) in acute pancreatitis reveals several notable differences in their diagnostic capabilities.

Overall, CT imaging provides superior visualization of the pancreas compared to ultrasound. This is supported by historical data indicating that CT scans had good to excellent visualization of the pancreas in 64% of cases, compared to only 20% with sonographic studies. With technological advancements, the visualization of the pancreas on CT has further improved. In our study, the pancreas was visualized in 88% of patients on ultrasound and in 100% of patients on CT.

CT imaging also excels in assessing alterations in pancreatic size. In our study, CT detected a bulky pancreas in 98% of acute pancreatitis cases, whereas ultrasound visualization of size alterations was less precise.

Both modalities were effective in identifying duct dilation and calcifications, but CT proved more useful in detecting free fluid, which was observed in 13 patients compared to 8 patients detected by ultrasound.

The sensitivity of ultrasound in detecting acute pancreatitis was 88%, but CT had a sensitivity of 100% with superior visualization and assessment of size. Negative ultrasound findings do not exclude significant pancreatic disease, highlighting the importance of additional imaging modalities.

However, ultrasound visualization was adequate in all patients, and the observation of a dilated pancreatic duct and an atrophic pancreas was diagnostic of chronic pancreatic pathology. Therefore, ultrasound should remain the first diagnostic step when pancreatic disease is suspected.

CT demonstrated a sensitivity of 100%, which was higher than reported in previous studies. Ultrasound can lead to a definite diagnosis and visualize complications of chronic pancreatitis, but the most accurate assessment involves a combination of clinical evaluation and radiological definition of duct and parenchymal changes.

Conclusion

The diagnosis of specific pancreatic pathologies is often delayed due to the broad range of conditions presenting with abdominal pain in primary care settings. Additionally, certain blood investigations such as serum amylase and serum lipase, while specific for pancreatic pathologies, may be normal in the early stages of some individuals. Ultrasonography, while less expensive, non-invasive, and radiation-free, has limitations that can lead to poor visibility and potentially misleading results.

Contrast-enhanced computed tomography (CECT) of the abdomen is able to detect most pancreatic pathologies with a higher degree of accuracy. Thus, all patients with clinical suspicion of pancreatic pathology may benefit from CECT imaging. CECT scans are essential for diagnostic workup as certain pathologies are classified based on parenchymal status, and confident diagnoses can often be made with CECT alone or in correlation with clinical examination.

While ultrasonography visualized the pancreas in approximately 88% of patients, CT imaging achieved visualization in all patients. Ultrasonography remains a valuable tool due to its non-invasive nature, quick results, and widespread availability. However, it may not easily detect extra-pancreatic spread of inflammation and vascular complications due to its limitations.

CECT serves as a confirmatory investigation in diagnosing and staging acute or chronic pancreatic pathologies. Alterations in size and echogenicity were among the most common findings on ultrasonography. A bulky, hypoechoic pancreas was considered diagnostic of acute pancreatic pathologies on ultrasonography.

In conclusion, both ultrasonography and CT have roles to play in the diagnosis of pancreatitis, with each modality complementing the other's strengths and weaknesses.

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