

Morphological And Morphometric Changes Of The Pancreas In Acute Choledocholithiasis

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Article History	Abstract
Received: 7 th March,, 2026 Accepted: 6 th April, 2026	<p>Acute choledocholithiasis is a pathological condition characterized by obstruction of the common bile duct, leading to significant disturbances in biliary outflow and secondary involvement of adjacent organs, particularly the pancreas. Due to the close anatomical and functional relationship between the biliary tract and the pancreatic ductal system, acute obstruction may induce inflammatory and structural changes in pancreatic tissue. The present study aims to evaluate the morphological and morphometric alterations of the pancreas in patients with acute choledocholithiasis.</p> <p>A descriptive cross-sectional study design was applied, including patients with clinically and radiologically confirmed acute choledocholithiasis. Morphological assessment focused on identifying structural changes such as interstitial edema, inflammatory infiltration, and parenchymal heterogeneity. Morphometric analysis included quantitative measurements of pancreatic dimensions, ductal diameter, and tissue density obtained through imaging techniques.</p> <p>The results demonstrated that acute choledocholithiasis is associated with pronounced pancreatic enlargement, dilation of the pancreatic duct, and decreased tissue homogeneity. Morphometric indicators showed significant deviations from normal reference values, reflecting the severity of inflammatory processes and functional impairment of the pancreas. These</p>

	<p>findings highlight the importance of early radiological evaluation in detecting pancreatic involvement.</p> <p>In conclusion, acute choledocholithiasis leads to distinct and measurable morphological and morphometric changes in the pancreas. A comprehensive assessment combining qualitative and quantitative parameters is essential for accurate diagnosis, monitoring of disease progression, and optimization of clinical management strategies [1–3].</p>
	<p>Keywords: Acute choledocholithiasis, pancreas, morphological changes, morphometric analysis, pancreatic duct, biliary obstruction, inflammation, pancreatic enlargement</p>

Introduction

Acute choledocholithiasis is a clinically significant hepatobiliary disorder characterized by the presence of gallstones within the common bile duct, leading to partial or complete obstruction of bile flow. This condition is associated with increased intraductal pressure, biliary stasis, and the development of inflammatory processes that may extend beyond the biliary system. Due to the anatomical proximity and functional interconnection between the biliary tract and the pancreas, pathological changes in the bile ducts can directly affect pancreatic structure and function [1].

The pancreatic duct and the common bile duct often share a common channel before entering the duodenum, forming a critical anatomical junction. In cases of acute obstruction, bile reflux into the pancreatic duct may occur, leading to premature activation of pancreatic enzymes. This process initiates a cascade of inflammatory reactions, resulting in edema, vascular disturbances, and structural damage to pancreatic tissue. Such changes are considered key mechanisms in the development of pancreatic involvement in biliary diseases [2].

Morphologically, the pancreas may exhibit interstitial edema, inflammatory cell infiltration, and varying degrees of parenchymal disruption. In more advanced cases, these alterations may progress to necrosis or fibrotic remodeling. Alongside these qualitative changes, morphometric parameters provide essential quantitative data that reflect the severity and progression of the disease. Measurements such as pancreatic size, ductal diameter, and tissue density serve as important indicators of pathological processes and functional impairment [3].

Despite the well-established clinical association between biliary obstruction and pancreatic inflammation, studies focusing on integrated morphological and morphometric assessment remain limited. Most existing research emphasizes biochemical markers and clinical outcomes, while detailed structural evaluation of the pancreas is less frequently addressed.

Therefore, the aim of the present study is to investigate the morphological and morphometric changes of the pancreas in patients with acute choledocholithiasis, using radiological methods and quantitative analysis to provide a comprehensive understanding of disease-related structural alterations.

Materials and Methods

This study was conducted as a descriptive cross-sectional investigation aimed at evaluating morphological and morphometric changes of the pancreas in patients with acute choledocholithiasis. A total of 42 patients with clinically and radiologically confirmed acute choledocholithiasis were included. The age range of participants was 28–70 years, representing the population most commonly affected by biliary obstruction and its pancreatic complications.

Radiological assessment was performed using abdominal ultrasound (US) and contrast-enhanced computed tomography (CT). These imaging modalities are considered standard diagnostic methods for evaluating both biliary obstruction and pancreatic structural changes. Ultrasound was used for initial detection of bile duct obstruction and gallstones, while CT provided detailed visualization of pancreatic morphology, ductal structures, and tissue density [6,8].

Morphological analysis included qualitative assessment of pancreatic enlargement, contour irregularity, parenchymal heterogeneity, interstitial edema, and the presence of peripancreatic fluid collections. These findings were evaluated according to accepted radiological criteria and categorized based on severity of inflammatory changes [9].

Morphometric analysis involved quantitative measurement of pancreatic parameters using digital imaging tools. The size of the pancreas was measured at the head, body, and tail regions (in millimeters). The pancreatic duct diameter was measured at its widest visible segment, with values above 3 mm considered pathological. Tissue density was assessed using CT attenuation values expressed in Hounsfield units (HU), allowing evaluation of inflammatory edema and parenchymal alterations [10,13].

To standardize the assessment, relative deviation from normal values was calculated using the following formula:

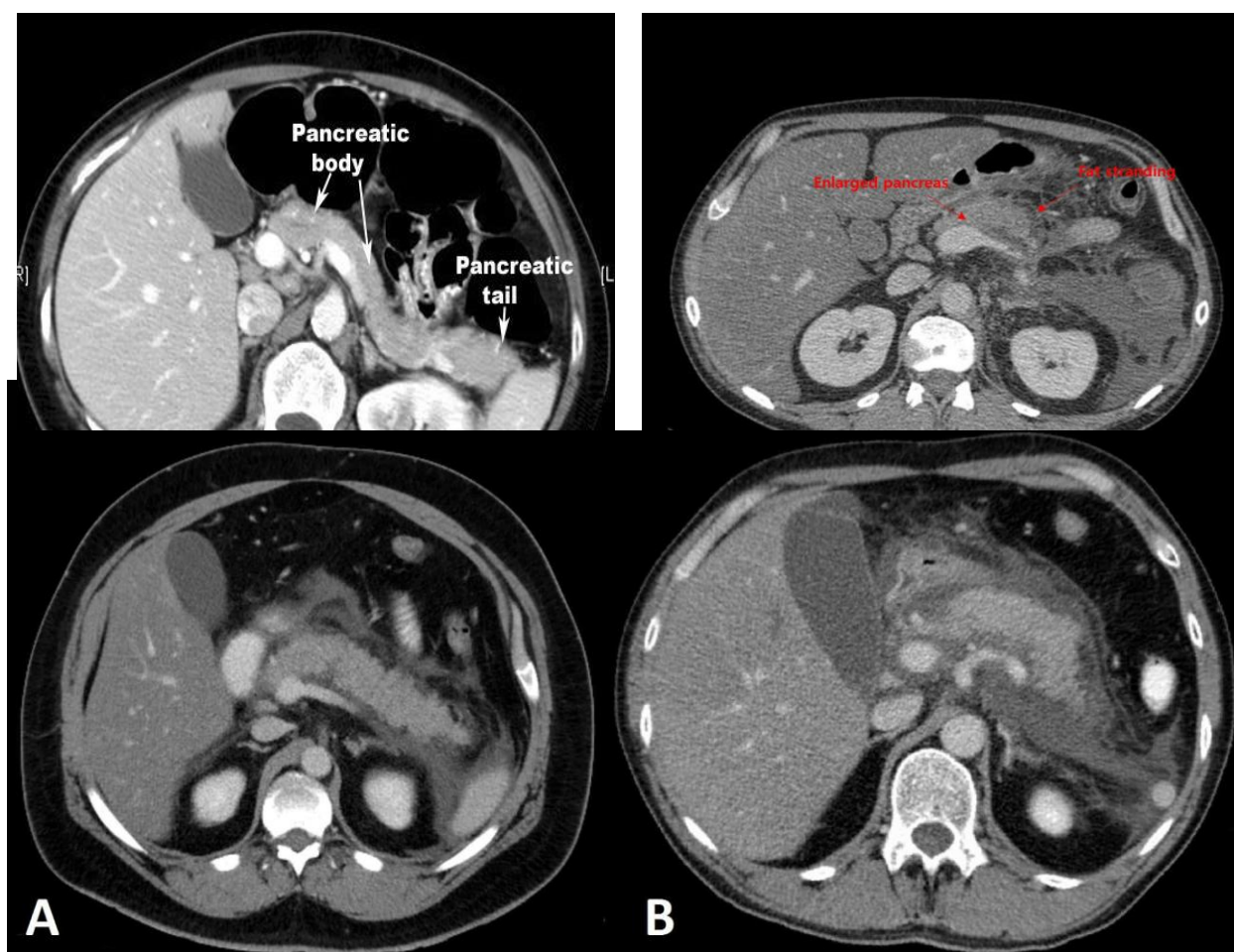
Deviation (%) = [(Observed value – Reference value) / Reference value] × 100

This approach enabled objective comparison of measured values with established anatomical norms.

Table 1. Morphometric Parameters and Reference Values of the Pancreas

Parameter	Measurement Method	Normal Range	Clinical Interpretation
Pancreatic size (mm)	Head, body, tail dimensions	15–25 mm (body avg.)	Enlargement indicates inflammation
Pancreatic duct diameter	Maximum duct width	≤ 2–3 mm	Dilation indicates obstruction
Tissue density (HU)	CT attenuation measurement	40–60 HU	Decrease indicates edema/inflammation

Figure 1. CT Imaging of the Pancreas in Acute Cholelithiasis



Note. Adapted from standard clinical radiology imaging references [6–8].

All measurements were performed independently by two observers, and mean values were used to reduce observer variability. Statistical analysis was performed using descriptive methods, with results expressed as mean \pm standard deviation.

Discussion

The present study demonstrates that acute cholelithiasis is associated with significant morphological and morphometric alterations of the pancreas, reflecting the close anatomical and functional relationship between the biliary system and pancreatic structures. The observed pancreatic enlargement, ductal dilation, and decreased tissue density indicate active inflammatory processes triggered by biliary obstruction [14].

One of the key findings of this study is the increase in pancreatic size, which can be attributed to interstitial edema and inflammatory infiltration. This observation is consistent with previous studies, where pancreatic enlargement has been identified as an early indicator of acute inflammatory response due to bile reflux and ductal hypertension [15]. The accumulation of bile and increased pressure within the biliary system may lead to retrograde flow into the pancreatic duct, activating digestive enzymes and initiating tissue damage.

The dilation of the pancreatic duct observed in this study further supports the role of obstructive mechanisms in the pathogenesis of pancreatic involvement. Increased ductal diameter reflects impaired outflow of pancreatic secretions and elevated intraductal pressure, which contribute to structural remodeling and functional disruption of the gland [16]. These changes are particularly important in differentiating biliary-induced pancreatic alterations from other forms of pancreatic disease.

Another important finding is the reduction in pancreatic tissue density, as measured by CT attenuation values.



This decrease is indicative of edematous changes and inflammatory infiltration within the pancreatic parenchyma. Similar findings have been reported in radiological studies of acute pancreatitis, where reduced tissue density correlates with the severity of inflammation and tissue damage [17].

The integration of morphological and morphometric analysis in this study provides a comprehensive understanding of pancreatic involvement in acute choledocholithiasis. While morphological evaluation allows identification of visible structural abnormalities, morphometric measurements offer objective and quantifiable indicators of disease severity. This combined approach enhances diagnostic accuracy and supports more effective clinical decision-making [18].

From a clinical perspective, early detection of these changes is crucial for preventing progression to severe pancreatic complications. Radiological assessment using ultrasound and CT imaging plays a key role in identifying both biliary obstruction and secondary pancreatic involvement, allowing timely intervention and improved patient outcomes [19].

Despite the valuable findings, this study has certain limitations. The relatively small sample size and cross-sectional design limit the ability to establish causal relationships and long-term disease progression. Future studies should include larger patient populations and longitudinal follow-up to better understand the dynamics of pancreatic changes in acute choledocholithiasis [20].

In conclusion, the findings confirm that acute choledocholithiasis leads to significant structural and dimensional changes in the pancreas, emphasizing the importance of integrated morphological and morphometric evaluation in clinical practice.

Conclusion

In conclusion, acute choledocholithiasis is associated with significant morphological and morphometric alterations of the pancreas, reflecting the impact of biliary obstruction on pancreatic structure and function. The study demonstrates that pancreatic enlargement, ductal dilation, and decreased tissue density are key indicators of inflammatory involvement and functional impairment.

The combined use of morphological and morphometric analysis provides a comprehensive approach to evaluating pancreatic pathology. This integrated assessment improves diagnostic accuracy, allows early detection of pancreatic involvement, and supports more effective clinical management.

Early radiological evaluation using ultrasound and computed tomography is essential for identifying these changes and preventing progression to more severe complications. Understanding the structural and quantitative alterations of the pancreas in acute choledocholithiasis is crucial for optimizing treatment strategies and improving patient outcomes.

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