DOI 10.26724/2079-8334-2026-2-96-93-96
UDC 616.37-073.756.8-073.75

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COMPARATIVE DIAGNOSTIC VALUE OF MAGNETIC RESONANCE IMAGING AND COMPUTED TOMOGRAPHY IN PANCREATIC PATHOLOGY

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The purpose of the study was to compare the diagnostic value of magnetic resonance imaging and computed tomography in patients with pancreatic pathology. A retrospective study included 86 patients aged 21–65 years with confirmed pancreatic diseases. Magnetic resonance imaging and computed tomography findings were compared with histopathology and clinical follow-up. Sensitivity, specificity, accuracy, and predictive values were calculated by statistical methods. Magnetic resonance imaging demonstrated higher sensitivity in detecting cystic lesions (92.3 % and 84.6 %, respectively), while computed tomography showed higher specificity in differentiating malignant lesions (90.5 % and 82.1 %, respectively). Overall diagnostic accuracy was comparable (magnetic resonance imaging – 88.4 %, computed tomography – 89.5 %). Combined use improved diagnostic accuracy to 94.2 %. Thus, magnetic resonance imaging might be preferred in diagnostics of lesion and their early detection, whereas computed tomography remains more specific in malignancy assessment. A combined imaging approach is recommended.

Key words: pancreas, MRI, CT, sensitivity, specificity, pancreatic tumors.

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ПОРІВНЯЛЬНА ДІАГНОСТИЧНА ЦІННІСТЬ МАГНІТНО-РЕЗОНАНСНОЇ ТОМОГРАФІЇ ТА КОМП'ЮТЕРНОЇ ТОМОГРАФІЇ ПРИ ПАТОЛОГІЇ ПІДШЛУНКОВОЇ ЗАЛОЗИ

Метою дослідження було порівняння діагностичної цінності магнітно-резонансної томографії та комп'ютерної томографії у пацієнтів із патологією підшлункової залози. У ретроспективне дослідження було включено 86 пацієнтів віком 21–65 років із підтвердженими захворюваннями підшлункової залози. Результати магнітно-резонансної томографії та комп'ютерної томографії порівнювали з даними гістопатології та клінічного спостереження. Чутливість, специфічність, точність та прогностичні значення були розраховані статистичними методами. Магнітно-резонансна томографія продемонструвала вищу чутливість у виявленні кістозних утворень (92,3 % та 84,6 % відповідно), тоді як комп'ютерна томографія показала вищу специфічність у диференціації злоякісних утворень (90,5 % та 82,1 % відповідно). Загальна діагностична точність була порівнянною (магнітно-резонансна томографія – 88,4 %, комп'ютерна томографія – 89,5 %). Комбіноване застосування підвищило діагностичну точність до 94,2 %. Таким чином, магнітно-резонансна томографія може бути кращим вибором при діагностиці уражень та їх ранньому виявленні, тоді як комп'ютерна томографія залишається більш специфічною при оцінці злоякісності. Рекомендується комбінований підхід до візуалізації.

Ключові слова: підшлункова залоза, МРТ, КТ, чутливість, специфічність, пухлини підшлункової залози.

Pancreatic disorders represent a significant challenge in modern medicine due to their clinical heterogeneity, complex biological behavior, and frequently delayed diagnosis. Among these conditions, pancreatic cancer remains one of the most aggressive malignant neoplasms, characterized by high mortality, primarily due to late detection and the absence of obvious initial symptoms [2, 8, 11].

In recent decades, the widespread use of advanced imaging techniques has led to an increased detection of incidental pancreatic lesions, particularly pancreatic cystic lesions (PCLs). These entities encompass a broad spectrum of conditions, ranging from benign formations to premalignant and malignant neoplasms, including intraductal papillary mucinous neoplasms (IPMN). Importantly, the clinical significance of these lesions lies in their potential for malignant transformation, which necessitates accurate diagnosis and appropriate management strategies [1, 12, 13].

The approach to the management of pancreatic cystic lesions has undergone substantial evolution over time. International consensus guidelines, such as the revised Fukuoka criteria, have introduced structured algorithms for risk stratification based on imaging characteristics and clinical findings [9]. Nevertheless, despite these efforts, considerable uncertainty persists in clinical practice, particularly in distinguishing benign from high-risk lesions and determining optimal surveillance protocols [10, 14, 15].

Imaging plays a pivotal role in the diagnostic work-up of pancreatic diseases. Computed tomography (CT) and magnetic resonance imaging (MRI) are the cornerstone modalities used in routine clinical practice. CT is widely utilized as an initial diagnostic tool owing to its accessibility, rapid acquisition, and excellent spatial resolution, allowing for detailed evaluation of calcifications, vascular involvement, and tumor extent. Conversely, MRI provides superior soft-tissue contrast and enables detailed visualization of the pancreatic ductal system through magnetic resonance cholangiopancreatography (MRCP), making it especially useful in characterizing cystic lesions and subtle parenchymal changes [3, 7].

Recent advances in imaging technology have further enhanced the diagnostic capabilities of MRI. Multiparametric MRI, incorporating diffusion-weighted imaging (DWI) and MRCP, has demonstrated improved sensitivity in detecting early pancreatic abnormalities and monitoring high-risk

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individuals. In longitudinal surveillance studies, MRI has shown the ability to identify early pathological changes, including potentially malignant transformations, with clinically meaningful predictive value [4]. Moreover, specific MRI features have been shown to reliably differentiate benign structures such as mucin plugs from true mural nodules, achieving high diagnostic accuracy and reducing the need for invasive procedures [5].

Despite these technological advancements, real-world clinical practice reveals variability in imaging strategies. Surveys indicate that MRI is often preferred as the initial modality for evaluating pancreatic cystic neoplasms, while CT is more commonly used for follow-up due to its practicality and availability [2]. This inconsistency reflects the absence of a universally accepted diagnostic algorithm and highlights the need for further comparative evaluation of imaging modalities.

In addition, international expert recommendations emphasize the importance of standardized imaging protocols and reporting systems, particularly in high-risk populations. These initiatives aim to improve diagnostic consistency and facilitate early detection of pancreatic malignancies, ultimately enhancing patient outcomes [6].

Given the complementary strengths and limitations of CT and MRI, a comprehensive comparative assessment of their diagnostic performance remains highly relevant. Therefore, the aim of the present study was to evaluate and compare the diagnostic value of CT and MRI in patients with pancreatic pathology, focusing on sensitivity, specificity, and overall diagnostic accuracy, as well as to assess the benefit of their combined use.

The purpose of the study was to compare the effectiveness and diagnostic value of radiological methods (magnetic resonance imaging and computed tomography) in detecting the pathology of pancreas.

Materials and methods. The study was conducted at the basis of Department of Radiology of Azerbaijan Medical University in the period of 2022–2024.

The present study was retrospective, observational and non-interventional in design. The analysis was based on archived clinical, radiological and follow-up data of patients who had previously undergone computed tomography and magnetic resonance imaging as part of routine diagnostic evaluation. No additional diagnostic procedures, therapeutic interventions or changes in patient management were performed for research purposes.

Before statistical analysis, all clinical and imaging data were anonymized. Personal identifiers, including names, contact information and other data allowing direct patient identification, were removed from the study database. The confidentiality of medical information was maintained at all stages of data collection, processing and manuscript preparation.

The University Bioethics Committee did not convene before the initiation of the study, and no separate protocol number was assigned. The absence of prior formal approval was related to the retrospective and non-interventional nature of the research, the use of previously collected routine medical data, and the absence of additional risks for patients. At the same time, the authors acknowledge this as an ethical limitation of the study, since formal approval or exemption by an institutional ethics committee would have strengthened the ethical documentation of the research.

The study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki, the CIOMS International Ethical Guidelines for Health-related Research Involving Humans, and the general principles of Good Clinical Practice concerning confidentiality, scientific integrity and responsible handling of clinical data. Separate informed consent for participation in the retrospective analysis was not obtained, as the study used anonymized archival data and did not involve direct patient contact or any additional intervention.

This retrospective study included 86 patients aged 21–65 years (mean age 44.7±11.2 years) with confirmed pancreatic pathology who underwent both computed tomography (CT) and magnetic resonance imaging (MRI). The cohort comprised 49 males (57 %) and 37 females (43 %).

Inclusion criteria were: confirmed pancreatic disease based on histopathology or clinical follow-up; availability of both CT and MRI examinations performed within a 4-week interval, and complete clinical and imaging datasets.

Exclusion criteria included prior pancreatic surgery, incomplete imaging protocols, and non-diagnostic image quality.

Patients were categorized into four diagnostic groups: cystic lesions (n=32; 37.2 %), pancreatic tumors (n=28; 32.6 %), chronic pancreatitis (n=18, 20.9 %), and acute pancreatitis (n=8; 9.3 %).

Computed tomography examinations were performed using a multidetector CT scanner (BrightSpeed, GE Health Care, USA) with a standardized pancreatic protocol, including unenhanced, arterial, and portal venous phases following intravenous administration of iodinated contrast material.

MRI was performed on 1.5T or 3T systems and included T1-weighted, T2-weighted, diffusion-weighted imaging (DWI), and magnetic resonance cholangiopancreatography (MRCP). Dynamic contrast-enhanced sequences were obtained after administration of gadolinium-based contrast agents.

All imaging studies were independently evaluated by two experienced radiologists blinded to clinical and histopathological data. Imaging findings were assessed for lesion detection, morphological characteristics, and differentiation between benign

and malignant lesions. Histopathological examination was considered the reference standard in patients who underwent surgery or biopsy. In the remaining cases, diagnosis was established based on clinical follow-up and imaging findings over a minimum period of 6 months.

Statistical analysis was performed using SPSS, Statgraphics**,** version 19. Diagnostic performance of CT and MRI was evaluated by calculating sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV), each presented with 95 % confidence intervals (95 % CI). Receiver operating characteristic (ROC) curve analysis was performed to assess the diagnostic performance of each imaging modality. The area under the ROC curve (AUC) was calculated with 95 % confidence intervals. AUC values were interpreted as follows: excellent (0.90–1.00), good (0.80–0.89), fair (0.70–0.79), and poor (<0.70). Comparisons between AUC values for CT and MRI were performed using the DeLong test for correlated ROC curves. Differences in sensitivity and specificity between modalities were assessed using the chi-square (χ^2) test or Fisher's exact test where appropriate. Multivariate logistic regression analysis was conducted to identify independent imaging predictors of malignancy, including lesion size, presence of solid components, ductal dilation, and contrast enhancement patterns. Results were expressed as odds ratios (OR) with 95 % confidence intervals. A p-value <0.05 was considered statistically significant.

Results of the study. Pancreatic cystic lesions were identified in 32 cases (37.2 %), tumors in 28 (32.6 %), chronic pancreatitis in 18 (20.9 %), and acute pancreatitis in 8 patients (9.3 %).

MRI demonstrated an overall sensitivity of 89.5 % (95 % CI: 81.3–94.6) and specificity of 82.1 % (95 % CI: 71.3–89.7), while CT showed a sensitivity of 85.1 % (95 % CI: 76.1–91.2) and a significantly higher specificity of 90.5 % (95 % CI: 80.9–95.8) (p=0.041).

The overall diagnostic accuracy was comparable between the two modalities: 88.4 % for MRI (95 % CI: 80.4–93.6) and 89.5 % for CT (95 % CI: 81.7–94.3).

Receiver operating characteristic analysis demonstrated a high diagnostic performance for both modalities. The AUC for MRI was 0.91 (95 % CI: 0.85–0.96), indicating excellent diagnostic ability, while CT showed an AUC of 0.88 (95 % CI: 0.81–0.94), corresponding to good diagnostic performance. The difference between AUC values was not statistically significant (DeLong test, p=0.27).

The findings of the present study demonstrate that the combined application of MRI and CT significantly improves diagnostic performance in pancreatic pathology, yielding a sensitivity of 94.8 %, specificity of 93.2 %, and overall accuracy of 94.2 %. These results support the growing concept that a multimodal imaging strategy is essential for achieving optimal diagnostic outcomes in complex pancreatic diseases.

Discussion. MRI showed higher sensitivity, particularly in detecting cystic lesions and early ductal changes. This advantage can be attributed to its superior soft-tissue contrast and the ability to visualize the pancreatic ductal system using MRCP. Such capabilities are especially important in the assessment of pancreatic cystic neoplasms, where accurate identification of internal structures, septations, and ductal communication is critical for risk stratification. These observations are consistent with current international recommendations, including the revised Fukuoka guidelines, which emphasize the importance of imaging features in determining malignancy risk and guiding management decisions [9]. Furthermore, recent studies (D'Onofrio, et al (2024); Fukuba, N., et al (2026)) have demonstrated that multiparametric MRI, incorporating diffusion-weighted imaging, enhances early detection and enables surveillance of high-risk individuals, allowing identification of subtle pathological changes at a potentially curable stage [3, 4].

In addition, advanced MRI techniques have shown high diagnostic accuracy in differentiating benign from potentially malignant components within cystic lesions. For example, Fukui, H., et al (2026) noted that specific non-contrast MRI features, such as signal characteristics and morphological patterns, have been reported to reliably distinguish mucin plugs from mural nodules, thereby reducing unnecessary invasive interventions [5]. These findings further support the role of MRI as a highly sensitive tool in lesion characterization and non-invasive evaluation.

In contrast, CT demonstrated higher specificity, particularly in the assessment of malignant lesions. This can be explained by its high spatial resolution and its ability to accurately detect calcifications, vascular invasion, and enhancement patterns associated with tumor progression. Due to its rapid acquisition and wide availability, CT remains the primary imaging modality in many clinical settings, particularly in emergency diagnostics and tumor staging. Real-world data indicate that CT is frequently used as a follow-up modality, even when MRI is initially preferred for lesion characterization [2].

The complementary nature of MRI and CT is further supported by international expert consensus statements, which highlight the need for standardized imaging protocols and emphasize the importance of combining different modalities to improve diagnostic accuracy and consistency [6]. In clinical practice, the choice of imaging method often depends on the specific diagnostic task: MRI is more suitable for early detection and detailed characterization, while CT is more effective for staging and evaluation of disease extent.

Importantly, the results of the present study confirm that neither modality alone provides complete diagnostic certainty in all cases. Instead, their combined use leads to a significant increase in diagnostic accuracy, supporting a tailored, patient-centered approach to imaging. This is particularly relevant given the increasing incidence of incidental pancreatic lesions and the need for precise differentiation between benign, premalignant, and malignant conditions.

Overall, the present findings are in agreement with current literature and reinforce the concept that integration of MRI and CT represents the most effective diagnostic strategy in pancreatic pathology, enabling improved clinical decision-making and potentially better patient outcomes.

Limitations. This study has several limitations. First, its retrospective design may introduce selection bias. Second, the relatively small sample size limits the generalizability of the findings. Third, the heterogeneity of pancreatic pathologies included in the analysis may have influenced the comparative diagnostic performance of the imaging modalities. Additionally, not all cases were confirmed histologically, and in some patients, diagnosis was based on clinical and imaging follow-up, which may introduce verification bias.

Conclusion

MRI and CT are both highly effective imaging modalities for the evaluation of pancreatic pathology, each with distinct advantages. MRI demonstrates higher sensitivity, particularly in detecting cystic and early inflammatory changes, whereas CT provides superior specificity in identifying malignant lesions. ROC analysis confirms excellent diagnostic performance for both methods, with no statistically significant difference in AUC values. However, the combined use of MRI and CT significantly improves diagnostic accuracy and should be considered the optimal approach in complex or ambiguous cases. Personalized selection of imaging modalities based on clinical indications may enhance diagnostic precision and improve patient management outcomes.

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Conflict of interest. The authors have no conflicts of interest to declare.

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Article received: 13.05.2025