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LABORATORY DIAGNOSTICS OF PANCREATIC DISEASES: CURRENT APPROACHES AND EMERGING BIOMARKERS

Yakubova D.M.
Assistant of the Department of Clinical Laboratory Diagnostics,
Samarkand State Medical University

Nabiyeva F.S.
Senior Lecturer of the Department of Clinical Laboratory Diagnostics,
Samarkand State Medical University

Xamidova T.S.
Cadet of the Department of Clinical Laboratory Diagnostics,
Samarkand State Medical University

Abstract

The pancreas plays a vital role in both endocrine and exocrine functions, and its dysfunction is associated with a wide range of disorders including acute and chronic pancreatitis, pancreatic cancer, and diabetes mellitus. Early and accurate diagnosis of pancreatic diseases remains a clinical challenge due to overlapping symptoms and nonspecific biochemical markers. This article provides a comprehensive overview of current laboratory diagnostic methods used in the evaluation of pancreatic diseases, including enzymatic assays, immunological tests, and molecular diagnostics. Furthermore, we discuss emerging biomarkers and the potential of omics-based approaches to improve diagnostic accuracy and patient outcomes.

Keywords: pancreatic diseases, acute pancreatitis, chronic pancreatitis, pancreatic cancer, biomarkers, CA 19-9, lipase, elastase, molecular diagnostics.

Introduction

Pancreatic diseases encompass a spectrum of conditions that significantly impact global morbidity and mortality. Pancreatic diseases arise from a complex interaction of genetic, environmental, and lifestyle factors. Chronic alcohol use, gallstones,

smoking, and obesity are some of the leading causes of pancreatic disease, while genetic mutations and autoimmune conditions can predispose people to these diseases. Understanding the specific cause of pancreatic disease is critical for effective treatment and management [2,4,6].

Acute and chronic pancreatitis, pancreatic ductal adenocarcinoma (PDAC), and cystic lesions of the pancreas require accurate laboratory evaluation for timely diagnosis and management. Despite advances in imaging techniques, laboratory tests remain essential for initial assessment, differential diagnosis, and monitoring of disease progression [1,3,5].

Biochemical Markers in Pancreatic Disease

Serum amylase and lipase. Amylase and lipase are the primary enzymes measured in suspected cases of acute pancreatitis. Lipase is considered more specific and has a longer half-life compared to amylase. A threefold elevation above the upper normal limit is typically diagnostic. However, these enzymes may also be elevated in other conditions such as renal failure and gastrointestinal perforation, reducing their specificity [2,5].

Pancreatic elastase. Fecal pancreatic elastase-1 (FE-1) is a non-invasive marker used to assess exocrine pancreatic insufficiency (EPI), particularly in chronic pancreatitis and cystic fibrosis. A value below 200 µg/g of stool suggests EPI. This test is relatively stable and unaffected by enzyme supplementation.

Serum trypsinogen. Serum trypsinogen is another marker of exocrine function, though less commonly used due to variable sensitivity. In the early stages of chronic pancreatitis, levels may remain normal, limiting its utility in mild disease [1,4].

Tumor Markers

CA 19-9. Carbohydrate antigen 19-9 is the most commonly used serum tumor marker for pancreatic cancer, especially PDAC. While elevated levels correlate with tumor burden, its specificity is compromised by elevations in benign biliary diseases, pancreatitis, and diabetes. CA 19-9 is not effective as a screening tool in asymptomatic populations but can be useful for monitoring treatment response and recurrence.

CEA and other markers. Carcinoembryonic antigen CEA may also be elevated in pancreatic malignancies, though it lacks the sensitivity of CA 19-9. Research is ongoing into other novel markers such as MIC-1, PAM4, and circulating tumor DNA ctDNA for better diagnostic precision.

Endocrine Evaluation

Endocrine dysfunction of the pancreas, particularly in the context of diabetes, is assessed through standard glucose metabolism tests:

- Fasting glucose and HbA1c for long-term glycemic control;
- C-peptide and insulin levels to differentiate between type 1 and type 2 diabetes or pancreatic diabetes;
- Autoantibody testing (e.g., GAD, IA-2) to assess autoimmune involvement.

Molecular And Omics-Based Approaches

Emerging diagnostic modalities focus on genomic, proteomic, and metabolomic profiling of pancreatic tissue and body fluids. These technologies offer promise in: early detection of pancreatic neoplasms, differentiating between benign and malignant cystic lesions (e.g., IPMN vs. mucinous cystadenomas), identifying hereditary pancreatic disease syndromes. For instance, KRAS mutations in cyst fluid or blood are highly suggestive of malignancy in pancreatic cystic lesions.

Novel Biomarkers and Future Directions

Biomarkers such as microRNAs, exosomes, and circulating tumor cells are gaining traction for their potential role in non-invasive diagnostics. Combined biomarker panels and artificial intelligence algorithms analyzing large-scale omics data may provide the next frontier in personalized pancreatic disease diagnostics.

Conclusion

Laboratory diagnostics remain foundational in the evaluation of pancreatic diseases, aiding in the differentiation of various pathologies, guiding therapy, and monitoring disease progression. Despite limitations in sensitivity and specificity, a combination of biochemical, immunological, and molecular markers significantly improves

diagnostic accuracy. The integration of novel biomarkers and precision medicine approaches holds promise for the early detection and improved management of pancreatic disorders.

References

1. Ashraf H. et al. A clinical overview of acute and chronic pancreatitis: the medical and surgical management //Cureus. – 2021. – Т. 13. – №. 11.
2. Beyer G. et al. Acute and Chronic Pancreatitis //Deutsches Ärzteblatt International. – 2022. – Т. 119. – №. 29-30. – С. 495.
3. Mederos M. A., Reber H. A., Girgis M. D. Acute pancreatitis: a review //Jama. – 2021. – Т. 325. – №. 4. – С. 382-390
4. Rudinsky A. J. Laboratory diagnosis of pancreatitis //Veterinary Clinics: Small Animal Practice. – 2023. – Т. 53. – №. 1. – С. 225-240.
5. Sadriddinovna N. F., Kizi O. S. G. U., Ugli N. S. T. ENZYME LINKED IMMUNOSORBENT ASSAY //Research Focus. – 2023. – Т. 2. – №. 1. – С. 139-145.
6. Szatmary P. et al. Acute pancreatitis: diagnosis and treatment //Drugs. – 2022. – Т. 82. – №. 12. – С. 1251-1276.