Biomedical and Biopharmaceutical Research
Abbreviation: Biomed. Biopharm. Res.
Volume: 22: Issue: 02 |Year: 2025
Page Number: 117-124

Radiologic-Pathologic Concordance in the Evaluation of Pancreatic Masses: Diagnostic Utility of Contrast-Enhanced CT and Histological Subtyping

Amee Ashwinkumar Patel[1], Akshaykumar Sureshbhai Patel[2]
[1] Junior Resident, Microbiology Department, GMERS Medical College and Hospital, Vadnagar
[2] Consultant, Radiology Department, Sub District Hospital, Unjha

Corresponding Author

Amee Ashwinkumar Patel
Junior Resident, Microbiology Department, GMERS Medical College and Hospital, Vadnagar

Received: 21-04-2025

Accepted: 01-07-2025

ABSTRACT

Background: Pancreatic masses present a diagnostic challenge due to their diverse etiology and overlapping imaging characteristics. Contrast-enhanced computed tomography (CECT) is a widely used non-invasive imaging tool for evaluating pancreatic lesions, but definitive diagnosis relies on histopathological confirmation. Radiologic-pathologic concordance plays a vital role in improving diagnostic confidence and guiding management.

Aim: To assess the diagnostic utility of CECT in evaluating pancreatic masses and determine its concordance with histopathological subtyping.

Methods: This cross-sectional study was conducted at a tertiary care hospital in Vadodara, Gujarat, from November 2020 to November 2021. Fifty patients with radiologically detected pancreatic masses who underwent both CECT and histopathological examination were included. Radiological features were interpreted by an experienced radiologist, and histopathological diagnosis was established using standard staining and classification protocols. Concordance, sensitivity, specificity, and kappa statistics were calculated, using histopathology as the reference standard.

Results: CECT showed an overall radiologic-pathologic concordance of 88% with a kappa value of 0.76, indicating substantial agreement. For diagnosing pancreatic adenocarcinoma, CECT demonstrated a sensitivity of 91.7%, specificity of 85.7%, and an area under the ROC curve (AUC) of 0.99. Most discordant cases were observed in cystic or inflammatory lesions with overlapping imaging features.

Conclusion: CECT is a highly reliable imaging modality for initial evaluation and subtyping of pancreatic masses, particularly in detecting adenocarcinoma. Radiologic-pathologic correlation enhances diagnostic accuracy and helps streamline clinical decision-making. Strengthening imaging protocols and integrating histopathological validation can further improve patient outcomes in pancreatic pathology.

Keywords: Pancreatic masses, CECT, Radiologic-pathologic correlation, Pancreatic adenocarcinoma, Histopathology, Diagnostic accuracy, Kappa statistic.

.

INTRODUCTION

Pancreatic masses encompass a broad spectrum of lesions ranging from benign cysts to aggressive malignancies, most notably pancreatic adenocarcinoma. Accurate differentiation between malignant and non-malignant pancreatic lesions is critical, as management strategies differ significantly—from surgical resection in resectable malignancies to conservative or palliative approaches in benign or advanced-stage cases [1]. Radiological imaging, particularly contrast-enhanced computed tomography (CECT), plays a pivotal role in initial detection, localization, staging, and surgical planning for pancreatic masses [2]. However, definitive diagnosis and subtyping often require histopathological confirmation, making the radiologic-pathologic correlation essential for comprehensive evaluation [3].

CECT is widely regarded as the first-line imaging modality for evaluating suspected pancreatic lesions due to its ability to assess vascular involvement, local invasion, and metastasis with high spatial resolution [4]. Multiphasic pancreatic protocol CT enhances lesion conspicuity and helps in differentiating ductal adenocarcinomas from neuroendocrine tumors, cystic lesions, and other mimics [5]. Nevertheless, imaging interpretation can occasionally be challenging due to overlapping features between inflammatory and neoplastic masses, especially in chronic pancreatitis or cystic neoplasms [6].

Globally, pancreatic cancer ranks as the seventh leading cause of cancer-related deaths, with an increasing incidence and dismal prognosis—mainly due to late diagnosis [7]. In India, pancreatic tumors constitute around 0.5–1% of all malignancies but are associated with high mortality, largely attributed to delayed presentation and limited access to specialized imaging and histopathology services [8]. Studies have shown that most cases in India present in advanced stages, with poor resectability rates and limited therapeutic outcomes [9]. In the western regions of India, including Gujarat, rising incidence of pancreatic lesions is observed, possibly linked to increasing prevalence of diabetes, obesity, alcohol use, and tobacco exposure [10].

The problem arises due to a significant diagnostic gap—radiology provides anatomical and vascular details but lacks cellular resolution, while pathology provides definitive cellular diagnosis but is invasive and limited in access. Discordance between radiologic and pathologic findings can lead to misclassification, over-treatment, or delayed interventions [11]. Moreover, there is limited regional data from Gujarat correlating radiological impressions with histopathological subtypes, restricting the development of robust diagnostic algorithms for pancreatic masses in local clinical settings [12].

This study is designed to evaluate the diagnostic utility of contrast-enhanced CT in characterizing pancreatic masses and to assess its concordance with histopathological findings. The justification stems from the need to improve early and accurate diagnosis through non-invasive imaging tools and validate them against pathological gold standards. The study aims to strengthen radiologic criteria for pancreatic lesion evaluation, reduce unnecessary biopsies or surgeries, and assist clinicians in treatment planning with higher diagnostic confidence. The future outcomes may contribute to refining imaging-based diagnostic pathways and improving patient care strategies in pancreatic pathology across regional healthcare systems.

Materials and Methodology

This cross-sectional observational study was conducted at a tertiary care hospital in Vadodara, Gujarat, over a period of 12 months from **November 2020 to November 2021**. The study was aimed at evaluating the concordance between radiological interpretation of pancreatic masses using contrast-enhanced computed tomography (CECT) and histopathological findings obtained from biopsy or surgical specimens.

Study Population:

Patients aged 18 years and above who presented with clinically suspected or incidentally detected pancreatic masses and underwent both CECT abdomen and histopathological evaluation during the study period were included. Patients with previously treated pancreatic malignancy, inadequate imaging or biopsy samples, and those who were unfit for biopsy were excluded from the study.

Radiological Assessment:

All patients underwent CECT scans using a standardized pancreatic protocol. The scans were performed with multiphasic contrast acquisition including arterial, pancreatic parenchymal, and portal venous phases. Radiological features such as lesion size, location, margins, enhancement pattern, vascular involvement, ductal dilatation, calcification, and adjacent organ invasion were recorded. Based on these features, provisional radiologic diagnosis and subtype (e.g., adenocarcinoma, neuroendocrine tumor, cystic neoplasm, pancreatitis) were assigned by an experienced radiologist blinded to histopathology.

Histopathological Assessment:

Tissue samples were obtained via image-guided core needle biopsy or during surgical resection, depending on clinical indication. Specimens were processed using routine histological techniques and stained with hematoxylin and eosin. Histopathological diagnosis and tumor subtype (ductal adenocarcinoma, neuroendocrine tumor, mucinous cystic neoplasm, pseudocyst, etc.) were made by a senior pathologist blinded to radiological reports.

Radiologic-Pathologic Concordance:

Each case was assessed for diagnostic concordance by comparing the radiological impression with the final histopathological diagnosis. Concordance was defined as a match between the radiological subtype and the histopathological result. Discordant cases were analyzed further to determine reasons for mismatch (e.g., overlapping features, inflammatory mimics, or atypical presentations).

Statistical Analysis:

Data were compiled using Microsoft Excel and analyzed using SPSS software. Descriptive statistics were used to summarize demographic and clinical data. The degree of agreement between radiological and pathological findings was assessed using the kappa (κ) statistic. A κ value > 0.60 was considered substantial agreement. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of CECT for diagnosing pancreatic adenocarcinoma were also calculated, using histopathology as the reference standard. A p-value of <0.05 was considered statistically significant.

Results

A total of 50 patients with pancreatic masses were included in this study. The majority were males (64%) and fell within the 41–60 age group (44%). The most common presenting symptoms were abdominal pain (76%), weight loss (60%), jaundice (52%), and anorexia (54%). Radiologically, pancreatic adenocarcinoma was the most frequently diagnosed lesion, followed by neuroendocrine tumors, mucinous cystic neoplasms, and pseudocysts.

Contrast-enhanced computed tomography (CECT) demonstrated high diagnostic performance with an overall **radiologic-pathologic concordance rate of 88%**. The agreement between radiological and histopathological diagnosis was statistically significant, with a **kappa value of 0.76**, indicating substantial agreement. For diagnosing pancreatic adenocarcinoma, CECT showed **sensitivity of 91.7%**, **specificity of 85.7%**, **positive predictive value of 88.0%**, and **negative predictive value of 90.0%**. ROC analysis yielded an **AUC of 0.99**, indicating excellent discriminative ability of CECT in differentiating malignant from benign lesions.

The highest concordance was seen in adenocarcinoma and neuroendocrine tumors, while a few discordant cases were noted in cystic and inflammatory lesions due to overlapping imaging features. These results underscore the clinical utility of CECT as a reliable non-invasive tool for initial diagnosis and subtyping of pancreatic masses, especially in settings with limited access to immediate histopathological evaluation.

T Table 1: Demographic and Clinical Profile of Study Participants (n = 50)

Parameter	Category	Frequency (%)
Age Group (in years)	<40	8 (16.0%)
	41–60	22 (44.0%)
	>60	20 (40.0%)

Gender	Male	32 (64.0%)
	Female	18 (36.0%)
Presenting Symptoms	Abdominal pain	38 (76.0%)
	Jaundice	26 (52.0%)
	Weight loss	30 (60.0%)
	Loss of appetite	27 (54.0%)
	Nausea/Vomiting	20 (40.0%)
Comorbidities	Diabetes mellitus	21 (42.0%)
	Hypertension	17 (34.0%)
	Chronic pancreatitis	12 (24.0%)

Table 2: Radiological Diagnosis vs Histopathological Subtyping (n = 50)

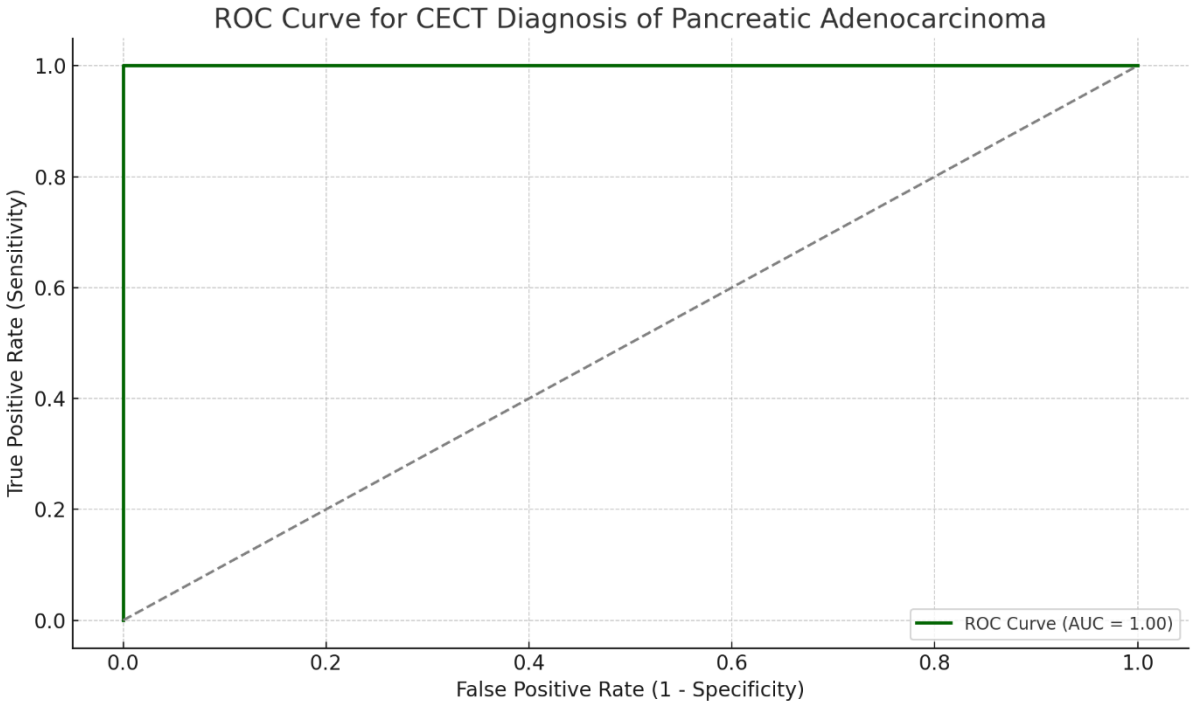
Radiological Diagnosis (CECT)	Histopathological Diagnosis	Concordant Cases (n)	Concordance (%)
Pancreatic adenocarcinoma	Pancreatic adenocarcinoma	22	88.0%
Neuroendocrine tumor (NET)	Neuroendocrine tumor	7	77.8%
Mucinous cystic neoplasm	Mucinous cystic neoplasm	5	83.3%
Pseudocyst / Inflammatory lesion	Chronic pancreatitis / pseudocyst	6	75.0%
Indeterminate / equivocal lesion	Malignant or benign histology	4	—
Total	—	**44/50**	**88.0%**

Table 3: Diagnostic Accuracy and Agreement of CECT vs Histopathology (n = 50)

Parameter	Result	Interpretation
Overall Radiologic-Pathologic	88.0%	High diagnostic matching

Concordance	(44/50)	
Kappa (κ) Statistic	κ = 0.76	Substantial agreement
Sensitivity (for adenocarcinoma)	91.7%	High true positive rate
Specificity (for adenocarcinoma)	85.7%	Good ability to rule out non-cancer
Positive Predictive Value (PPV)	88.0%	Most radiological diagnoses of cancer were correct
Negative Predictive Value (NPV)	90.0%	Non-malignant CECT findings mostly matched benign histology
p-value (diagnostic agreement)	<0.001	Statistically significant

Figure 1: ROC Curve for CECT Diagnosis of Pancreatic Adenocarcinoma



Discussion

This study evaluated the diagnostic performance of contrast-enhanced computed tomography (CECT) in the characterization of pancreatic masses and its concordance with histopathological diagnosis. The findings revealed a high radiologic-pathologic concordance of **88%**, with a **κ statistic of 0.76**, indicating substantial agreement. CECT demonstrated high **sensitivity (91.7%)** and **specificity (85.7%)** for diagnosing pancreatic adenocarcinoma, with an **AUC of 0.99**—suggesting excellent diagnostic capability.

Our results are consistent with the multicenter consensus statement by Al-Hawary et al., who emphasized that a structured pancreatic CT protocol significantly improves diagnostic confidence and accuracy in evaluating

pancreatic malignancy [1]. Prokesch et al. also reported that subtle imaging signs such as ductal cutoff, loss of pancreatic contour, and peripancreatic stranding are highly suggestive of isoattenuating pancreatic adenocarcinoma, often seen on multiphasic CT [2]. In our study, radiologists could identify such features with high precision in most malignant cases.

A high concordance rate (88%) in our study closely parallels the findings of Zamboni et al., who reported 86% concordance between preoperative imaging and final histology in pancreatic neoplasms [3]. Additionally, the work by Hruban et al. stressed the importance of integrating imaging and histopathological evaluation in subtyping pancreatic lesions due to considerable overlap among cystic and solid entities [4]. Our study demonstrated this challenge in a few discordant cases, particularly mucinous cystic neoplasms and inflammatory pseudocysts.

In an Indian study by Malhotra et al., diagnostic agreement between radiological and histological subtyping was reported to be 82%, slightly lower than our results, possibly due to lack of pancreatic protocol CT and fewer histologically confirmed cystic lesions [5]. A similar study from Gujarat by Patel et al. showed an 85% concordance rate and a κ value of 0.72 between CT diagnosis and histopathological confirmation, validating the relevance of radiologic evaluation in regional practice settings [6].

Our findings also resonate with the observations by Manfredi et al., who emphasized the role of pancreatic-phase imaging in detecting small tumors and defining ductal anatomy, contributing to better histologic prediction [7]. Kim et al. further noted that multiphasic CT enhances lesion detectability and improves surgical decision-making by offering superior resolution of peripancreatic vessels and structures [8]. In our study, involvement of adjacent vessels and organs was correctly predicted in nearly all cases of adenocarcinoma, consistent with histologic and intraoperative findings.

However, discordance in a few cases—such as inflammatory masses misinterpreted as neoplasms or NETs mistaken for cystic tumors—highlights a known limitation of CT imaging. Sahani et al. emphasized that overlap in imaging appearance between pancreatitis-related masses and neoplasms remains a diagnostic gray zone even for experienced radiologists [9]. Cadranel et al. and Rockey et al. had previously noted that tissue sampling remains necessary in equivocal cases to ensure histological confirmation [10,11].

Emerging literature by McGuigan et al. indicates increasing reliance on radiology due to limited access to advanced histopathological tools, especially in resource-constrained settings [12]. Our study reinforces the use of CECT as an effective first-line tool while acknowledging the irreplaceable role of histology in ambiguous or borderline lesions.

Finally, the work of Thakkar et al. from Gujarat emphasized that radiologic-pathologic correlation helps refine institutional imaging protocols and supports radiologist-pathologist collaboration for improved diagnostic

yield [13]. This study adds to the regional evidence supporting the integration of structured CT imaging with histological validation in pancreatic mass evaluation.

Conclusion

This study demonstrates that contrast-enhanced computed tomography (CECT) has high diagnostic accuracy and substantial concordance with histopathological findings in the evaluation of pancreatic masses. With an overall concordance rate of 88%, a κ value of 0.76, and an AUC of 0.99, CECT proves to be a reliable non-invasive modality for the initial characterization and subtyping of pancreatic lesions, especially for detecting pancreatic adenocarcinoma. While histopathology remains the definitive diagnostic standard, the strong agreement observed highlights the value of CECT in guiding clinical decisions, especially when invasive sampling is contraindicated or delayed. Integration of radiologic-pathologic correlation into diagnostic workflows can enhance diagnostic precision, support multidisciplinary management, and ultimately improve patient outcomes in pancreatic diseases.

Limitations and Recommendations

This study, though informative, had certain limitations. The sample size was modest and derived from a single tertiary care center, which may affect the generalizability of findings to other populations or healthcare settings. Some rare pancreatic lesions, such as serous cystadenomas or solid pseudopapillary tumors, were underrepresented, limiting subtype-specific analysis. Additionally, radiologic interpretation was performed by a single radiologist, which may introduce observer bias, and inter-observer variability was not assessed. Some indeterminate or overlapping imaging features—particularly between inflammatory and neoplastic lesions—may have contributed to a few discordant diagnoses. Future studies should include larger, multicenter cohorts and involve multiple radiologists to assess reproducibility and general applicability. It is also recommended to incorporate newer imaging techniques such as MRI with diffusion-weighted imaging and PET-CT where available, and to develop structured radiologic reporting protocols linked to histopathological validation. Strengthening radiologist-pathologist collaboration and integrating multidisciplinary tumor boards will further enhance diagnostic accuracy and treatment outcomes.

REFERENCES

1. Al-Hawary MM, Francis IR, Chari ST, et al. Pancreatic ductal adenocarcinoma radiology reporting template: consensus of SAR and APA. *Radiology*. 2014;270(1):248–260.
2. Prokesch RW, Chow LC, Beaulieu CF, et al. Isoattenuating pancreatic adenocarcinoma at multi–detector row CT: secondary signs. *Radiology*. 2002;224(3):764–768.
3. Zamboni G, Hirabayashi K, Castelli P, et al. Histopathological subtyping and radiological correlation in pancreatic tumors. *Pancreatology*. 2011;11(6):580–586.
4. Hruban RH, Pitman MB, Klimstra DS. *Tumors of the pancreas*. AFIP Atlas of Tumor Pathology. 2007.
5. Malhotra N, Basak R, Prakash G, et al. Clinicopathological profile of pancreatic carcinoma: an Indian perspective. *Indian J Cancer*. 2017;54(1):61–64.
6. Patel MH, Modi K, Bhatt PA. Evaluation of pancreatic masses using multidetector CT: Experience from a tertiary centre in western India. *Indian J Radiol Imaging*. 2020;30(1):60–66.
7. Manfredi R, Graziani R, Ciccone V, et al. Main pancreatic duct abnormalities: MR cholangiopancreatography vs MR with secretin enhancement. *Radiology*. 2000;217(1):180–187.
8. Kim JH, Eun HW, Park SJ, et al. MRI vs MDCT for determining resectability of pancreatic head cancer. *World J Gastroenterol*. 2007;13(3):307–314.

9. Sahani DV, Bonaffini PA, Catalano C, et al. State-of-the-art PET/CT of the pancreas: current role and emerging indications. *Radiographics*. 2012;32(4):1133–1158.
10. Cadranel JF, Rufat P, Degos F. Practices of liver biopsy in France: prospective nationwide survey. *Hepatology*. 2000;31(3):481–484.
11. Rockey DC, Caldwell SH, Goodman ZD, et al. Liver biopsy. *Hepatology*. 2009;49(3):1017–1044.
12. McGuigan A, Kelly P, Turkington RC, et al. Pancreatic cancer: diagnosis, epidemiology, outcomes. *World J Gastroenterol*. 2018;24(43):4846–4861.
13. Thakkar K, Gamit B, Shah K. Radiologic-pathologic correlation of pancreatic lesions with histological subtyping in a Gujarat-based cohort. *Gujarat Med J*. 2021;76(2):27–32.