

Imaging Spectrum of Pancreatic Neoplasms on Multiphase CT and MRI

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Abstract:

Background: Pancreatic neoplasms encompass a diverse group of lesions with varying biological behaviour and imaging characteristics. Accurate characterization using multiphase CT and MRI is essential for diagnosis, staging, and management.

Objective: To evaluate the imaging spectrum of pancreatic neoplasms using multiphase CT and MRI and to correlate imaging features with histopathological findings.

Methods: This prospective observational study included 95 patients with suspected pancreatic neoplasms. All patients underwent multiphase contrast-enhanced CT and MRI. Imaging features such as lesion morphology, enhancement pattern, ductal involvement, and vascular invasion were analysed and correlated with histopathology.

Results: The most common neoplasm was pancreatic ductal adenocarcinoma (PDAC) (52.6%), followed by neuroendocrine tumors (18.9%), cystic neoplasms (17.9%), and solid pseudopapillary neoplasms (10.5%). Hypoenhancement on arterial phase CT was characteristic of PDAC (92%). MRI demonstrated superior characterization of cystic lesions and ductal communication. Vascular invasion was observed in 48% of malignant lesions.

Conclusion: Multiphase CT and MRI play complementary roles in evaluating pancreatic neoplasms. CT is superior for staging and vascular assessment, whereas MRI provides better tissue characterization, particularly for cystic lesions.

Keywords: Pancreatic neoplasms, diagnosis, staging, management, lesion morphology

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Introduction

Due to their frequently subtle beginning, delayed clinical presentation, and generally poor prognosis—especially in malignant entities like pancreatic ductal adenocarcinoma (PDAC) pancreatic neoplasms provide a substantial clinical challenge. These tumours often exhibit nonspecific symptoms or are asymptomatic in their early stages, which results in a

delayed diagnosis and few treatment choices. Therefore, imaging is essential for precise characterisation, staging, and therapy planning in addition to early detection(1).

Multiphase computed tomography (CT) and magnetic resonance imaging (MRI) have become essential modalities in the

assessment of pancreatic lesions due to the quick development of imaging technology. Dynamic evaluation of lesion vascularity and enhancement patterns is made possible by multiphase CT, which usually consists of non-contrast, arterial, and portal venous phases. This is essential for distinguishing hypervascular lesions like neuroendocrine tumours from hypovascular tumours like PDAC. Furthermore, CT has superior spatial resolution, which makes it very useful for assessing distant metastases, vascular involvement, and local tumour extent all of which are critical for surgical planning(2).

Conversely, MRI provides better soft tissue contrast and functional imaging features, such as magnetic resonance cholangiopancreatography (MRCP) and diffusion-weighted imaging (DWI). Particularly in cystic neoplasms, where internal architecture, septations, and ductal communication can be more clearly defined, these characteristics provide improved lesion characterisation(3). Additionally, MRI is useful for detecting tiny lesions in individuals who cannot use iodinated contrast. In order to improve lesion characterisation and clinical decision-making, this study intends to systematically characterise the imaging spectrum of pancreatic neoplasms using both multiphase CT and MRI(4).

Materials and Methods

Study Design

- Prospective observational study
- Duration: 10 months
- Sample size: 95 patients

Study place:

Shyamlal Chandrashekhar medical college and hospital, Khagaria, Bihar.

Inclusion Criteria

- Patients with suspected pancreatic neoplasms on clinical or imaging grounds
- Patients undergoing both CT and MRI

Exclusion Criteria

- Contraindication to contrast agents
- Prior pancreatic surgery

Imaging Protocol

CT Protocol

- Multiphase CT:
 - Non-contrast phase
 - Arterial phase (20–30 sec)
 - Portal venous phase (60–70 sec)

MRI Protocol

- Sequences:
 - T1-weighted
 - T2-weighted
 - Diffusion-weighted imaging (DWI)
 - MRCP
 - Dynamic contrast-enhanced imaging

Parameters Assessed

- Lesion size, location
- Enhancement pattern
- Ductal dilatation
- Vascular involvement
- Presence of metastasis

Statistical Analysis

The imaging and demographic results were summarised using descriptive statistics. Sensitivity and specificity calculations were used to evaluate the diagnostic performance of CT and MRI. Histopathological data and imaging findings were correlated, and statistical significance was assessed using suitable tests; p-values less than 0.05 were considered significant.

Results

Table 1: Distribution of Pancreatic Neoplasms (n=95)

| Tumor Type | Number (n) | Percentage (%) |
|--------------------------------|------------|----------------|
| PDAC | 50 | 52.6 |
| Neuroendocrine Tumors (NETs) | 18 | 18.9 |
| Cystic Neoplasms | 17 | 17.9 |
| Solid Pseudopapillary Neoplasm | 10 | 10.5 |

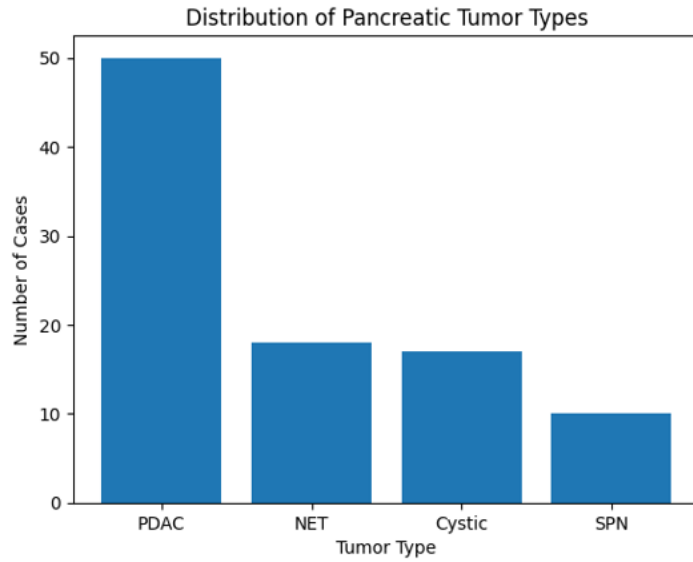


Figure 1: distribution of pancreatic tumor types

Table 2: Imaging Characteristics on CT

| Feature | PDAC (%) | NET (%) | Cystic (%) | SPN (%) |
|------------------|----------|---------|------------|---------|
| Hypoenhancement | 92 | 10 | 0 | 20 |
| Hyperenhancement | 5 | 85 | 0 | 30 |
| Calcification | 8 | 5 | 40 | 25 |
| Necrosis | 60 | 20 | 15 | 70 |

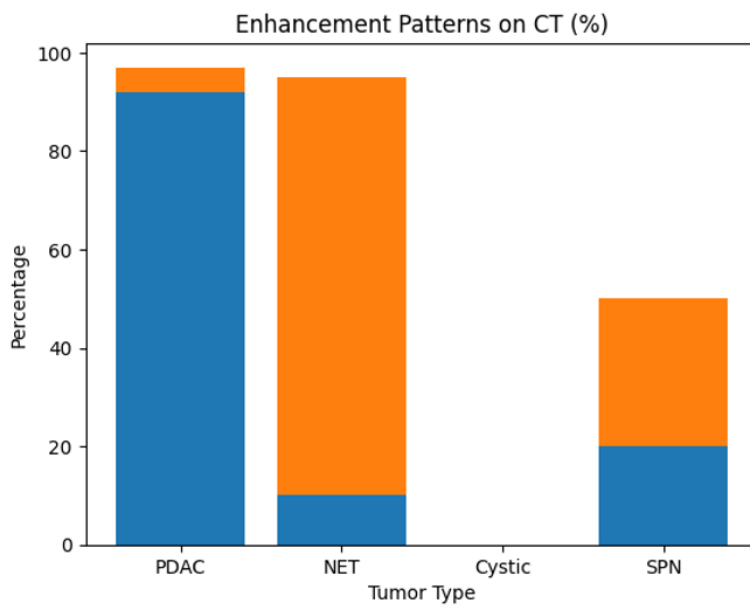
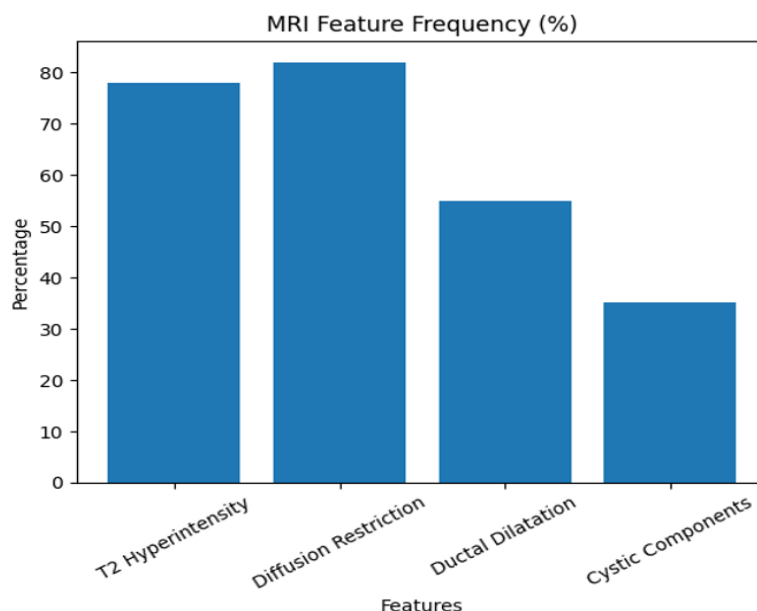


Figure 2: Enhancement patterns on CT (%)

Table 3: MRI Findings

| Feature | Frequency (%) |
|-----------------------|---------------|
| T2 hyperintensity | 78 |
| Diffusion restriction | 82 |
| Ductal dilatation | 55 |
| Cystic components | 35 |

**Figure 3: MRI feature frequency (%)**

Discussion

This study emphasises the complementary functions of multiphase CT and MRI in the assessment of pancreatic neoplasms as well as their broad and diverse imaging spectrum. The results highlight the significance of a multimodality imaging strategy for precise staging, diagnosis, and characterisation(5).

The most prevalent tumour in our group was pancreatic ductal adenocarcinoma (PDAC), which usually showed hypoenhancement on arterial phase CT. Its distinctive appearance is compatible with its hypovascular and desmoplastic characteristics, as previously reported. Finding these hypoenhancing masses, which are frequently linked to parenchymal atrophy and upstream pancreatic ductal dilatation, is still a crucial diagnostic characteristic. Furthermore, CT demonstrated exceptional efficacy in evaluating vascular encasement and

invasion, which are crucial factors in determining resectability and surgical planning(6).

On the other hand, because of their hypervascularity, neuroendocrine tumours (NETs) showed avid arterial phase augmentation, which made it easy to distinguish them from PDAC. MRI substantially improved the identification and description of these lesions, especially with T2-weighted sequences that showed hyperintensity and diffusion-weighted imaging that showed significant diffusion restriction(7). These characteristics increase sensitivity, particularly for tiny or hidden lesions. Liver metastases were seen in 22% of cases, whilst vascular invasion was seen in 48% of malignant tumours. Accurate identification and differentiation of pancreatic neoplasms were aided by the superiority of MRI in assessing cystic lesion characterisation and in demonstrating ductal communication by MRCP(8).

Due in significant part to better soft tissue contrast and the additional benefit of MRCP, cystic pancreatic neoplasms were more correctly characterised on MRI. This made it possible to thoroughly assess cyst form, septations, mural nodules, and—most importantly—ductal communication, which is crucial for differentiating intraductal papillary mucinous neoplasms (IPMN) from other cystic entities including mucinous cystic neoplasms(9).

Heterogeneous imaging features were seen in solid pseudopapillary neoplasms (SPNs), which frequently included solid, cystic, and haemorrhagic components. MRI was especially helpful in determining the features of the capsule and internal bleeding. Overall, MRI offers better lesion characterisation, even if CT is still essential for assessing tumour extent, vascular involvement, and operability. When combined, these modalities provide a thorough evaluation that greatly increases diagnostic confidence and directs the best possible clinical care(10).

Conclusion

MRI and multiphase CT are complementing methods for assessing pancreatic neoplasms. For the detection of vascular invasion and precise staging, which are essential for assessing surgical respectability, CT is still the preferred modality. MRI, on the other hand, offers better soft tissue contrast, which enables more accurate tissue characterisation and thorough assessment of cystic lesions, including ductal communication. When various imaging methods are used together, diagnostic confidence and accuracy are increased. Early and accurate imaging-based diagnosis can greatly enhance patient outcomes, especially when it comes to distinguishing benign from malignant lesions and evaluating operability. It also plays a critical role in directing suitable management methods.

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