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ORIGINAL ARTICLE

Assessment of Pancreatic Malignancy through MRI and MDCT Modalities: A Comparative Analysis

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ABSTRACT:

Background:Detecting pancreatic abnormalities through routine noninvasive radiological methods, such as plain radiography and gastrointestinal barium studies, is feasible. However, these tests have limitations in terms of sensitivity and specificity. In the past, more invasive techniques, like retroperitoneal air insufflations with tomography, were attempted but didn't gain widespread clinical acceptance. Isotope scans also fell short due to their tendency to produce false-positive results.**Methods**:This retrospective study spanned one year, focusing on a study group comprising 200 patients suspected of having pancreatic diseases. The primary diagnostic modalities employed for examination were MDCT scans, MRI, or a combination of both.**Results**:In this study, pancreatic carcinoma was identified as a hypovascular mass, resulting in either no enhancement or mild post-contrast enhancement. Among the 28 cases examined, all displayed mild post-contrast enhancement, while 4 cases exhibited no enhancement at all. Upon contrast-enhanced computed tomography (CECT) examination of the 20 cases with a mass in the head of the pancreas, 16 were hypodense, 4 were isodense, and 18 showed dilated main pancreatic duct (MPD), the most prevalent finding, followed by dilated common bile duct (CBD) in 16 cases (80.00%) and invasion of other organs in 4 cases (20%).On magnetic resonance imaging (MRI) examination of the 8 cases with head carcinoma, 6 appeared hyperintense, 2 appeared hypointense, and all exhibited dilatation of MPD and CBD. Additionally, organ invasion was observed in one case. Among the 28 cases of head carcinoma, 8 (28.57%) showed distal metastasis in the liver. **Conclusion**:The findings of this study lead us to the conclusion that dual-phasic contrast-enhanced MDCT, specifically in the pancreatic parenchymal and venous phases, stands out as the preferred method for both detecting and staging pancreatic cancer, inflammatory lesions, and associated vascular complications. However, when it comes to identifying small, hypervascular neuroendocrine tumors, it is noteworthy that no single imaging method can capture all tumors comprehensively. In this context, a synergistic approach utilizing both MDCT and MRI proves to be beneficial, with each method complementing the other in providing a more comprehensive understanding of these tumors.

Keywords:MRI, MDCT, Pancreatic malignancy.

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INTRODUCTION

The pancreas, a crucial organ in the body's functioning, remains a formidable challenge for evaluation through both clinical assessments and routine radiological methods. Disorders affecting the pancreas, encompassing neoplastic and inflammatory conditions, carry a heightened risk of significant morbidity and mortality, making their timely identification and management imperative .[1]Despite its importance, the pancreas often reveals its pathologies in a subtle and insidious manner, further complicating the diagnostic process. Routine noninvasive radiological methods, such as plain radiography and gastrointestinal barium studies, serve as initial approaches for detecting pancreatic abnormalities. However, their utility is constrained by inherent limitations in sensitivity and specificity.In earlier eras, attempts to overcome these limitations led to the exploration of more invasive techniques, like retroperitoneal air insufflations with tomography.[2] Regrettably, despite their potential, these approaches failed to achieve widespread clinical application. Simultaneously, isotope scans were employed in the pursuit of enhanced diagnostic capabilities. However, these scans proved disappointing, primarily due to their susceptibility to false-positive results.

Navigating the complexities of pancreatic disorders demands a nuanced and comprehensive diagnostic strategy. The limitations of individual methods underscore the need for a multifaceted approach, incorporating advancements in both noninvasive techniques, such as modern imaging modalities like dual-phasic contrast-enhanced MDCT and MRI, as well as judicious consideration of the clinical context and patient history. By embracing a more integrated and sophisticated diagnostic paradigm, healthcare practitioners can enhance their ability to detect, characterize, and appropriately manage pancreatic abnormalities.[3]Assessing the pancreas through ultrasonography (USG) offers several advantages, including its cost-effectiveness, widespread availability, noninvasiveness, absence of radiation hazards, real-time imaging capabilities, and the ability to be repeated as needed. However, a significant limitation arises in patients with acute pancreatitis, where the visualization of the pancreas may be

compromised due to distended bowel loops resulting from paralytic ileus and epigastric tenderness.

With the advent of computed tomography (CT), dynamic incremental bolus CT scan has emerged as the gold standard for imaging pancreatic pathologies. CT has become the preferred technique for diagnosing pathology, assessing severity, staging, and detecting complications. It serves as a valuable prognostic indicator for morbidity and mortality, identifying high-risk patients. Early detection of complications through CT allows for timely image-guided aspiration and drainage procedures. Additionally, CT provides detailed anatomical information, optimizing surgical interventions .The evolution of imaging techniques has introduced newer modalities like helical CT scanning, which acquires volumetric data, reducing misregistration and respiratory artifacts.[4] This advancement enhances the appreciation of the relationship between the pancreas and adjacent contrast-enhanced vessels. In light of these capabilities, the present study was conducted to evaluate pancreatic malignancies using magnetic resonance imaging (MRI) and multi-detector computed tomography (MDCT) modalities, aiming to leverage their respective strengths for a comprehensive understanding of pancreatic pathology.

MATERIALS AND METHODS

The present retrospective study, spanning a duration of one year, was meticulously conducted at [Location], aiming to delve into the diagnostic intricacies of pancreatic diseases. The study group comprised 200 patients with suspected pancreatic disorders, and their comprehensive evaluation was undertaken using the prime diagnostic modalities of multi-detector computed tomography (MDCT) scan, magnetic resonance imaging (MRI), or a combination of both.[5]Each patient underwent a thorough examination, with due consideration given to clinical history, physical examination, and laboratory investigations. Prior to CT and MRI scans, ultrasonography (USG) was performed for all patients. A detailed explanation of the procedures and associated risks was provided to each patient, and informed consent was diligently obtained.

The study excluded certain categories of patients, namely those with contraindications to MR evaluation (such as claustrophobia or metallic implants), individuals with a history of hypersensitivity to intravenous contrast agents, or those exhibiting deranged renal function tests (serum creatinine > 1.5 mg/dl). Additionally, patients who were unable to maintain stillness during the examination, even after appropriate sedation, along with post-surgical patients and pregnant women, were excluded from the study.

Imaging procedures were carried out using state-of-the-art equipment, including a Philips Brilliance 16-slice and Siemens 128-slice multidetector CT SCAN machine. For MRI, a 1.5-tesla superconducting InteraAchieva Philips system equipped with a phased array body coil was employed.

To extract meaningful insights from the amassed data, statistical analysis was performed using the chi-square test, offering a robust methodology to ascertain the significance of the findings. This comprehensive approach, encompassing advanced imaging technologies and meticulous patient selection, underscores the commitment to unraveling the complexities of pancreatic diseases in this study.

RESULTS

In the current investigation, we meticulously enrolled a cohort of 200 patients who presented with suspected pancreatic diseases. The diagnostic evaluation employed either multi-detector computed tomography (MDCT) scan, magnetic resonance imaging (MRI), or a combination of both, serving as the primary modalities for the comprehensive assessment of these patients. Among the total participants in the study, it was observed that pancreatic lesions were most prevalent in individuals within the 4th and 5th decades of life, with a notably lower incidence in the 1st decade of life. This demographic insight provides valuable information about the age distribution of pancreatic diseases in the context of our study population.

Table 1: Distribution of study subjects according to age and gender.

Age Group	No. of Male	No. of Female	Total	Percentage
<1-10	0	2	2	1%
11-20	12	2	14	7%
21-30	28	2	30	15%
31-40	46	8	58	27%
41-50	34	6	40	20%
51-60	1	12	30	15%
61-70	14	8	22	11%
>70	2	6	8	4%
Total	**154**	**46**	**200**	**100.00%**

Table 2: Distribution of study subjects according to thetype of malignancy

Type of Malignancy	No. of Cases	Percentage
Pancreatic carcinoma	28	63.63%
Islet cell tumor	6	13.60%

Cystic pancreatic tumor	2	4.54%
Other (Sarcoma, Lymphoma)	6	13.60%
Pancreatic metastasis	2	4.54%

Figure1: Type of malignancy in patients

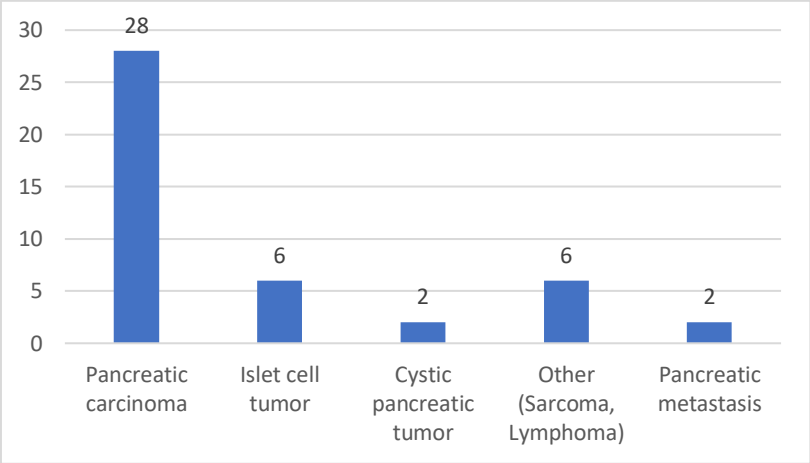
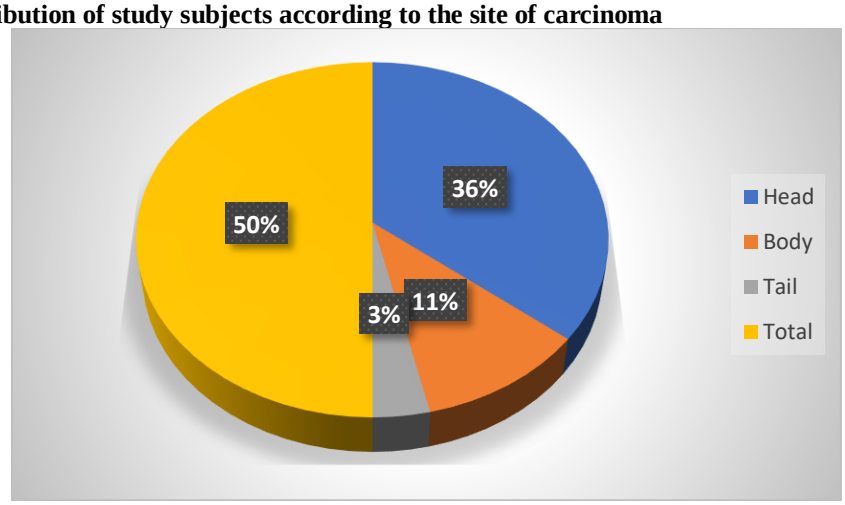


Table 3: Distribution of study subjects according to the site of carcinoma

Site	No. of Cases	Percentage	Clark *et al*
Head	20	71.42%	60%
Body	6	21.42%	20%
Tail	2	7.14%	10%
Total	**28**		

Figure 2: Distribution of study subjects according to the site of carcinoma



DISCUSSION

In this comprehensive study, we scrutinized 200 cases presenting with suspected pancreatic lesions, utilizing CT scans, MRI, or a combination of both as the primary diagnostic modalities. The diagnostic conclusions were meticulously correlated with ultrasonography (USG) features, laboratory investigations, and, whenever feasible, histopathological examination reports. Additionally, a follow-up was conducted to assess the outcomes of patients after treatment.[6]The study revealed a broad spectrum of pancreatic etiologies across different age groups, spanning from 1 to 70 years, with the highest incidence observed in the 4th and 5th decades of life, comprising 47% of the cases. Notably, pancreatic lesions exhibited a higher prevalence in males (77%) compared to females (25.38%).Among the presenting symptoms, abdominal pain was the most frequently reported (94%), followed by vomiting (60%). The identified etiologies included alcoholism (33%) and biliary calculi (22%), aligning with findings from the DC. Whitecomb study, which underscores alcohol and gallstones as the most common causes of acute pancreatitis. This convergence of results emphasizes the consistency and relevance of our study's observations within the broader context of pancreatic pathology.

In the thorough exploration of our dataset comprising 44 cases presenting with pancreatic masses, a nuanced analysis of the diverse pathological entities unraveled compelling insights. Pancreatic adenocarcinoma emerged as the dominant pathology, representing a substantial 63.63% of the cases, with 28 instances.[7] This observation underscores the significant impact and prevalence of adenocarcinoma within the spectrum of pancreatic masses in our study. Islet cell tumors, constituting a distinct and less frequent subset, accounted for 13.60% with a total of 6 cases. Additionally, lymphoma, cystic pancreatic tumor metastasis, and sarcoma each comprised 9.09%, with 4, 2, and 2 cases, respectively.

A more granular examination of pancreatic carcinoma brought to light intriguing details regarding its regional distribution within the pancreas. The head region emerged as the primary site of occurrence, housing the majority of cases at 71.42% (20 instances).[8] The body region contributed to 21.42% of cases, with 6 instances, while the tail region displayed 7.14%, represented by 2 cases. This distinctive distribution pattern highlights the inherent propensity of pancreatic adenocarcinoma to predominantly affect the head region.

A noteworthy parallel can be drawn with the findings of the Clark study, where their observations indicated that a significant majority (60%) of pancreatic carcinoma is concentrated in the head region. The convergence in distribution patterns across studies lends further credence to the prevailing understanding that pancreatic adenocarcinoma exhibits a notable predilection for the head region. This nuanced exploration of pathology not only underscores the clinical significance of regional characterization in pancreatic malignancies but also enhances our comprehension of the diverse landscape of pancreatic masses.In the detailed examination of pancreatic carcinoma within our study cohort, the hypovascular nature of this malignancy was evident, manifesting in either no enhancement or mild post-contrast enhancement. The cohort comprised 28 cases, all of which exhibited mild post-contrast enhancement, while an additional 4 cases showed no enhancement on imaging studies.

Upon closer investigation of the CECT findings, a specific focus on the 20 cases with a mass in the head region unveiled distinct patterns.[9] Sixteen of these cases appeared hypodense, indicative of reduced tissue density, while 4 were isodense. Notably, dilatation of the main pancreatic duct (MPD) was a prominent finding in 90.00% of cases, establishing it as the most prevalent feature. Furthermore, dilated common bile ducts (CBD) were observed in 80.00% of cases, underscoring the relevance of these imaging characteristics. Additionally, organ invasion was identified in 20.00% of cases, emphasizing the comprehensive insights gained from CECT.

In tandem with CECT, the evaluation extended to MRI examination of 8 cases with head carcinoma. The findings revealed that 6 cases presented as hyperintense, while 2 appeared hypointense. A consistent feature across all cases was the concurrent dilatation of both the main pancreatic duct (MPD) and the common bile duct (CBD). Furthermore, organ invasion was identified in one of the cases, reinforcing the diagnostic capabilities of MRI in characterizing pancreatic carcinoma.

Expanding the analysis to metastatic patterns, out of the 28 cases of head carcinoma, 28.57% exhibited distal metastasis in the liver, emphasizing the importance of assessing not only the primary tumor but also its potential systemic impact.[10]Turning attention to body-tail masses, among the 14 cases, six appeared hypodense, and one was visible on non-contrast CT (NCCT). Distant metastasis and dilated MPD were detected in 8 cases, while CBD dilation was noted in one case within the body mass category, providing valuable insights into the heterogeneity of pancreatic malignancies.The high sensitivity of multi-detector computed tomography (MDCT) reported by McNulty et al., reaching 96%, underscores the efficacy of this imaging modality in the accurate detection of pancreatic carcinoma. These findings collectively emphasize the nuanced and comprehensive nature of our study, shedding light on both the macroscopic and metastatic aspects of pancreatic malignancies.

CONCLUSION

Our study has led us to a comprehensive and nuanced understanding of the diagnostic landscape for pancreatic pathologies. Drawing upon our findings, we have arrived at several key conclusions that hold significant implications for the detection and staging of various pancreatic conditions.First and foremost, our study underscores the pivotal role of dual-phasic contrast-enhanced MDCT in the pancreatic parenchymal and venous phases as the method of choice. This approach proves highly effective not only in detecting pancreatic cancer but also in staging it, along with inflammatory lesions and associated vascular complications. The dual-phasic nature of the contrast-enhanced MDCT provides a dynamic view, enhancing our ability to discern and characterize abnormalities in the pancreatic region.Moreover, our study highlights the utility of three-dimensional reconstructions, such as CPR (Curved Planar Reconstruction), MIP (Maximum Intensity Projection), or VRT (Volume Rendering Technique). In the realm of cystic lesion characterization, our study indicates that MDCT is comparable to MRI with MRCP (Magnetic Resonance Cholangiopancreatography). While MDCT stands as a robust method for characterizing cystic lesions, MRI with MRCP enhances diagnostic confidence, offering a complementary role in refining the characterization of these lesions.In conclusion, our study advocates for a multimodal approach, emphasizing the significance of dual-phasic contrast-enhanced MDCT, three-

dimensional reconstructions, and the complementary roles of MDCT and MRI in the intricate landscape of pancreatic pathology. These insights contribute to refining diagnostic strategies and hold promise for improving patient outcomes through more informed and precise management approaches.

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