

# *Research progress on postoperative infection of pancreatic cancer*

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**Abstract:** Pancreatic ductal adenocarcinoma has the characteristics of rapid onset and poor prognosis. At present, how to improve the postoperative survival rate and long-term quality of life of patients is a difficult problem for hepatobiliary and pancreatic surgeons. Surgery is one of the main ways to treat pancreatic cancer. Postoperative infection of pancreatic cancer is frequent, which seriously reduces the postoperative quality of life and survival time of patients. This article reviews the related research progress in recent years, and discusses the related aspects of postoperative infection of pancreatic cancer, such as postoperative pulmonary infection, abdominal infection and incision infection. Through systematic analysis of relevant literature, the definition, category, diagnostic methods, preventive measures and treatment strategies of postoperative infection were sorted out, aiming to provide more practical reference for clinicians, so as to optimize patient management and improve treatment effect.

## 1. Introduction

The incidence of pancreatic cancer [90 % is pancreatic ductal adenocarcinoma (PDAC)] varies greatly with race and geographical distribution, with the highest incidence in Western Europe and North America, and the lowest in East Africa and Central and South Asia, with a gap of more than 10 times<sup>[1]</sup>.

Pancreatic cancer is a highly malignant digestive system tumor. The global incidence of pancreatic cancer is on the rise. The mortality and morbidity are similar, and the mortality rate is extremely high<sup>[2,3]</sup>. According to statistics in 2021, among all malignant tumors in the United States, new cases of pancreatic cancer rank 10th in men and 9th in women, accounting for 4th in cancer-related mortality. According to the statistics of China National Cancer Center in 2021, pancreatic cancer ranks seventh in the incidence of malignant tumors in men and 11th in women in China, accounting for sixth in the mortality rate related to malignant tumors<sup>[4]</sup>.

Surgical resection is currently the only feasible method for the cure and long-term survival of patients with pancreatic cancer<sup>[4]</sup>. Pancreatic cancer surgery has the characteristics of great trauma, complicated intraoperative operation and high incidence of postoperative infection, which has a

serious impact on the postoperative rehabilitation and quality of life of patients. Therefore, it is of great clinical value to carry out and explore the research on postoperative infection of pancreatic cancer.

## **2. Definition, classification and diagnosis of postoperative infection of pancreatic cancer**

There are many kinds of postoperative complications of pancreatic cancer, including pancreatic fistula, biliary fistula, gastrointestinal dysfunction, postoperative infection, postoperative bleeding and so on. This article mainly describes the current research status of postoperative infection of pancreatic cancer. Many studies have shown that many factors such as the pathophysiological characteristics of perioperative patients, surgical procedures and postoperative management are closely related to the occurrence of postoperative infection.

### **2.1 Definition and classification of postoperative infection of pancreatic cancer**

Postoperative infection of pancreatic cancer is a common and serious complication, which is mainly divided into incision infection, abdominal infection and pulmonary infection. Common clinical manifestations can include chills, high fever, pain in the infected area, hypoproteinemia, etc.

### **2.2 Diagnosis of postoperative infection of pancreatic cancer**

The occurrence of postoperative infection is related to pancreatic fistula, biliary fistula or abdominal bleeding caused by surgical trauma, long operation time<sup>[5]</sup>, preoperative diabetes<sup>[6]</sup>, intraoperative massive blood transfusion<sup>[7]</sup>, low serum albumin level<sup>[8]</sup>, improper postoperative nursing and other factors. The diagnostic criteria are as follows:

(1) The diagnostic criteria of incision infection were purulent secretions at the incision, positive bacterial culture, infection symptoms (such as pain, swelling, redness, fever) and the discovery of abscesses within 30 days after surgery.

(2) The diagnosis of intra-abdominal infection is often based on the color of the peritoneal drainage fluid and laboratory bacterial culture. Postoperative intra-abdominal infection and abscess are often caused by pancreatic fistula and biliary fistula, with an incidence of about 4 % -16 %. Such complications will prolong the hospitalization time of patients and increase the mortality rate<sup>[9]</sup>.

(3) The diagnosis of postoperative pulmonary infection requires comprehensive consideration of imaging findings ( such as chest X-ray or CT scan showing pulmonary inflammation ), positive sputum culture, clinical symptoms ( such as fever, cough, sputum ), and abnormal signs found by lung auscultation ( such as moist rales or respiratory sounds ), the above factors can indicate the presence of pneumonia<sup>[10]</sup>.

The incidence of postoperative pulmonary infection was 12.07 %, mainly by affecting the body's defense mechanism and increasing the retention of respiratory secretions, such as long-term postoperative chronic consumption leading to decreased immunity, fear of incision pain and inhibition of cough reflex, can increase the risk of postoperative pulmonary infection<sup>[11]</sup>. In addition, smoking, long-term bedridden, incision infection, abdominal infection can increase the incidence of postoperative pulmonary infection in patients<sup>[11,12]</sup>.

During postoperative infection, common laboratory examination items include blood routine (WBC, erythrocyte sedimentation rate ( ESR ), C-reactive protein ( CRP ) ), blood culture, sputum culture, infection markers ( procalcitonin ( PCT ), interleukin-6 ( IL \_ 6 ), etc. ), secretion microbial culture<sup>[13]</sup> and detection of inflammatory mediators. In addition, electrolyte and acid-base balance need to be monitored. Imaging examinations included X-ray examination: chest X-ray, chest CT

and abdominal ultrasound, CT, MRI.

### 3. Prevention measures of postoperative infection of pancreatic cancer

To prevent postoperative infection of pancreatic cancer, preoperative evaluation, intraoperative operation and postoperative nursing should be paid attention to, so as to reduce the incidence of infection and promote the recovery of patients as soon as possible.

Infection after pancreatic surgery is usually more serious, and its severity is affected by many factors, including the patient's age, preoperative nutritional status, perioperative preventive medication, intraoperative conditions, and postoperative care. Among them, preoperative nutrition and perioperative preventive medication are important links in preventing postoperative infection. Complications after pancreatic surgery, such as pancreatic fistula, biliary fistula, bleeding, etc., may lead to postoperative infection, and even lead to complex infections in the lungs, abdomen, and surgical incisions.

A large number of multi-center studies have shown that smoking is an important external factor leading to postoperative pulmonary infection in patients with pancreatic cancer. Smoking will not only stimulate the nerve endings of the respiratory tract, resulting in increased secretion of mucus in the respiratory glands, but also reduce the clearing and purification function of the tracheal mucosa, resulting in difficult discharge of sputum and a large amount of deposition in the respiratory tract, resulting in gas exchange dysfunction in patients and significantly increasing the incidence of postoperative pulmonary infection in patients<sup>[12,14,15]</sup>. At the same time, studies have shown that in pancreatic cancer surgery, whether it is simple epidural anesthesia or epidural block combined with intravenous general anesthesia, it is helpful for patients to restore respiratory function after surgery, so as to achieve the effect of preventing pulmonary infection in patients<sup>[16]</sup>. The above description fully shows that epidural block combined with intravenous anesthesia is more conducive to the recovery of postoperative respiratory function than intravenous anesthesia alone, thereby reducing the incidence of pulmonary infection. The recovery time of spontaneous breathing, eye opening time, extubation time and other anesthesia recovery time in the intravenous anesthesia group were longer than those in the epidural block combined with intravenous anesthesia group, which increased the risk of pulmonary infection<sup>[11]</sup>.

Therefore, active treatment of other postoperative complications is also an important measure to prevent infection. In order to prevent the occurrence of infection, perioperative use of broad-spectrum antibiotics is necessary, while improving the nutritional status of patients is also essential.

### 4. Treatment strategies for postoperative infection of pancreatic cancer

The treatment strategy for postoperative infection of pancreatic cancer should be individualized according to the type of bacteria, the site of infection and the severity of infection. Once the postoperative infection is diagnosed, antibiotics should be quickly initiated within 1 hour, and appropriate broad-spectrum antibiotics should be selected for initial treatment based on local bacterial resistance data to improve the therapeutic effect<sup>[17]</sup>.

(1) For patients with mild infection, conservative treatment such as appropriate drug treatment and diet adjustment can be used for treatment. If the source of infection has been controlled and the empirical treatment is effective, there is no need to replace antibiotics.

(2) For patients with severe infection, such as postoperative lung, abdominal cavity and incision and other parts of the mixed infection, should strictly control the source of infection, and consider upgrading antibiotics or combination therapy, and drug sensitivity test to adjust sensitive antibiotics<sup>[18]</sup>. Maintaining adequate drainage is an important measure for the treatment of severe

infection after pancreatic cancer surgery, and further surgical treatment or other treatment should be taken if necessary.

During the anti-infective treatment, the patient's body temperature, blood routine and inflammatory indicators were dynamically monitored<sup>[19]</sup> to evaluate the efficacy of the current treatment regimen and determine the timing of antibiotic discontinuation. In order to ensure the stability of the patient's vital signs, an efficient venous access is established to correct the water and electricity.

## 5. Conclusions and prospects

According to the National Cancer Center, the total number of new cancer cases in China in 2022 was 4.82 million, including 2.53 million males and 2.29 million females. The total number of cancer deaths was 2.57 million, of which 1.63 million were males and 940,000 were females<sup>[20]</sup>. Among them, in 2022, the number of new cases of pancreatic cancer in the world was 510,000, slightly less than that of esophageal cancer, ranking 12th in malignant tumors, and the number of deaths was about 470,000, ranking 6th in malignant tumors. The prevalence and mortality of pancreatic cancer in developed regions of the world are about 4 times higher than those in developing regions. The developed regions are mainly Western Europe, North America and other regions. Sub-Saharan Africa and most of Asia have low incidence. Compared with other digestive system tumors, the mortality rate of pancreatic cancer continues to be high<sup>[21]</sup>, which has increasingly become a serious global public health security problem. At the same time, a large number of studies have shown that smoking, obesity, diabetes and heavy drinking are important risk factors for pancreatic cancer and death<sup>[22]</sup>. How to control the above risk factors has become the key to reduce the incidence and mortality of pancreatic cancer.

Although the research progress of postoperative infection of pancreatic cancer has been continuously promoted, there are still many problems and challenges. With the deepening research and development of medical technology, it is expected that more effective methods for preventing and treating postoperative infection of pancreatic cancer will be applied to clinical practice in the future, so as to provide better infection prevention and treatment guarantee for patients.

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