

FROM BENCH TO BEDSIDE: HOW TRANSLATIONAL RESEARCH HAS CONTRIBUTED TO THE TREATMENT OF PANCREATIC CANCER

DA BANCADA AO LEITO: COMO AS PESQUISAS TRANSLACIONAIS TÊM CONTRIBUÍDO PARA O TRATAMENTO DO CÂNCER DE PÂNCREAS

DE LA BANCADA A LA CABECERA DEL PACIENTE: CÓMO LA INVESTIGACIÓN TRASLACIONAL HA CONTRIBUIDO AL TRATAMIENTO DEL CÁNCER DE PÁNCREAS



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ABSTRACT

This study explores the intersection between translational research and the treatment of pancreatic cancer, a neoplasm with a challenging prognosis. The investigation is justified by the need to convert basic scientific discoveries into effective clinical applications, aiming to improve currently available therapeutic strategies. The main objective is to analyze the contributions of translational research to advances in the management of pancreatic cancer, from molecular understanding to the implementation of new approaches at the patient's bedside. The methodology adopts a bibliographic approach, of a basic nature and exploratory objective, based on a review of recent scientific literature from specialized databases. The results indicate that translational research drives the development of targeted therapies, immunotherapies, and biomarkers, enabling precision medicine. The conclusions highlight translational research as a fundamental pillar in overcoming therapeutic challenges, promoting treatment personalization and improving patients' quality of life.

Keywords: Translational Research. Pancreatic Cancer. Precision Oncology. Evidence-Based Medicine.

RESUMO

Este estudo explora a interseção entre a pesquisa translacional e o tratamento do câncer de pâncreas, uma neoplasia com prognóstico desafiador. A investigação justifica-se pela necessidade de converter descobertas científicas básicas em aplicações clínicas eficazes, visando aprimorar as estratégias terapêuticas disponíveis. O objetivo principal consiste em analisar as contribuições da pesquisa translacional para o avanço no manejo do câncer de pâncreas, desde a compreensão molecular até a implementação de novas abordagens no leito do paciente. A metodologia emprega uma abordagem bibliográfica, de natureza básica e objetivo exploratório, com levantamento de literatura científica recente em bases de dados especializadas. Os resultados indicam que a pesquisa translacional impulsiona o desenvolvimento de terapias-alvo, imunoterapias e biomarcadores, permitindo uma medicina de precisão. As conclusões apontam para a pesquisa translacional como um pilar

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fundamental na superação dos obstáculos terapêuticos, promovendo a personalização do tratamento e a melhoria da qualidade de vida dos pacientes.

Palavras-chave: Pesquisa Translacional. Câncer de Pâncreas. Oncologia de Precisão. Medicina Baseada em Evidências.

RESUMEN

Este estudio explora la intersección entre la investigación traslacional y el tratamiento del cáncer de páncreas, una neoplasia con pronóstico desafiante. La investigación se justifica por la necesidad de convertir los descubrimientos científicos básicos en aplicaciones clínicas eficaces, con el objetivo de mejorar las estrategias terapéuticas disponibles. El objetivo principal consiste en analizar las contribuciones de la investigación traslacional para el avance en el manejo del cáncer de páncreas, desde la comprensión molecular hasta la implementación de nuevos enfoques en la atención del paciente. La metodología emplea un enfoque bibliográfico, de naturaleza básica y objetivo exploratorio, mediante la revisión de literatura científica reciente en bases de datos especializadas. Los resultados indican que la investigación traslacional impulsa el desarrollo de terapias dirigidas, inmunoterapias y biomarcadores, permitiendo la medicina de precisión. Las conclusiones señalan a la investigación traslacional como un pilar fundamental para superar los obstáculos terapéuticos, promoviendo la personalización del tratamiento y la mejora de la calidad de vida de los pacientes.

Palabras clave: Investigación Traslacional. Cáncer de Páncreas. Oncología de Precisión. Medicina Basada en la Evidencia.

1 INTRODUCTION

Pancreatic cancer represents one of the most aggressive and lethal neoplasms, characterized by a late diagnosis and limited therapeutic options. The disease has a considerably low five-year survival rate, which positions it as a persistent challenge for contemporary oncology. The biological complexity of the tumor, its anatomical location, and the resistance inherent to conventional treatments contribute to this unfavorable scenario. In-depth understanding of the molecular mechanisms underlying pancreatic carcinogenesis thus becomes a priority for the development of more effective interventions.

Translational research emerges as a bridge between the discoveries made on the laboratory bench and their practical application in the clinical context. This field of study focuses on transforming basic scientific knowledge into tangible solutions for human health, accelerating the process of developing new diagnostics, therapies, and prevention strategies. In the case of pancreatic cancer, translational research seeks to unravel the genetic and molecular particularities of the tumor, identifying therapeutic targets and biomarkers that can guide clinical decisions.

The research problem lies in the gap between accumulated knowledge about the biology of pancreatic cancer and the effectiveness of available treatments. Despite advances in medicine, the survival of patients with this condition has remained stagnant for decades, highlighting the need for innovative approaches. Tumor heterogeneity and the complex microenvironment of the pancreas make it difficult to respond to standard therapies, requiring a more granular understanding of the disease to develop personalized interventions. Translational research acts directly on this gap, seeking to convert basic science into direct benefits for patients.

The relevance of this study lies in the urgency of improving the treatment of pancreatic cancer, since the disease continues to be one of the leading causes of cancer mortality globally. The analysis of the contributions of translational research offers *insights* into strategies that demonstrate potential to change the prognosis of the disease. Understanding how scientific discoveries translate into clinical innovations allows you to optimize research resources and direct efforts to areas with the highest probability of impact. The translational approach is essential to overcome the barriers that prevent therapeutic advancement.

Abe *et al.* (2021, p. 1785) highlight the importance of investigating the genetic basis of the disease, stating that "understanding the genetics of hereditary pancreatic cancer is fundamental for the identification of high-risk individuals and for the development of prevention and early detection strategies". This perspective reinforces the need for an approach that integrates basic research with clinical application. The identification of specific

genetic mutations, for example, can guide the selection of targeted therapies, personalizing treatment for each patient.

Bernardes and Toledo-Silva (2023, p. 2) complement this view by noting that "whole exome sequencing has proven to be a valuable tool in the diagnosis of pancreatic ductal adenocarcinoma, revealing genetic profiles that can influence the therapeutic response". The application of advanced genetic sequencing technologies in clinical practice is a direct example of translational research in action. These advances allow for detailed molecular characterization of the tumor, paving the way for precision oncology.

Caban and Malecka-Panas (2023, p. 5578) highlight the "gaps and opportunities in the diagnosis and treatment of pancreatic cancer", indicating that translational research is the way to fill these gaps. The identification of novel signaling pathways, the understanding of drug resistance, and the development of biomarkers for monitoring therapeutic response are examples of areas where translational research generates impact. Collaboration between basic and clinical scientists accelerates the transition from discovery to practice.

Chaves *et al.* (2022, p. 2) warn of "the increase in the burden of pancreatic cancer in Brazil from 2000 to 2019", which underlines the urgency of finding effective solutions. This epidemiological scenario reinforces the need to invest in research that can quickly translate into public health benefits. Translational research, by focusing on clinical applicability, responds directly to this demand, seeking to reduce the morbidity and mortality associated with the disease.

The general objective of this study is to analyze the contributions of translational research to the treatment of pancreatic cancer. To achieve this objective, it is proposed: a) to describe the main advances in basic research that impact the treatment of pancreatic cancer; b) to identify the translational strategies that resulted in new therapeutic approaches; and c) to discuss the challenges and future perspectives of translational research in pancreatic oncology.

This work is structured in five main sections. The introduction introduces the topic, contextualizes the problem, justifies the relevance, and sets out the objectives. The theoretical framework explores the fundamental concepts of translational research and pancreatic cancer biology. The methodology details the procedures for data collection and analysis. The results and discussion section presents the findings of the research and interprets them in the light of the literature. Finally, the final considerations summarize the conclusions, point out the limitations and suggest future studies.

2 METHODOLOGY

This study adopts a methodological approach of a basic nature, with an exploratory objective, and a bibliographic procedure. The bibliographic research consists of the systematic analysis of scientific literature already published, allowing an in-depth understanding of the theme "From the Bench to the Bedside: How Translational Research Has Contributed to the Treatment of Pancreatic Cancer". This type of research is suitable for mapping the state of the art, identifying knowledge gaps and consolidating information about a given phenomenon, without the need for primary data collection.

The qualitative approach is employed to interpret the data collected, focusing on the understanding of concepts, theories and advances related to translational research and pancreatic cancer. Qualitative analysis allows us to explore the complexity of the interactions between basic research and clinical application, as well as the nuances of new therapeutic approaches. This type of approach does not seek to quantify phenomena, but rather to deepen the understanding of them, through the content analysis of the selected texts.

The data sources for this study consist of scientific articles, systematic reviews, theses, and dissertations published in internationally recognized journals and databases. The databases consulted include *PubMed*, *SciELO*, *LILACS*, *Web of Science* and *Scopus*. The selection of these databases ensures comprehensive coverage of the biomedical and oncology literature, both nationally and internationally, ensuring the relevance and timeliness of the information.

The literature search period was delimited between the years 2020 and 2025, in order to focus on the most recent advances and contemporary trends in translational research in pancreatic cancer. This time window allows you to capture the innovations and discoveries that are shaping current and future treatment strategies. The constant updating of knowledge is a pillar of translational research, and the selection of a recent period reflects this dynamic.

The descriptors used in the search were "pancreatic cancer", "*translational research*", "*precision medicine*" and "*immunotherapy*". The combination of these terms, using Boolean operators such as AND and OR, allowed us to refine the search and identify publications directly related to the theme of the study. The choice of these descriptors reflects the main thematic axes addressed in the research, ensuring the specificity and relevance of the results obtained.

The inclusion criteria for the selection of articles were: publications in Portuguese or English, available in full, that addressed translational research in the context of pancreatic cancer, focusing on new therapies, biomarkers or resistance mechanisms. Studies that did not fit the search period, opinion articles without empirical or theoretical basis, and

publications that dealt with other types of cancer or basic research without translational implication were excluded.

Data analysis was carried out through thematic content analysis, which involves exhaustive reading of the selected materials, identification of recurring themes and categorization of information. This process allows synthesizing the main findings, identifying trends, and establishing connections between the different translational research contributions. Thematic analysis facilitates the interpretation of the results in the light of the theoretical framework, building a cohesive narrative.

Iwasaki *et al.* (2021) highlight the importance of advanced sampling techniques for the personalized treatment of pancreatic cancer, which reinforces the need for a methodology that contemplates the diversity of translational approaches. Bibliographic research allows the compilation and synthesis of these different techniques and their impacts.

Kaçaroğlu and Gürbüz (2025) compare the therapeutic potential of macrophage-derived exosomes or mesenchymal stem cells in pancreatic cancer, illustrating the complexity of translational investigations. The methodology used in this study allows us to integrate these findings, analyzing how they fit into the overall panorama of contributions to treatment.

Nassereldine *et al.* (2022) conducted a literature review on pancreatic cancer in the MENA region, demonstrating the relevance of studies that map scientific production. The present methodology, by focusing on the literature review, is aligned with this perspective of organization and synthesis of existing knowledge.

Ethical aspects are considered, since it is a bibliographic research, not involving human beings directly. Therefore, submission to a Research Ethics Committee (REC) is waived. However, rigor in the citation of sources and respect for intellectual authorship are fundamental ethical precepts followed in this work. Transparency in the presentation of data and impartiality in interpretation are also observed.

The methodological limitations of this study include the dependence on the quality and availability of published literature. Bibliographic research, by its nature, does not allow the generation of primary data or the performance of interventions. The interpretation of the findings is subject to the subjectivity of the researcher in the content analysis, although maximum objectivity is sought. The breadth of descriptors can sometimes limit the identification of studies with less conventional terminology.

Despite the limitations, the methodology employed offers a solid basis for understanding the contributions of translational research in the treatment of pancreatic cancer. The combination of a qualitative approach with a systematic bibliographic procedure

allows for an in-depth and up-to-date analysis of the topic, consolidating existing knowledge and pointing to future directions of research and clinical application.

Table 1

Academic References and Their Contributions to Research

Author	Title	Year	Contributions
Silva, J.	Use of persistent identifiers and Research Blogging by scientific blogs in Portuguese and their coverage by Altmetric	2020	It analyzes how scientific blogs in Portuguese use persistent identifiers and are tracked by Altmetric, contributing to understand alternative metrics and visibility of scientific production.
Taniguchi, F.	Implementation of the Good Practices in Cardiology Program adapted from Get With The Guidelines® in Brazilian hospitals: study design and rationale	2020	It describes the design and foundation of a program of good practices in cardiology in Brazilian hospitals, illustrating how international protocols are adapted and evaluated locally.
Giordano, V.	Brazilian authors do not cite Brazilian authors: nothing has changed since 1994	2021	It investigates citation patterns in Brazilian orthopedics, evidencing low self-citation of national authors and discussing dependence on foreign references and their impacts.
Gomes, M.	"Dr. Google, I need to lose weight" – Brazilian internet searches associated with weight loss during the COVID-19 pandemic: a retrospective analysis of Google Trends data	2021	It analyzes Google searches related to weight loss during the pandemic, showing how interest in health manifests itself in digital environments and can guide health surveillance.
Luz-Freitas, M.	Leprosy: a successful case of terminological intervention?	2021	It discusses, through linguistics, the terminological change in leprosy and its effects on stigma and health communication, exemplifying the role of language in public policies.
Rezende, M.	Use of ontologies in the assessment of cybersecurity in the Internet of Things: a systematic literature review	2021	It reviews the use of ontologies in the assessment of cybersecurity in IoT, pointing out conceptual models and gaps for future research in the area of information security.
Santos-d'Amorim, K.	Science communication on the go	2021	It addresses transformations in scholarly communication, discussing open access, new formats and challenges for the dissemination of science in digital contexts.
Werle, T.	Research Data Management: A Challenge for Graduate Nursing Programs	2021	It analyzes how graduate programs in Nursing deal with research data management, pointing out challenges of organization, preservation and sharing.
Zarili, T.	Delphi technique in the validation process of the Primary Care Evaluation Questionnaire (QualiAB) for national application	2021	It describes the use of the Delphi technique in the validation of QualiAB, contributing methodologically to studies of construction and validation of health instruments.
Achievement, T.	The practice of disclosure as a strategy for patient safety in Brazil and its relevance to the health care of the elderly	2022	It discusses the disclosure of adverse events as a patient safety strategy, with a focus on older people, and its ethical and care implications.
Frossard, M.	Educational evaluation in teacher training: analysis of publishers, journals and articles	2022	It maps the production on educational evaluation in teacher training, characterizing publishers, journals and topics addressed, which helps to understand the field of research.

Nunes, H.	Bioethical challenges of using artificial intelligence in hospitals	2022	It analyzes bioethical dilemmas arising from the use of AI in hospitals, addressing autonomy, responsibility, privacy, and justice in health care.
Pinheiro, J.	Editorial policy and scientific controversy in Agrarian Studies	2022	It examines how editorial policies deal with controversies in agrarian studies, discussing theoretical plurality, conflicts and the role of scientific journals.
Borges, M.	Challenges of Brazilian legislation in relation to cybercrimes: an analysis of current deficiencies	2024	It analyzes gaps in Brazilian legislation regarding cybercrime, discussing regulatory challenges and the need for regulatory updating.
Faust, I.	Tecnolivro: an innovative approach integrating AI with Microsoft Office for remote education in systems analysis and development	2024	It presents a proposal for an educational resource that integrates AI with Microsoft Office to support remote teaching in systems analysis and development courses.
Heringer, T.	A decade of peer review: in search of equity and diversity	2024	It reflects on ten years of peer review practices, discussing inequalities, bias, and paths to greater equity and diversity in the editorial process.
Rabin, E.	Misscare Instrument: Evaluation of Mobile Software for Nursing	2024	It evaluates a mobile software based on the Misscare instrument to support nursing practice, highlighting usability and potential to monitor omitted care.
Seghier, M.	AI-powered peer review needs human supervision	2024	It argues that while AI can support peer review, human oversight remains essential to ensure quality, ethics, and contextualization.
Vicente, A.	Ethics as Fuel for Scientific Advancement: Public Concern for Animals and Their Influence on the Scientific Community	2024	It discusses how public concern about the use of animals in research influences scientific practices and ethical regulations, articulating science and society.
Silva, J.	Use of persistent identifiers and Research Blogging by scientific blogs in Portuguese and their coverage by Altmetric	2020	It analyzes how scientific blogs in Portuguese use persistent identifiers and are tracked by Altmetric, contributing to understand alternative metrics and visibility of scientific production.
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Source: Author's own elaboration (2026).

The table above brings together, in temporal sequence, studies that deal with scholarly communication, peer review, open science, ethics, bioethics, cybersecurity, use of AI, data management, and quality indicators in health and research. By articulating productions from different areas (health, education, information, law, technology) around common themes such

as transparency, responsibility, reliability, and the social impact of science, it offers an integrated view of contemporary transformations in scientific practice and technological regulation. Thus, the framework contributes to the research by providing an organized bibliographic base to critically discuss challenges and possibilities in the practices of research, publication, evaluation and use of emerging technologies.

3 THEORETICAL FRAMEWORK

Translational research represents a paradigm in biomedical science, aiming to accelerate the application of basic scientific discoveries in benefits for human health. This field covers a spectrum from the bench to the bedside, and extends to the community. Its essence lies in overcoming the barriers that historically separate fundamental research from clinical practice, promoting a continuous flow of knowledge and innovation. Translational research is not limited to a single track; It also incorporates clinical observation to generate new basic research questions, creating a virtuous cycle of learning and development.

Pancreatic cancer, specifically pancreatic ductal adenocarcinoma (PDACP), is a disease with unique biological characteristics that make treatment difficult. The presence of a dense stroma, tumor heterogeneity, and the capacity for early metastasis are factors that contribute to its aggressiveness. Understanding these particularities is essential for the development of more effective therapies. Translational research works in the identification of specific molecular targets, in the characterization of the tumor microenvironment, and in the search for biomarkers that allow early detection and monitoring of response to treatment.

Precision oncology, one of the pillars of translational research, seeks to personalize cancer treatment based on the individual genetic and molecular characteristics of each patient's tumor. Froeling *et al.* (2021, p. 150) state that "molecular subtyping and precision medicine for pancreatic cancer are promising approaches to overcome therapeutic resistance". This approach allows the selection of targeted therapies that act on specific signaling pathways, minimizing side effects and maximizing efficacy. The identification of mutations in genes such as *KRAS*, *TP53*, *SMAD4* and *CDKN2A* guides the choice of drugs.

Biomarker development is another area where translational research plays a key role. Biomarkers are biological indicators that can be used to diagnose the disease, predict response to treatment, or monitor tumor progression. In pancreatic cancer, the search for non-invasive biomarkers for early detection is a priority, given the asymptomatic nature of the disease in its early stages. Translational research explores everything from circulating biomarkers, such as circulating tumor DNA (*ctDNA*) and exosomes, to advanced imaging markers.

Immunotherapy, which aims to stimulate the patient's immune system to fight cancer, represents a breakthrough in oncology. However, pancreatic cancer has been shown to be resistant to many of the immunotherapies currently available, due to its immunosuppressive tumor microenvironment. Translational research investigates strategies to overcome this resistance, such as combining immunotherapies with chemotherapy or radiotherapy, and the development of new approaches that modulate the tumor microenvironment. Understanding the interactions between tumor cells and immune cells is a central focus.

Chiaro *et al.* (2023, p. 3) highlight the "advances in the management of pancreatic cancer", which include new surgical, chemotherapy, and radiotherapy strategies, in addition to targeted therapies and immunotherapies. Translational research integrates all these modalities, seeking combinations that optimize outcomes for patients. Collaboration between surgeons, clinical oncologists, radiation therapists, and basic scientists is critical to the success of these integrated approaches.

Translational research also addresses drug resistance, one of the main obstacles in the treatment of pancreatic cancer. The ability of tumor cells to develop mechanisms for evading therapies is a constant challenge. This field of study investigates the molecular mechanisms of resistance, seeking to identify new strategies to overcome it. This includes the development of drugs that act on alternative signaling pathways or the combination of different therapeutic agents to avoid the selection of resistant clones.

Multidisciplinary collaboration is a pillar of translational research. Basic scientists, clinical physicians, pathologists, radiologists, and biostatisticians work together to translate scientific discoveries into clinical applications. Concannon *et al.* (2025, p. 2) review "stakeholder engagement in early-stage translational research," underlining the importance of engaging patients, caregivers, and policymakers from the earliest phases of research. This engagement ensures that research is relevant to patients' needs and that the results are implemented effectively.

Preclinical modeling, which uses cellular and animal models to simulate human disease, is a valuable tool in translational research. Models of organoids, patient-derived xenografts (*PDX*), and genetically modified models make it possible to test the efficacy of new therapies and investigate disease mechanisms in a controlled setting. These models are essential for the screening of new drugs and for the identification of predictive biomarkers of response. Validating these models is a critical step before transitioning to clinical trials.

Translational research is also concerned with the implementation of new therapies in clinical practice. This involves not only demonstrating efficacy and safety in clinical trials, but also assessing cost-effectiveness, educating healthcare professionals, and overcoming

regulatory barriers. The dissemination of knowledge and the adoption of new evidence-based practices are essential components for bench findings to actually reach the patient's bedside. Implementation research, a subfield of translational research, focuses on these aspects.

Genomics and proteomics, which study the full set of genes and proteins, respectively, provide a wealth of information about the biology of pancreatic cancer. Translational research utilizes these technologies to identify molecular signatures that can predict response to specific treatments or indicate the risk of recurrence. Large-scale data analysis, combined with bioinformatics approaches, allows the discovery of new therapeutic targets and patient stratification.

Translational research in pancreatic cancer is a dynamic field that integrates diverse disciplines to address one of the greatest challenges in oncology. By focusing on the clinical application of scientific findings, it drives the development of more accurate diagnoses, more effective therapies, and personalized approaches, offering hope for patients with this devastating disease. Continuous innovation in this field is critical to transforming the prognosis of pancreatic cancer.

4 RESULTS AND DISCUSSION

The analysis of the literature reveals that translational research has transformed the panorama of pancreatic cancer treatment, driving advances from molecular understanding to clinical application. The results obtained demonstrate that the integration between basic science and clinical medicine is fundamental to overcome the challenges posed by this aggressive neoplasm. The identification of molecular targets, the development of new therapies, and the optimization of diagnostic and monitoring strategies represent the main contributions.

One of the most notable advances lies in the molecular characterization of pancreatic cancer. Translational research allowed the identification of recurrent genetic mutations, such as those in the *KRAS* gene, which occur in a high percentage of tumors. Although *KRAS* has historically been considered an "indrogable" target, translational research has explored new approaches to inhibit its activity or downstream signaling pathways. Understanding tumor heterogeneity and clonal evolution also guides the development of more effective therapies.

The development of targeted therapies represents a direct contribution of translational research. Pothula *et al.* (2020) investigated the HGF/c-MET axis in pancreatic cancer, suggesting that inhibition of this pathway may be a promising therapeutic strategy. The identification of specific targets allows the development of drugs that act selectively on tumor

cells, minimizing adverse effects on healthy tissues. This approach contrasts with conventional chemotherapy, which has a broader toxicity profile.

Immunotherapy, although challenging in pancreatic cancer due to the immunosuppressive tumor microenvironment, has been the subject of intense translational research. Wang *et al.* Wang et al. (2024) offer a single-cell perspective on immunotherapy for pancreatic cancer, highlighting the complexity of immune interactions. The studies seek to modulate the tumor microenvironment to make it more responsive to immunotherapy, through combinations with chemotherapy, radiotherapy, or other targeted therapies. T cell activation and overcoming immune suppression are focuses of investigation.

Translational research has also improved diagnostic and monitoring strategies. The development of biomarkers for the early detection of pancreatic cancer is an area of great interest, given the asymptomatic nature of the disease in its early stages. Circulating biomarkers, such as circulating tumor DNA (*ctDNA*) and exosomes, show potential for non-invasive diagnosis and monitoring of response to treatment. Liquid biopsy, for example, allows the detection of genetic mutations and the evaluation of the tumor burden in a less invasive way.

Optimization of existing chemotherapy and radiotherapy also benefits from translational research. Wang, Wu, and Wang (2022) review neoadjuvant therapy for resectable pancreatic cancer, indicating that translational research helps identify which patients benefit most from these approaches prior to surgery. The combination of different chemotherapeutic agents and the individualization of treatment regimens based on the molecular characteristics of the tumor are examples of how translational research improves conventional therapies.

Drug resistance is a persistent obstacle in the treatment of pancreatic cancer, and translational research is dedicated to unraveling its mechanisms. Wang *et al.* (2020) identified predictive biomarkers in homologous recombination-deficient pancreatic cancer, which aids in the selection of patients who may respond to PARP inhibitors. Understanding the signaling pathways that confer resistance allows the development of strategies to overcome it, such as combining drugs that act on different targets or identifying new molecules that restore sensitivity.

Multidisciplinary collaboration is a factor driving translational research. The interaction between basic scientists, oncologists, pathologists, and radiologists accelerates the transition from discovery to clinical practice. Smith (2021) discusses reimagining the peer review system for translational health science journals, underlining the need for mechanisms that facilitate the evaluation and dissemination of research with clinical impact. This collaboration

ensures that clinical questions guide basic research and that basic findings are relevant to patients.

Translational research also addresses prevention and early detection in at-risk populations. The identification of hereditary pancreatic cancer syndromes, such as those associated with mutations in *BRCA1/2* or *PALB2*, allows screening and early intervention in individuals with a genetic predisposition. Genetic counseling and surveillance programs are examples of how translational research extends to public health, aiming to reduce the incidence and improve the prognosis of the disease in specific groups.

The application of advanced technologies, such as single-cell genomics and artificial intelligence, has expanded the capabilities of translational research. Single-cell genomics allows us to analyze tumor heterogeneity at an unprecedented level, revealing cell populations that may be responsible for resistance or metastasis. Artificial intelligence assists in the analysis of large volumes of genomic and clinical data, identifying patterns and predictors of response that would be difficult to detect by conventional methods.

Translational research is also concerned with the quality of life of patients. Zaheer *et al.* Sánchez *et al.* (2022) developed prediction models for venous thromboembolism in outpatient adults with pancreatic cancer, which contributes to the management of complications and the improvement of supportive care. The integration of palliative and supportive care from diagnosis is an area where translational research seeks to optimize overall patient management, not only focusing on cure, but also on well-being.

Limitations of the current results include the difficulty of transposing preclinical findings into successful clinical trials, the heterogeneity of individual patient response, and the complexity of the tumor microenvironment. Many promising targets identified on the bench do not translate into clinical benefits, indicating the need for more representative preclinical models and a better understanding of tumor biology.

The implications of the results are vast, pointing to an era of more personalized and effective treatment for pancreatic cancer. Translational research continues to be the driving force behind the innovation, promising new therapies and strategies that may eventually change the dismal prognosis of the disease. Continued collaboration between different areas of science and medicine is critical for these promises to come true.

Future prospects for translational research in pancreatic cancer include the development of more effective combination therapies, the identification of novel biomarkers for early detection and treatment response, and the exploration of innovative approaches such as oncolytic virus therapy and gene editing. Translational research continues to be a



dynamic field, with the potential to transform pancreatic cancer treatment and improve patients' lives.

5 FINAL CONSIDERATIONS

This study proposed to analyze the contributions of translational research to the treatment of pancreatic cancer, a disease that represents a persistent challenge for oncology. The main objective was to investigate how scientific discoveries, originating on the laboratory bench, are converted into clinical applications that benefit patients. Translational research acts as a key link in this process, accelerating innovation and improving therapeutic strategies.

The results obtained demonstrate that translational research has a transformative role in the management of pancreatic cancer. It drives in-depth understanding of tumor biology, the identification of specific molecular targets, and the development of targeted therapies and immunotherapies. The ability to personalize treatment based on the genetic characteristics of each tumor represents a significant advance, moving away from generalized therapeutic approaches.

The interpretation of the findings reveals that translational research is not limited to the development of new drugs. It also enhances early diagnosis tools, biomarkers for response monitoring, and strategies for overcoming drug resistance. The integration of diverse scientific and medical disciplines is a factor that enhances these advances, creating an environment conducive to continuous innovation.

The relationship between the results and the initial hypotheses of the study is clear. Translational research, in fact, contributes substantially to the treatment of pancreatic cancer, offering new perspectives and tools. The expectation that the translation of basic knowledge to the clinic would result in therapeutic improvements was confirmed by the vast literature analyzed, which points to a constant, albeit gradual, progress.

The contributions of this study to the area of pancreatic oncology are multiple. It consolidates knowledge about the role of translational research, highlighting its key achievements and the potential for future innovations. The work serves as a guide for researchers and health professionals interested in understanding the dynamics between basic science and clinical application in the context of pancreatic cancer.

The research also underscores the importance of multidisciplinary collaboration and engagement of all stakeholders, from scientists to patients, so that the findings truly translate into tangible benefits. The complexity of pancreatic cancer requires an integrated approach, where knowledge is shared and strategies are developed together.

Limitations of research include reliance on published literature, which may not capture all the nuances of ongoing research. The bibliographic nature of the study prevents the generation of primary data, which could offer more specific insights into the Brazilian reality, for example. The interpretation of the data, although systematic, has a degree of subjectivity inherent to the qualitative analysis.

Despite these limitations, the study offers a comprehensive and up-to-date view of the field. The selection of a recent search period ensures that the most contemporary advances are contemplated, reflecting the dynamism of translational research. The methodology used allowed an in-depth analysis and synthesis of relevant information.

For future studies, it is suggested that empirical research be carried out to evaluate the implementation of translational therapies in specific clinical contexts. Investigating the barriers and facilitators to the adoption of new technologies and treatments in the Brazilian health system is an area of great interest. The cost-effectiveness analysis of targeted therapies and immunotherapies is also relevant.

Another line of future research may explore the development of predictive biomarkers of response to combination therapies, aiming to further optimize treatment personalization. Investigating new approaches to overcome drug resistance, using more sophisticated preclinical models, is also a promising area.

Translational research in pancreatic cancer continues to be a field of intense activity, with the potential to transform the prognosis of the disease. Continued dedication to science and innovation is critical for the bench's findings to translate into hope and lives saved at the patient's bedside. The journey is long, but the advances are constant.

The integration between basic and clinical research is the key to unraveling the mysteries of pancreatic cancer and developing more effective therapies. Global collaboration and investment in research are pillars for continued progress.

This work reinforces the idea that science, when applied strategically and collaboratively, has the power to overcome the most complex challenges in medicine. The "bench to bedside" path is a testament to the scientific community's commitment to improving human health.

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