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Rapid rehabilitation nursing with early enteral nutrition improves psychological and clinical recovery after pancreatic cancer surgery

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Abstract: This study investigated the effectiveness of rapid rehabilitation nursing combined with early enteral nutrition in improving postoperative recovery and psychosocial outcomes in patients undergoing surgery for pancreatic cancer. A total of 115 eligible patients were included, with the control group receiving routine perioperative nursing and delayed enteral nutrition, while the observation group received rapid rehabilitation nursing and early enteral nutrition. Postoperative clinical indicators, nutritional and immune function, inflammatory response, psychological status, quality of life, and patient satisfaction were compared between groups. The observation group demonstrated significantly shorter first flatus time, earlier postoperative mobilization, and reduced length of hospital stay compared with the control group ($p < 0.01$). The incidence of postoperative complications was markedly lower in the observation group (3.44% vs. 15.79%, $p < 0.05$). Postoperative IgG, IgA, and IgM levels and the levels of total protein, albumin, and prealbumin were significantly higher in the observation group ($p < 0.05$), while IL-6, TNF- α , and CRP levels were significantly lower ($p < 0.05$). Quality of life scores based on the EORTC QLQ C30 increased in both groups but showed greater improvement in the observation group ($p < 0.05$). Anxiety and depression levels measured by the Hamilton scales decreased in both groups, with significantly greater reductions observed in the observation group ($p < 0.05$). Patient satisfaction was also higher in the observation group (96.55% vs. 82.46%, $p < 0.05$). These findings indicate that rapid rehabilitation nursing combined with early enteral nutrition enhances postoperative physiological recovery and provides meaningful psychological and quality of life benefits for patients with pancreatic cancer

Keywords: anxiety; depression; early enteral nutrition; pancreatic cancer; patient satisfaction; psychological status; quality of life; rapid rehabilitation nursing

1. Introduction

Pancreatic cancer belongs to a type of the common malignant tumors of digestive tract, famous as the “king of cancer” in the field of cancer [1]. The causes of pancreatic cancer are not yet fully clear, but studies have shown that factors, such as long-term smoking, poor dietary habits, high body mass index, and chronic damage to the pancreas may increase the risk of pancreatic cancer [2]. Based on the Lancet, the 5-year survival rate of pancreatic cancer after diagnosis is around 10%, which belongs to one of the worst prognoses of malignant tumors [3]. The clinical symptoms of pancreatic cancer are insidious and atypical, and usually become obvious when the disease progresses to an advanced stage, including jaundice, weight loss, abdominal discomfort, or pain [4]. Recently, the incidence of pancreatic cancer is

on the rise both at home and abroad [5]. According to 2021 statistics, among all malignancies in the United States, pancreatic cancer ranks tenth in new cases in men and ninth in women, and accounts for the fourth highest rate of malignancy related mortality [6]. Based on 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, and sixth in the mortality rate related to malignant tumors in China [7]. Surgical resection is an effective measure for the clinical treatment of pancreatic cancer patients at present. By removing the diseased tissue and inhibiting the continuous progression of cancer cells, it has a positive significance for prolonging the survival period of patients [8].

Beyond the physical disease burden, pancreatic cancer is also associated with a profound psychosocial burden. The diagnosis, rapid disease progression, uncertainty, and complex surgical procedures often trigger significant emotional distress including anxiety, depression, fear, and reduced coping capacity among patients. Recent evidence shows that patients with pancreatic and biliary cancers frequently present with considerable distress at diagnosis, underscoring the need for early psychosocial evaluation [9]. Likewise, psycho-oncology studies indicate that patients undergoing aggressive gastrointestinal cancer surgery experience heightened psychological vulnerability, reduced emotional function, and substantial declines in overall quality of life [10]. Additional research specifically in pancreatic cancer confirms high levels of anxiety and depression and highlights the importance of structured psychological support within care pathways [11]. These psychological responses may further influence postoperative recovery, patient cooperation, and long-term well-being, aligning with perioperative trials demonstrating the clinical relevance of integrated supportive care in major cancer surgery [12]. Therefore, integrating psychological support and psychosocially oriented nursing within perioperative care is increasingly regarded as essential in modern oncology.

Although the effect of surgical treatment for pancreatic cancer has been recognized, surgery has a certain degree of trauma, which can easily cause great physical and mental stress to patients [13]. The requirements for nursing work are relatively high. Once the nursing is improper, it will prolong the postoperative recovery process of patients and affect their quality of life [14]. Therefore, it is very important to strengthen perioperative nursing of pancreatic cancer patients. The perioperative period is not only a window for physiological recovery but also a critical period during which emotional distress, uncertainty, and postoperative fear peak, making structured nursing interventions vital to both physical and psychological outcomes.

In the past, relatively conservative nursing measures were often adopted for pancreatic cancer patients during perioperative period, which failed to achieve ideal results [15]. The rapid rehabilitation nursing path is an optimized routine nursing concept which adopts a series of measures, such as gastrointestinal decompression, reducing the number of enema operations, shortening the time of fasting and water restriction before surgery, and getting out of bed as soon as possible after surgery so as to significantly lessen the incidence of adverse conditions in the perioperative period of patients and ultimately promote the rapid recovery of patients after surgery [16]. In recent years, the concept of enhanced recovery after surgery has been applied in the perioper-

ative care of patients undergoing laparoscopic surgery in general surgery, laparoscopic radical prostatectomy, and has achieved remarkable results [17]. However, there are few reports on its application in patients undergoing pancreatic cancer surgery.

Importantly, rapid rehabilitation nursing does not only influence physiological recovery. Many of its components, including preoperative psychological communication, patient education, emotional reassurance, and early mobilization, directly address psychological stressors experienced by cancer patients. Evidence from oncology nursing research shows that enhanced recovery programs emphasize these elements and provide measurable psychological benefits for patients undergoing cancer surgery [18]. In addition, structured nursing communication combined with psychological care has been shown to reduce both mental and physical stress responses and improve coping after gastrointestinal procedures [19]. These elements are increasingly recognized within psycho oncology as essential contributors to reducing anxiety, promoting emotional stability, strengthening coping ability, and improving postoperative quality of life. Therefore, examining both psychological and physical benefits of such nursing pathways is highly relevant to the field.

However, due to the complex structure around the pancreas, large scope of radical resection and many anastomoses, postoperative patients are often accompanied by different degrees of malnutrition, which seriously affects postoperative quality of life [20]. Currently, nutritional support has a key role in the clinical treatment of pancreatic cancer, which is of great significance for alleviating clinical symptoms and improving patient prognosis [21]. Nutrition support mainly includes enteral nutrition and parenteral nutrition [22]. Although parenteral nutrition can meet the nutrition needs of the gastrointestinal tract, long-term parenteral nutrition may cause intestinal mucosa atrophy and intestinal barrier function impairment [23]. More and more clinical cases have proved that early nutritional support is safe and does not add the risk of infectious complications [24]. Early enteral nutrition is relatively in line with the physiological needs of the human body and the nutritional effect is better [25].

In addition to its physical benefits, nutritional status has been shown to correlate strongly with emotional resilience and psychosocial well-being in cancer patients. Evidence indicates that malnutrition is significantly associated with greater psychological distress, highlighting its impact on emotional functioning [26]. Likewise, improved nutritional status and reduced inflammatory responses have been linked to better quality of life outcomes and diminished emotional disturbance among individuals undergoing cancer treatment [27]. Poor nutrition may exacerbate fatigue, irritability and depressive symptoms, whereas adequate nutritional support may indirectly alleviate psychological distress. Therefore, integrating early enteral nutrition with rehabilitation nursing may simultaneously support physiological healing and psychosocial recovery.

In our study, we aimed to explore the effects of rapid rehabilitation nursing path combined with early enteral nutrition on nutritional status as well as immune function of pancreatic cancer patients after surgery. Given the psychological vulnerability of postoperative cancer patients, we also assessed anxiety, depression, quality of life, and patient satisfaction to understand how these interventions might influence psychosocial recovery, which is a core dimension of psycho oncology.

2. Materials and methods

2.1. Baseline demographic and clinical characteristics

A total of 115 patients with pancreatic cancer who underwent surgical treatment between March 2021 and March 2023 were included after meeting the predefined eligibility criteria. All participants provided informed consent. Baseline demographic and clinical variables, including gender, age, duration of disease, tumor stage, and pathological type, were comparable between the two groups, with no statistically significant differences observed ($p > 0.05$). This baseline equivalence indicates that both groups began from similar clinical starting points, ensuring that postoperative differences in physiological and psychosocial outcomes could be validly attributed to the respective interventions rather than preexisting patient characteristics.

2.2. Sample size

Sample size estimation was conducted using G*Power software. With a desired statistical power of 80% and a two-sided significance level of 0.05, the required minimum number of participants was calculated to ensure adequate ability to detect group differences. A total of 115 patients meeting the inclusion criteria were enrolled in the study, which satisfied the required sample size and provided sufficient power for comparison of postoperative clinical and psychosocial outcomes.

2.3. Perioperative nursing interventions

The control group (CG) received routine perioperative nursing for pancreatic cancer. Before surgery, patients were instructed to avoid alcohol and fast for more than 8 h. Routine skin preparation and disinfection were performed, and disease related information and perioperative precautions were explained to patients and family members. Emotional reassurance was provided, and assistance with preoperative examinations was offered. During surgery, vital signs, consciousness, and pupil responses were continuously monitored to prevent unexpected events. After surgery, patients received conventional analgesia and anti-infection treatment, and were guided through gradual dietary advancement from water intake to liquid, semi-liquid and regular food according to recovery. Rehabilitation training was provided based on the patient condition.

The observation group (OG) received nursing care based on the rapid rehabilitation nursing path. Preoperative nursing involved active communication to build trust, provision of disease and treatment related information, clarification of complication risks, surgical cooperation requirements, and perioperative precautions. Nursing staff offered psychological support, identified abnormal emotions in a timely manner and guided patients to reduce fear and anxiety. Patients were instructed on skin protection, avoidance of injury and restriction of food and water intake 12 h before surgery. During surgery, vital signs and body temperature were closely monitored and any abnormalities were promptly reported. Postoperatively, patients received timely anti-inflammatory treatment, monitoring of vital signs and incision status, and regular assessment of drainage output. Nursing staff maintained continuous communication, redirected negative emotions, and supported patients in pain relief. Diet was

adjusted according to gastrointestinal recovery, and patients were encouraged to get out of bed within 24 h, with rehabilitation activities added gradually to promote safe and progressive mobility.

2.4. Perioperative nutritional support approach

The CG received delayed enteral nutrition intervention, and the time of nutrition intervention was 48 h after admission. The OG received early enteral nutrition intervention within 24 h after admission.

The specific intervention methods of enteral nutrition intervention are as follows: First, the jejunal nutrition tube was inserted into the patient through the nose, and the position of the tube was temporarily fixed. After X-ray was applied to determine the status of the tube and the indentation site, it could be effectively fixed. Within 2 h, 500 mL of normal saline at 37 °C was injected to gradually adapt the patient's intestine, and peptide and amino acid nutritional products (product name: Peptison, Nutricia Pharmaceutical (Wuxi) Co., LTD.) were injected at 28 kcal kg⁻¹ and the heat and nitrogen ratio of 120:1–150:1. On the first day, the rate was 25 mL h⁻¹, and then it was adjusted to 100–120 mL h⁻¹ according to the patient's tolerance degree. 5 days later, according to the patient's metabolism, nutritional requirements, infusion response, etc., enteral nutrient suspension (TPF, Nutricia Pharmaceutical (Wuxi) Co., LTD.) were given, and the enteral nutrition type and speed were appropriately adjusted. After the patient's condition improved, the enteral nutrition could be stopped and the diet gradually opened.

2.5. Clinical and psychosocial assessment indicators

Postoperative outcomes were evaluated using a comprehensive set of clinical and psychosocial indicators. Operative recovery was assessed by recording the first flatus time, the time of getting out of bed and the length of hospital stay in both groups. The incidence of postoperative complications was also documented, including anastomotic fistula, incision infection, abdominal infection, and gastrointestinal hemorrhage. Immune function was evaluated by collecting three milliliters of venous blood from patients in both groups before surgery and 10 days after surgery, followed by the measurement of serum immunoglobulin G (IgG), immunoglobulin A (IgA), and immunoglobulin M (IgM) using immunoturbidimetry.

Nutritional status was examined by obtaining 3 mL of peripheral venous blood before surgery and 10 days after surgery, with total protein (TP), albumin (ALB), and prealbumin (PA) measured using a Hitachi 7800 automatic biochemical analyzer. Inflammatory responses were assessed by collecting 3 mL of peripheral venous blood before and after treatment, centrifuging the samples at 3000 revolutions per minute for 10 min, and determining the levels of interleukin 6 (IL-6), tumor necrosis factor α (TNF- α), and C reactive protein (CRP) through enzyme linked immunosorbent assay.

Quality of life was evaluated before nursing and at discharge using the European Organization for Research and Treatment of Cancer Quality of Life Core Questionnaire (EORTC QLQ C30), [28] which assesses cognitive, physical, social, role, and emotional functioning. The total score is 100 points, with higher scores indicating

better quality of life. Psychological status was assessed using the Hamilton Depression Scale (HAMD) and Hamilton Anxiety Scale (HAMA) before nursing and at discharge [29]. The HAMD total score is 54 points, where greater than 14 points indicates anxiety, 7–14 points suggests possible anxiety and less than 7 points indicates no anxiety. The HAMA total score is 56 points, with greater than 17 points indicating depression, 7–17 points indicating possible depression and less than 7 points indicating no depression. Higher scores on both scales represent more severe anxiety or depression.

Patient satisfaction was evaluated using a self-developed hospital questionnaire with a total score of 100 points. Scores of 90 points or above were classified as very satisfied, scores between seventy and 89 points were classified as satisfied and scores below 70 points were classified as dissatisfied. The total satisfaction rate was calculated as the proportion of patients who reported being very satisfied or satisfied in each group.

2.6. Statistical processing

All statistical analyses were performed using SPSS version 20.0. Categorical data were expressed as frequencies and percentages, and comparisons between groups were conducted using the chi square test or Fisher exact test where appropriate. Continuous data were presented as mean plus or minus standard deviation, and independent sample *t*-tests were used to compare differences between groups. A significance level of *P* less than 0.05 was considered statistically significant for all analyses.

3. Results

3.1. Baseline characteristics of the study population

As shown in **Table 1**, there were no statistically significant differences between the control group and the observation group in demographic characteristics, duration of disease, tumor stage, or pathological types (*p* > 0.05). This baseline comparability

Table 1. Baseline patient characteristics [*n* (%)]/(*x* ± *s*).

Items	Control group (<i>n</i> = 57)	Observation group (<i>n</i> = 58)	χ^2/t	<i>p</i>
Gender			0.00	0.94
Male	37(64.91)	38(65.52)		
Female	20(35.09)	20(34.48)		
Age (years)	55.78 ± 6.56	55.72 ± 6.53	0.04	0.96
Couse of disease (years)	1.35 ± 0.35	1.32 ± 0.31	0.48	0.62
Tumor stage			0.01	0.91
Stage I	24(42.11)	25(43.10)		
Stage II	33(57.89)	33(56.90)		
Types of pancreatic cancer			0.10	0.74
Ductal adenocarcinoma	50(87.72)	52(89.66)		
Acinic cell carcinoma	7(12.28)	6(10.34)		

Note: χ^2 test or *t*-test was adopted for comparison, error bars represent standard error.

indicates that both groups began from a similar clinical starting point, ensuring that any subsequent differences observed in postoperative psychological status, quality of life, nutritional and immune function, or satisfaction outcomes can be attributed to the interventions rather than preexisting imbalances.

3.2. Early postoperative recovery indicators

Early postoperative recovery was compared between the two study groups to evaluate the impact of the nursing interventions on immediate surgical recovery. As shown in **Figure 1**, the observation group demonstrated significantly faster physiological recovery following surgery. Specifically, the first flatus time, time of getting out of bed and total length of hospital stay were all shorter in the observation group compared with the control group ($p < 0.01$). These findings indicate that the rapid rehabilitation nursing path combined with early enteral nutrition was effective in accelerating key aspects of postoperative recovery. Faster mobilization and earlier return of gastrointestinal function are clinically meaningful improvements and may also contribute to reduced psychological stress, greater confidence in recovery, and enhanced overall postoperative experience for patients undergoing pancreatic cancer surgery.

3.3. Incidence of postoperative complications

As summarized in **Table 2**, the observation group experienced fewer postoperative complications compared with the control group. In the control group, com-

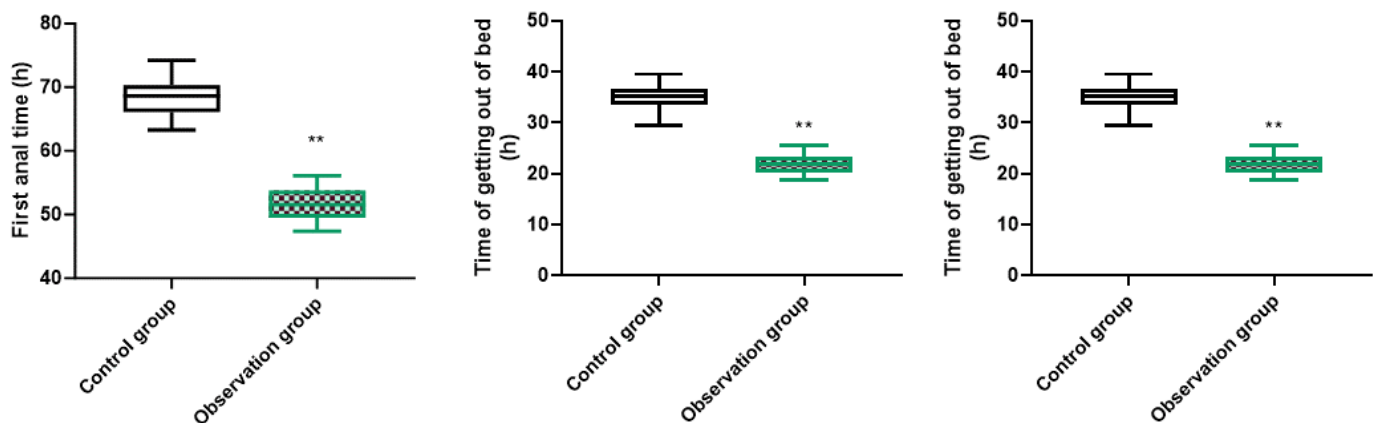


Figure 1. Comparison of early postoperative recovery indicators in the two groups. The observation group showed significantly shorter first flatus time, earlier mobilization, and reduced length of hospital stay compared with the control group ($p < 0.01$). Note: t -test was adopted for comparison, error bars represent standard error.

Table 2. Incidence of postoperative complications [n (%)].

Groups	Cases	Anastomotic fistula	Incision infection	Abdominal infection	Gastrointestinal hemorrhage	Total incidence rate
Control group	57	2(3.51)	3(5.26)	2(3.51)	2(3.51)	9(15.79)
Observation group	58	1(1.72)	0(0.00)	1(1.72)	0(0.00)	2(3.44)
Fisher's exact test						
P						0.029

Note: χ^2 test was adopted for comparison.

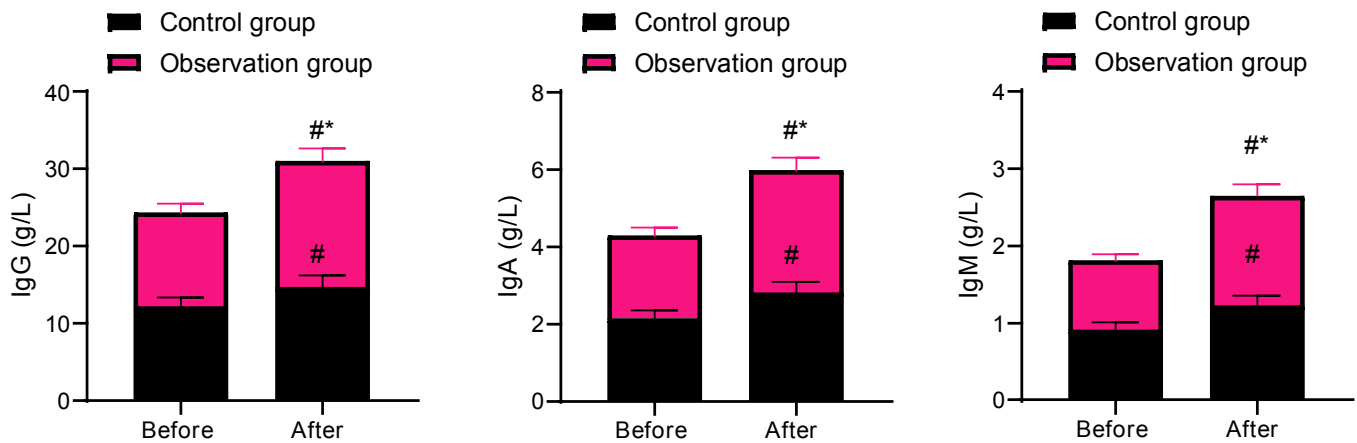


Figure 2. Immune function indicators before and after intervention. Postoperative levels of IgG, IgA, and IgM increased in both groups, with the observation group showing significantly higher levels compared with the control group ($p < 0.05$). Note: t -test was adopted for comparison, error bars represent standard error.

plications included anastomotic fistula ($n = 2$), incision infection ($n = 3$), abdominal infection ($n = 2$), and gastrointestinal hemorrhage ($n = 2$), resulting in a total incidence rate of 15.79%. In contrast, the observation group presented only one case of anastomotic fistula and one case of abdominal infection, corresponding to a markedly lower incidence rate of 3.44% ($p < 0.05$).

3.4. Immune function indicators

Before the intervention, there were no significant differences in IgG, IgA, or IgM levels between the groups ($p > 0.05$). As illustrated in **Figure 2**, all three immunoglobulin levels increased after surgery in both groups; however, the improvement was more pronounced in the observation group. Postoperative IgG, IgA, and IgM levels were significantly higher in the observation group compared with the control group ($p < 0.05$), indicating enhanced immune recovery following rapid rehabilitation nursing and early enteral nutrition.

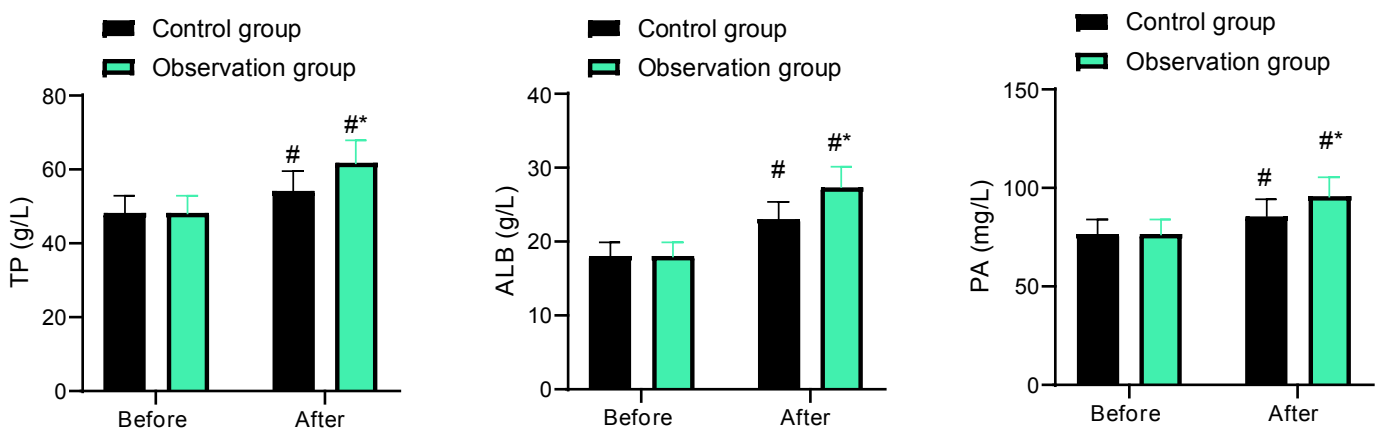


Figure 3. Nutritional status indicators before and after intervention. Postoperative TP, ALB, and PA levels increased in both groups, with significantly greater improvements observed in the observation group ($p < 0.05$). Note: t -test was adopted for comparison, error bars represent standard error.

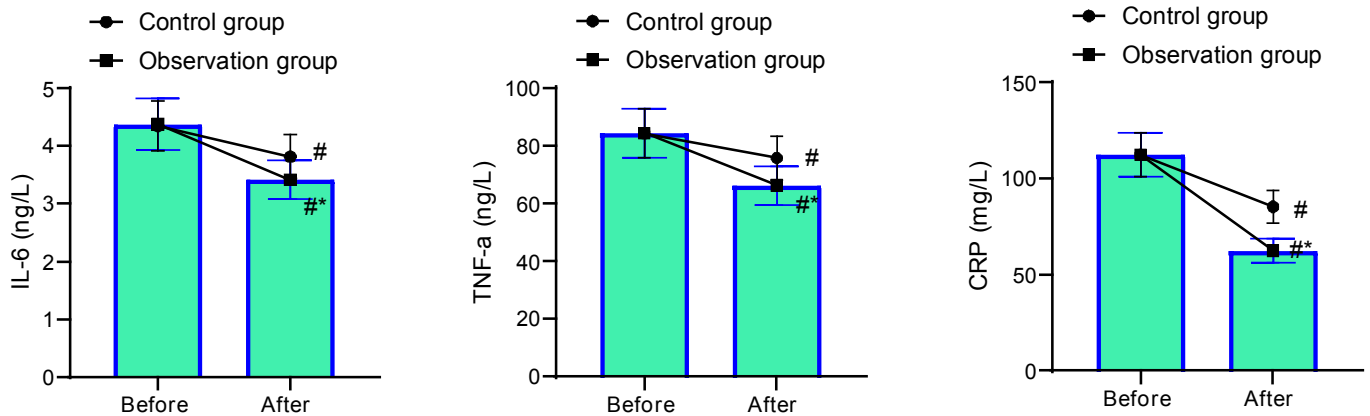


Figure 4. Inflammatory response indicators before and after intervention. Postoperative IL-6, TNF-a, and CRP levels decreased in both groups, with significantly lower levels observed in the observation group ($p < 0.05$). Note: t -test was adopted for comparison, error bars represent standard error.

3.5. Nutritional status indicators

Before the intervention, there were no significant differences in total protein (TP), albumin (ALB), or prealbumin (PA) levels between the groups ($p > 0.05$). As presented in **Figure 3**, postoperative assessments showed that all three nutritional markers increased in both groups; however, the observation group demonstrated significantly greater improvements in TP, ALB, and PA levels compared with the control group ($p < 0.05$).

3.6. Inflammatory response indicators

Before the intervention, there were no significant differences between the groups in IL-6, TNF-a, or CRP levels ($p > 0.05$). As shown in **Figure 4**, all three inflammatory markers declined after surgery in both groups. However, the observation group exhibited significantly lower postoperative IL-6, TNF-a, and CRP levels compared with the control group ($p < 0.05$).

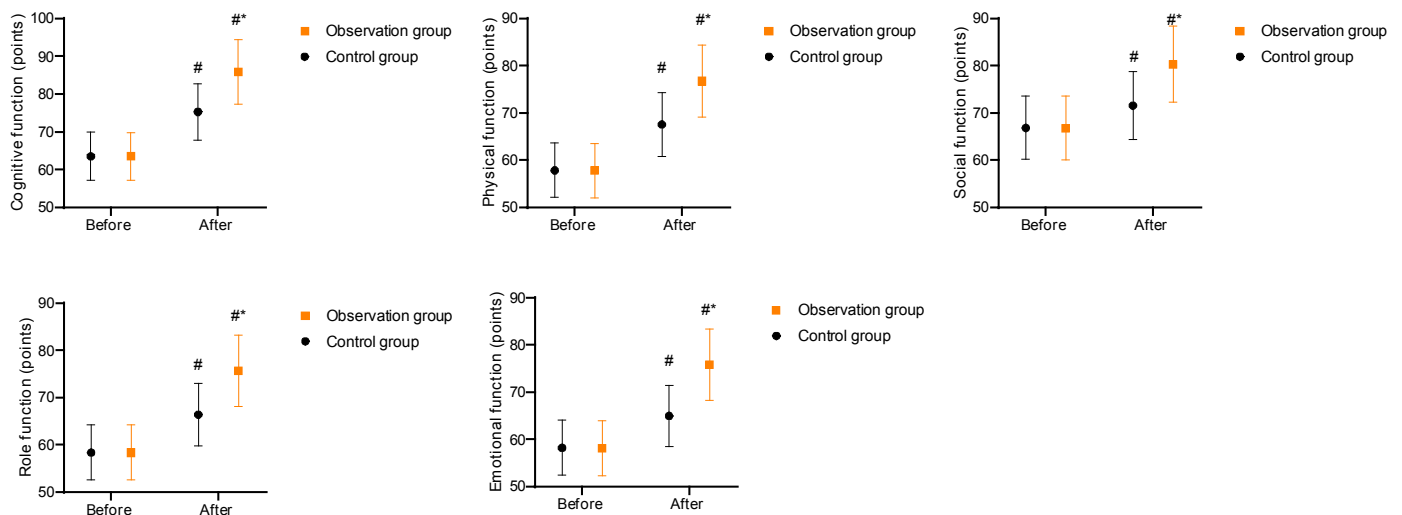


Figure 5. Quality of life outcomes based on EORTC QLQ C30. Postoperative quality of life scores improved in both groups, with significantly greater increases observed in the observation group ($p < 0.05$). Note: t -test was adopted for comparison, error bars represent standard error.

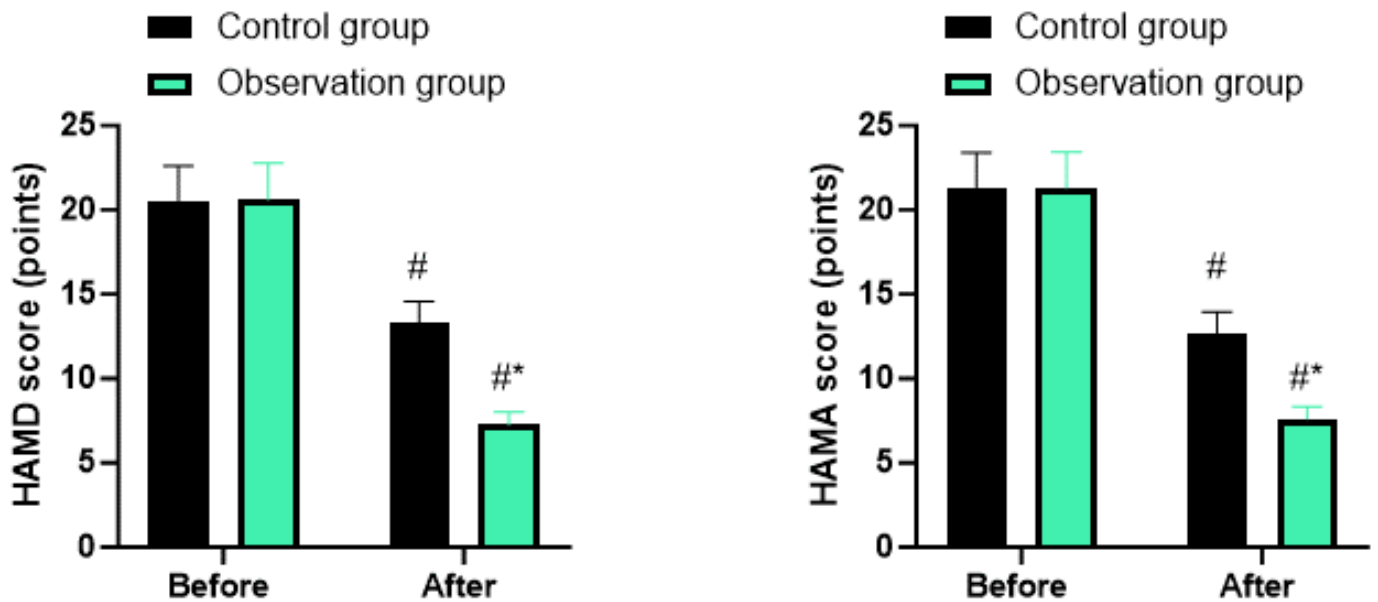


Figure 6. Psychological status before and after intervention. Postoperative HAMA and HAMD scores decreased in both groups, with significantly lower scores observed in the observation group ($p < 0.05$). Note: t -test was adopted for comparison, error bars represent standard error.

3.7. Quality of life outcomes

Before the intervention, there were no significant differences in EORTC QLQ C30 scores between the two groups ($p > 0.05$). As displayed in **Figure 5**, postoperative quality of life scores increased in both groups; however, the observation group showed significantly greater improvements in cognitive, physical, social, role, and emotional functioning compared with the control group ($p < 0.05$).

3.8. Psychological status

Before the intervention, HAMA and HAMD scores showed no significant differences between the groups ($p > 0.05$). As illustrated in **Figure 6**, postoperative assessments revealed that both anxiety and depression levels declined in the two groups. However, the observation group demonstrated significantly lower postoperative HAMA and HAMD scores compared with the control group ($p < 0.05$).

3.9. Patient satisfaction

Patient satisfaction with postoperative care was evaluated to assess the overall patient experience associated with the different nursing approaches. As presented in **Table 3**, the control group reported 27 cases of being very satisfied, 20 satisfied,

Table 3. Patient satisfaction with postoperative care [n (%)].

Groups	<i>n</i>	Very satisfied	Satisfied	Dissatisfied	Total satisfaction rate
Control group	57	27(47.37)	20(35.09)	10(17.54)	47(82.46)
Observation group	58	30(51.72)	26(44.83)	2(3.45)	56(96.55)
χ^2					6.112
<i>P</i>					0.013

Note: χ^2 test was adopted for comparison.

and 10 dissatisfied, resulting in a total satisfaction rate of 82.46%. In contrast, the observation group reported 30 cases of being very satisfied, 26 satisfied and only 2 dissatisfied, yielding a significantly higher satisfaction rate of 96.55% ($p < 0.05$).

4. Discussion

In recent years, the incidence of pancreatic cancer has been increasing year by year and has gradually developed into a type of malignant tumor that affects human health [30]. There are many factors related to pancreatic cancer, such as heavy drinking, smoking, abuse of nonsteroid anti-inflammatory drugs, and other chronic diseases, which can lead to the incidence of pancreatic cancer [31]. At present, surgery is still the main means for patients with pancreatic cancer to obtain long-term survival [32]. According to relevant reports, more than 80% of patients with pancreatic cancer cannot be surgically treated due to reasons such as the long course and duration of pancreatic cancer patients [33]. Therefore, for patients with operable pancreatic cancer, preoperative examination, diagnosis, and perioperative effective nursing intervention are crucial to improve the prognosis of patients [14].

Beyond the physical burden, the perioperative period in pancreatic cancer is widely recognized as a psychologically vulnerable phase. Patients commonly experience substantial anxiety, fear of postoperative complications and emotional distress related to major abdominal surgery. Recent studies have shown that individuals scheduled for pancreatic cancer surgery exhibit high levels of preoperative anxiety and surgery-related fear, [34] while postoperative distress remains prevalent and is closely linked to poorer quality of life outcomes [35]. These psychological responses can affect postoperative recovery, treatment adherence, and overall well-being. Therefore, perioperative nursing interventions that integrate both physical and emotional support align closely with the goals of psycho oncology.

Rapid rehabilitation nursing path is a series of optimal nursing measures implemented in the perioperative period proposed by Danish scholars on the basis of evidence based medical evidence [36]. In our study, the rapid rehabilitation nursing path formulated scientific, comprehensive, and safe evidence-based programs in time for different constitutions of patients before surgery and made timely adjustments according to different conditions of patients in actual nursing, so as to meet patients psychological and physiological needs as far as possible and implement comprehensive nursing, so as to improve patients' satisfaction and safety [37]. By informing patients of the surgical method, treatment process and precautions, the communication between nursing staff and patients was increased, and patients also took the initiative to participate in the treatment, which mobilized the subjective initiative of patients and alleviated the relationship between nurses and patients [38]. By taking postoperative analgesic measures and encouraging patients to get out of bed early, it could not only reduce the postoperative stress of patients, but also reduce intestinal paralysis and contribute to the recovery of physical strength and gastrointestinal tract [39]. By encouraging patients to get out of bed early after surgery, it could effectively prevent lower extremity deep vein thrombosis and lung swelling, restore intestinal peristalsis, enhance patients' resistance, avoid lung infection, improve blood circula-

tion, make the incision heal as soon as possible, and fully mobilise patients' subjective initiative [40].

In the context of psycho oncology, many of these nursing measures also play an important role in relieving psychological stress. Early mobilization, structured communication, emotional reassurance, and continuous support have been shown to reduce anxiety and depressive symptoms in postoperative cancer patients. Evidence from recent studies demonstrates that components of rapid rehabilitation nursing can markedly decrease negative psychological emotions following cancer surgery, [41] and perioperative nursing care with psychological focus can further improve postoperative mood and overall well-being [42]. This is consistent with our findings, in which rapid rehabilitation nursing was associated with lower HAMA and HAMD scores.

Studies show that over 80% of pancreatic cancer patients experience significant weight loss at the time of diagnosis and gradually develop into systemic failure [43]. There are three reasons for malnutrition in pancreatic cancer: (1) the growth of the tumor will consume the nutrients of the human body [44]; (2) malnutrition caused by factors such as loss of appetite and negative emotions [45]; (3) the side effects and irritations on patients during cancer treatment have led to malnutrition [46]. After pancreatic cancer surgery, pancreatic function is low and the ability to eat decreases. Patients are highly prone to abnormal protein energy metabolism [47]. Therefore, nutritional intervention for such patients is mainly to prevent further damage to the pancreas, alleviate steatorrhea, and correct malnutrition [48]. Surgical injuries can cause stress in the body and abnormal secretion and metabolism of hormones in the body, which has a significant impact on both the overall and local aspects of the body [49]. Meanwhile, surgical trauma is closely related to the body catabolism, immunosuppression, and poor wound healing [50]. As the tumor grows, the nutrients it requires, such as fat emulsion, glucose, and amino acids will also increase accordingly [51]. Meanwhile, during the treatment process, negative emotions, such as fear and anxiety as well as changes in dietary habits can stimulate organs like the stomach and intestines and affect normal digestion and absorption functions. This can lead to a series of symptoms such as nausea, vomiting, and loss of appetite, resulting in nutrient loss or insufficient supply and further aggravating malnutrition [52]. At present, nutritional support is one of the crucial treatment methods for pancreatic cancer, among which enteral nutrition is one of the effective treatment methods that can meet the needs of high catabolic metabolism, regulate intestinal flora, and help enhance immunity [53].

As for the timing of enteral nutrition in pancreatic cancer patients, there is still no conclusion. The traditional view is that early enteral nutrition is easy to increase the burden of the gastrointestinal tract of patients, especially the burden of the pancreas, which will affect the repair of the pancreas [54]. Therefore, clinically, delay is generally adopted to ensure the safety of treatment [55]. In recent years, relevant studies have revealed that early enteral nutrition in pancreatic cancer patients can effectively enhance the therapeutic effect of patients, help lessen the complications of patients, and promote the outcome of the disease, suggesting that early implementation of enteral nutrition is feasible [56]. The advantages of early enteral nutrition are mainly reflected in the following aspects: (1) early enteral nutrition can provide

the body with a variety of nutrients needed such as protein, fat, and carbohydrates to meet the high metabolic state after surgery [57]; (2) early enteral nutrition helps maintain the integrity of the intestinal mucosa, reduces the translocation of intestinal bacteria, and lowers the risk of infection [58]; (3) early enteral nutrition can promote intestinal peristalsis, accelerate the recovery of intestinal function, and shorten the length of hospital stay [59].

In our study, the results indicated that in comparison with the control group, the first flatus time, time of getting out of bed, and length of hospital stay in the observation group were shorter. At the same time, the control group had 2 cases of anastomotic fistula, 3 cases of incision infection, 2 cases of abdominal infection, and 2 cases of gastrointestinal bleeding, while the observation group had only 1 case of anastomotic fistula and 1 case of abdominal infection. The total incidence rate was 15.78% in the control group compared with 3.44% in the observation group. These results suggested that rapid rehabilitation nursing path plus early enteral nutrition could promote postoperative recovery and decrease the incidence of complications in pancreatic cancer patients after surgery. Consistently, Xu et al have indicated that rapid rehabilitation nursing reduces complications and relieves pain in postoperative patients with colorectal cancer [60].

Another finding of our study was that after intervention, IgG, IgA, and IgM levels were elevated in both groups, and those in the observation group were superior to the control group. Meanwhile, TP, ALB, and PA levels were elevated in both groups after intervention, and those in the observation group were superior to the control group. These results suggested that rapid rehabilitation nursing path combined with early enteral nutrition could promote the nutritional status and immune function in pancreatic cancer patients after surgery. This might be because early enteral nutrition support can promote the absorption of nutrients, enhance physical condition, improve postoperative immunity, and protect intestinal mucosa. Similarly, Wang et al. have indicated that early enteral nutrition can improve the disorder of intestinal flora as well as the nutritional status of patients with traumatic intracerebral hemorrhage [61].

IL-6 is an interleukin index that mediates and participates in the body inflammatory response [62]. TNF- α belongs to a proinflammatory cytokine mainly produced by macrophages and monocytes [63]. CRP is an acute phase protein that participates in and promotes inflammation [64]. IL-6, TNF- α , and CRP play important roles in the inflammation process of pancreatic cancer [65]. The results of our study indicated that after intervention, IL-6, TNF- α , and CRP levels were declined in both groups, and those in the observation group were inferior to the control group, suggesting that rapid rehabilitation nursing path combined with early enteral nutrition could inhibit the inflammatory response in patients with pancreatic cancer after surgery, which was in accordance with previous reports [66].

In addition, our study indicated that after intervention, EORTC QLQ C30 scores increased in both groups, and those in the observation group were superior to the control group. Meanwhile, after intervention, HAMA and HAMD scores declined in both groups and were lower in the observation group. The total satisfaction rate was 82.45% in the control group and 96.55% in the observation group. These findings suggest that rapid rehabilitation nursing path combined with early enteral nutrition

could relieve negative emotions, enhance emotional comfort, and promote quality of life and patient satisfaction in pancreatic cancer patients after surgery. This is similar to previous studies reporting beneficial psychological and quality of life effects of early activity guidance, nursing interventions and nutritional support in cancer treatment [67,68].

This study was limited to a single center and therefore the generalizability of findings may be affected. Second, the sample size of our study was small, and the effects of rapid rehabilitation nursing path combined with early enteral nutrition should further be confirmed in larger populations of pancreatic cancer patients after surgery. Furthermore, we did not conduct follow up in this study. Therefore, the observation time of the study needs to be extended in future.

5. Conclusion

Our study reveals that the rapid rehabilitation nursing path combined with early enteral nutrition can significantly improve postoperative outcomes in patients with pancreatic cancer. In addition to enhancing nutritional status, immune function, and physical recovery, this integrated approach also alleviates anxiety and depression, improves emotional well-being, and promotes better quality of life. The improvements in psychological status and patient satisfaction observed in the observation group suggest that this nursing model has meaningful value not only for physiological healing but also for psychosocial recovery.

As psychological distress is common among postoperative cancer patients, nursing measures that strengthen communication, emotional reassurance, and early engagement may offer important benefits consistent with the principles of psycho oncology. Notably, the rapid rehabilitation nursing path combined with early enteral nutrition may serve as an efficient and patient centered strategy with significant clinical and psychosocial implications for postoperative pancreatic cancer care. Future studies with larger sample sizes and extended follow up are needed to further validate these findings.

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