

Streszczenie w języku angielskim

Biliary bacterial colonization as a potentially modifiable risk factor for postoperative complications following pancreatoduodenectomy in patients with pancreatic head cancer

Introduction

Pancreatic ductal adenocarcinoma (PDAC) remains one of the most lethal solid malignancies, characterized by highly aggressive tumor biology, early metastatic dissemination, and limited responsiveness to systemic treatment. Only chance for patients to conquer this malignant disease is radical surgical resection combined with regional lymphadenectomy, followed by adjuvant chemotherapy. A pancreatoduodenectomy (PD) is the standard surgical approach for tumors localized in the head of the pancreas.

However, PD is among the most technically demanding procedures in abdominal surgery, and postoperative morbidity—particularly postoperative pancreatic fistula (POPF) and infectious complications—remains substantial. In this context, the identification of modifiable risk factors is critical not only for improving short-term surgical outcomes but also for optimizing multimodal oncologic treatment and long-term survival.

Bacterial colonization of bile (bacterobilia) is frequently observed in patients undergoing PD and may lead to significant clinical implications. This condition is particularly frequent among patients who undergo preoperative biliary drainage via endoscopic retrograde cholangiopancreatography (ERCP), where disruption of the physiological barrier of the sphincter of Oddi and the presence of a biliary stent facilitate microbial translocation and persistent colonization of the biliary tract.

Although available data suggest an association between bacterobilia and infectious complications, its impact on clinically relevant POPF and long-term survival has not been clearly explained in a homogeneous cohort of patients with PDAC. Furthermore, current perioperative antibiotic prophylaxis protocols in pancreatic surgery do not adequately reflect the actual microbiological spectrum of pathogens isolated intraoperatively from bile.

This doctoral dissertation comprises a series of two original studies based on a retrospective analysis of a homogeneous cohort of 138 patients with histopathologically confirmed PDAC of the pancreatic head who underwent PD between 2017 and 2022 in referral surgical center.

Objectives

The primary aim of this doctoral thesis was to comprehensively evaluate the clinical significance of bacterial bile colonization in patients with PDAC of the pancreatic head

undergoing PD, with particular emphasis on its association with postoperative complications and long-term overall survival (OS).

Additionally, the study included a detailed microbiological evaluation of bile cultures to assess whether current perioperative antibiotic prophylaxis should be modified based on the pathogens identified intraoperatively in bile.

Publication #1

Olszewska N, et al. *Bile Bacterial Colonization Increases Risk of Postoperative Pancreatic Fistula and Worsens Overall Survival Following Pancreatoduodenectomy.* Journal of Clinical Medicine. 2026; 15(4):1566.

The first study titled “*Bile Bacterial Colonization Increases Risk of Postoperative Pancreatic Fistula and Worsens Overall Survival Following Pancreatoduodenectomy*” evaluated the clinical relevance of bacteriobilia in patients with pancreatic head PDAC undergoing PD, focusing on its association with postoperative pancreatic fistula and overall survival.

Multivariable analysis demonstrated that bacteriobilia was an independent risk factor for clinically relevant POPF (OR 5.50; $p = 0.034$) and grade B POPF (OR 8.04; $p = 0.048$). Moreover, the presence of bacteria with resistance mechanisms (BRM) was independently associated with grade C POPF (OR 6.17; $p = 0.047$).

Survival analysis revealed significantly reduced OS in patients with positive bile cultures (median 26.7 vs. 54.7 months; $p = 0.009$). In Cox proportional hazards model, positive bile culture remained an independent predictor of impaired survival (HR 1.95; $p = 0.019$), irrespective of tumor stage.

These findings indicate that bacteriobilia represents a clinically significant factor influencing both perioperative morbidity and long-term oncologic outcomes in patients with PDAC undergoing PD.

Publication #2

Olszewska N, et al. *Should Preoperative Biliary Decontamination Be Considered to Minimize Morbidity and Mortality Following Pancreatoduodenectomy?* Antibiotics. 2026; 15(2):134.

The second study titled “*Should Preoperative Biliary Decontamination Be Considered to Minimize Morbidity and Mortality Following Pancreatoduodenectomy?*” expanded upon the microbiological findings and translated them into potential therapeutic implications and perioperative management strategies.

Bacterial bile colonization was identified in 76.8% of the cohort, with a significantly higher incidence among patients undergoing ERCP (93.1% vs. 32.4%). Bacterobilia was associated with increased five-year mortality (OR 3.01; $p = 0.007$), higher rates of POPF grade B (OR 5.11; $p = 0.088$), and surgical site infections (OR 2.9; $p = 0.038$).

Isolation of BRM identified a subgroup of patients at particularly high risk for adverse events, including increased in-hospital mortality (OR 8.43; $p = 0.004$), need for reoperation (OR 4.17; $p = 0.017$), and severe POPF grade C (OR 4.97; $p = 0.026$). Kaplan–Meier analysis demonstrated significantly reduced OS in patients with bacterobilia (log-rank $p = 0.038$).

Bile colonization was polymicrobial. Among 252 isolated microorganisms, Gram-negative rods predominated (61.3%), followed by Gram-positive cocci (30.6%); BRM accounted for 9.8%.

Antimicrobial susceptibility analysis revealed poor coverage with cephalosporin-based regimens combined with metronidazole (30.2%), whereas the highest coverage was achieved with amoxicillin/clavulanate plus gentamicin (93.6%).

These results underscore the substantial clinical impact of bacterobilia, suggesting its influence on both perioperative morbidity and long-term survival in patients with PDAC undergoing PD. Collectively, these findings provide a compelling rationale for reconsidering standard perioperative prophylaxis in favor of targeted antibiotic strategies tailored to the local microbiological bile profile.

Conclusions

This series of studies demonstrates a significant association between bacterial bile colonization and increased postoperative morbidity as well as impaired OS in patients with pancreatic head PDAC undergoing PD.

The high prevalence of bacterobilia in this population and the presence of BRM organisms suggest that PD in these patients may reasonably be considered as a “contaminated” operation. These findings underscore the need to reconsider current perioperative antibiotic protocols and support a targeted approach guided by microbiological data, potentially incorporating broader-spectrum combinations such as amoxicillin/clavulanate with gentamicin to ensure adequate antimicrobial coverage.

The presented results expand current understanding of the role of bacterobilia in pancreatic surgery and provide a robust foundation for future interventional prospective and randomized studies aimed at validating these observations and improving perioperative therapeutic strategies.