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A Study of the Effect of Personalized ERAS Protocol on Perioperative Rehabilitation and Quality of Life in Elderly Patients with Small and Medium-Sized Abdominal Wall Incisional Hernias

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Abstract

The aim of this study is to evaluate the perioperative effectiveness of a personalized Enhanced Recovery After Surgery (ERAS) program in elderly patients with small and medium-sized abdominal wall incisional hernias. A total of 120 elderly patients were randomized into a personalized ERAS group and a traditional treatment group. Key perioperative indicators, recovery process, complication rates, and quality of life were compared between the groups. Results showed that the personalized ERAS group experienced shorter times to first postoperative defecation, bowel movement, and ambulation, as well as significantly reduced hospital stays, lower complication rates, higher quality of life scores at 1 and 3 months postoperatively, and lower pain scores at all stages. These findings indicate that personalized ERAS protocols significantly enhance rehabilitation, reduce complications, and improve quality of life for this patient population.

Keywords: Abdominal wall incisional hernia; Elderly; Enhanced recovery after surgery; Perioperative period; Quality of life.

Introduction

Background of the study

Incisional hernia of the abdominal wall is a frequent long-term complication of abdominal surgery and is particularly prevalent in the elderly. The risk of incisional hernia is significantly higher in elderly patients due to atrophy of abdominal wall muscles, degeneration of connective tissues, and the presence of chronic diseases such as cardiovascular disease and diabetes mellitus. Small and medium-sized abdominal wall incisional hernias, despite the relatively small size of the hernia ring, have a significant impact on the quality of life of the patient and carry the potential risk of hernia incarceration.

Although traditional surgical treatment can repair hernia defects, however, elderly patients face many difficulties in postoperative recovery, such as long recovery time and frequent complications. The introduction of the concept of Rapid Recovery Surgery (ERAS) has opened up new ideas for optimizing the perioperative management of surgical patients. However, elderly patients have unique physiological and pathological characteristics that make it difficult for generic ERAS protocols to fit their individualized needs. Therefore, the development and implementation of individualized ERAS protocols is of great significance in improving the outcomes of elderly patients with small and medium-sized abdominal wall incisional hernias.

Purpose of the study

The aim of this study is to evaluate the perioperative application of personalized ERAS in elderly patients with small and medium-sized abdominal wall incisional hernia, and to analyze its effects on the recovery process, complication rate and quality of life of patients by comparing with the traditional treatment modes, so as to provide scientific basis for the clinical promotion of the personalized ERAS program.

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Rationale and design of a personalized ERAS programme

Overview of the ERAS concept: In 2001, Kehlet, a Danish surgeon, proposed the concept of ERAS for the first time. The core of the concept is to optimize and integrate a series of perioperative measures through multidisciplinary cooperation, so as to reduce the physiological and psychological stress of patients, reduce the incidence of complications, shorten the length of hospital stay, and promote the rapid recovery of patients. The ERAS concept runs through the preoperative, intraoperative and postoperative stages, covering optimization of the patient's physical state before surgery, fine operation and precise anesthesia management during surgery, active pain control after surgery, and early rehabilitation activities, etc. The ERAS concept has been used in many countries in recent years. In recent years, the ERAS concept has been widely applied in many surgical fields with remarkable results, gradually changing the traditional perioperative management model [1].

Characterization of elderly patients with small and medium-sized abdominal wall incisional hernias

Physiological decline:

Cardiovascular system: With ageing, elderly patients experience degenerative changes in cardiac structure and function, cardiomyocyte atrophy and fibrosis, poor cardiac compliance, reduced cardiac output, and reduced cardiac reserve capacity. This results in the weakening of the cardiovascular system's ability to regulate the cardiovascular system in the face of the stress of surgery and anesthesia, and increases the incidence of cardiovascular complications such as cardiac arrhythmia and heart failure in elderly patients [2].

Respiratory system: The elasticity of the thorax is reduced, the strength of respiratory muscles is weakened, and the elasticity and retraction of lung tissues are reduced, resulting in the reduction of lung ventilation and air exchange function. At the same time, the defense function of the respiratory mucosa decreases, and the cilia movement ability becomes weaker, which increases the risk of postoperative lung infection, pulmonary atelectasis and other respiratory complications [3].

Digestive system: Gastrointestinal peristalsis is slowed down, secretion of digestive juices is reduced, and activity of digestive enzymes is lowered, which affects digestion and absorption of food. Postoperative recovery of gastrointestinal function is delayed, prone to bloating, constipation and other problems, further hindering the patient's nutritional intake and recovery process [4].

Immune system: The immune system function declines, the activity and number of immune cells decrease, the body's immune response ability decreases. Postoperative patients have decreased resistance, slow wound healing, and increased risk of infection [5].

Underlying diseases are many

Hypertension: The prevalence of hypertension is high in elderly patients with incisional hernia of the abdominal wall. High blood pressure increases the burden on the heart and causes the walls of blood vessels to thicken, harden and become less elastic. Blood pressure fluctuations during surgery may cause cardiovascular and cerebrovascular accidents, and poor postoperative blood pressure control may also affect wound healing and recovery [2].

Diabetes mellitus: Diabetes mellitus patients are in a state of high blood sugar for a long time, which leads to vascular and neuropathy and affects wound healing. Postoperative patients' resistance decreases, and the hyperglycemic environment is conducive to bacterial growth and reproduction, which increases the risk of infections, such as incision infections, urinary tract infections, etc. [6].

Coronary heart disease: Some elderly patients have combined coronary heart disease, and coronary atherosclerosis leads to insufficient blood supply to the myocardium. The stress of surgery and anesthesia may induce angina pectoris, myocardial infarction and other acute cardiovascular events, seriously endangering the lives of patients [2].

Special psychological state: Elderly patients are often fearful and anxious about surgery, worrying about the effect of surgery, postoperative pain and recovery. This adverse psychological state not only affects the patient's sleep and appetite, but also leads to an increase in the body's stress response, hindering the smooth progress of surgery and postoperative recovery. In addition, elderly patients have a relatively low level of acceptance of new treatment concepts and methods, which requires more communication and explanation from healthcare professionals [7].

Rationale for the development of an individualized ERAS program

The formulation of personalized ERAS program is based on the characteristics of elderly patients with small and medium-sized abdominal wall incisional hernia, with comprehensive reference to relevant domestic and international ERAS guidelines and a large number of clinical research results. In the process of formulation, the individual differences of the patients were fully considered, including physical condition, control of underlying diseases, psychological state, etc. The program was developed based on the characteristics of elderly patients with small and medium-sized abdominal wall incisional hernia.

For patients who are physically weak and malnourished, preoperative nutritional support is strengthened; for patients with underlying diseases such as hypertension and diabetes mellitus, preoperative, intraoperative and postoperative treatment programs are adjusted according to their conditions to ensure that the underlying diseases are effectively controlled; and for patients with a heavy psychological burden, targeted psychological interventions are formulated. At the same time, we refer to the latest research progress and continue to optimize the content of the program in order to improve the scientificity, effectiveness and safety of the program.

Individualized ERAS program specifics

Preoperative preparation:

Nutritional support: After the patients were admitted to the hospital, the Mini Nutritional Assessment (MNA) was used to conduct a comprehensive nutritional assessment of the elderly patients. For malnourished patients with MNA score less than 17, individualized nutritional support plan was formulated according to their gastrointestinal function. If the gastrointestinal function is normal, oral short peptide enteral nutrition preparation is given at 25-30 kcal/(kg/d) per day with 3-5 oral doses. For patients who cannot eat by mouth or whose oral supplementation is insufficient, nasal enteral nutrition is used to ensure adequate intake of nutrients. The duration of preoperative nu-

tritional support is 7-14 days, in order to improve the patients' serum protein level, hemoglobin content and other nutritional indicators, to enhance the body's reserve capacity, and to promote postoperative recovery [8].

Management of underlying diseases: For patients with hypertension, antihypertensive drugs should be taken continuously before surgery to keep the blood pressure below 140/90 mmHg. For patients whose blood pressure fluctuates greatly or is difficult to control, the cardiologists will work together to adjust the antihypertensive regimen and use intravenous antihypertensive drugs if necessary to ensure stable blood pressure. For patients with diabetes mellitus, adjust the dosage of hypoglycemic drugs or insulin according to the results of blood glucose monitoring. Before surgery, fasting blood glucose should be controlled at about 7.0 mmol/L, and 2-hour postprandial blood glucose should be controlled at about 10.0 mmol/L. For patients with poor effect of oral hypoglycemic drugs, insulin subcutaneous injection was used to control blood glucose. For patients with combined coronary artery disease, cardiac function should be evaluated, and the use of antiplatelet, anticoagulation and vasodilator drugs should be adjusted according to the condition of the patients to ensure adequate blood supply to the myocardium during the operation [2].

Psychological intervention: The nurse in charge communicates fully with the patient and his family after the patient is admitted to the hospital to understand the patient's psychological state and concerns. Introduce the process, safety and postoperative recovery of abdominal wall incisional hernia surgery to the patient in detail, and enhance the patient's confidence by sharing successful cases. At the same time, encourage patients to express their inner feelings, patiently listen to patients' demands, and provide psychological support and comfort. For patients with heavy psychological burden and obvious anxiety, psychologists were invited to conduct professional psychological counseling, and cognitive behavioral therapy and relaxation training were used to help patients alleviate their anxiety and fear [7].

Intraoperative management:

Optimization of anesthesia: General anesthesia combined with epidural anesthesia is used. General anesthesia ensures that the patient's consciousness disappears and is painless during the operation, while epidural anesthesia provides good postoperative analgesia, and at the same time reduces the amount of general anesthesia drugs and the inhibitory effect on the cardiovascular system. During the induction and maintenance of anesthesia, the dosage and concentration of anesthetics are precisely adjusted according to the patient's age, weight, physical condition, and surgical needs, and the appropriate depth of anesthesia is maintained. By monitoring the electroencephalogram Bifrequency Index (BIS), heart rate, blood pressure and other indicators, we can ensure that the vital signs of the patients are stable, and avoid the adverse consequences caused by too deep or too shallow anesthesia [9].

Body temperature protection: Intraoperative hypothermia is one of the most important factors leading to increased postoperative complications in patients. In order to maintain the patient's normal body temperature, a variety of temperature protection measures have been taken. Inflatable heating blankets are laid on the operating beds at a set temperature of 38 - 40°C, which are used from the time the patient enters the operating room until the end of the operation. To warm the imported fluids and blood products, use the infusion warmer to heat the temperature of fluids to about 37℃ before importing them into the patient's body. At the same time, the operating room temperature is adjusted to 24-26℃, and the humidity is maintained at 50%-60% to minimize heat loss from the patient's body surface [10].

Minimally invasive surgery: Laparoscopic abdominal wall incision hernia repair is preferred. Compared with traditional open surgery, laparoscopic surgery is less traumatic, smaller incision, less postoperative pain and faster recovery. During the operation, laparoscopic instruments are inserted through several small incisions in the abdominal wall. With the magnifying effect of the laparoscope, the location, size and surrounding tissues of the hernia can be clearly observed, and precise hernia repair can be carried out. For some complex abdominal wall incisional hernia, such as the hernia ring around the tissue adhesion is serious, the hybrid technique of laparoscopy combined with open surgery is used to give full play to the advantages of the two surgical methods, to ensure that the operation is safe and effective [11].

Postoperative care

Multi-modal pain management: A multi-modal analgesic approach is used to reduce patients' postoperative pain . At the end of surgery, local anesthetic infiltration injection around the surgical incision, commonly used drug is ropivacaine, which can effectively relieve early postoperative pain. Postoperative use of non-steroidal anti-inflammatory drugs, such as flurbiprofen ester injection, at a dose of 5 mg/kg, every 8 hours intravenous drip, continued to use for 3 days. For patients with severe pain, opioid analgesics, such as oxycodone hydrochloride extended-release tablets, were used in combination, and the dose was adjusted according to the patient's pain level. At the same time, non-pharmacological analgesic methods, such as music therapy, relaxation training, etc., were used to help patients distract their attention and reduce the pain sensation. The pain level of patients was assessed every 4 hours by pain assessment scales, such as Visual Analog Scale (VAS), and the analgesic program was adjusted according to the assessment results [12].

Early activity: Early postoperative activity is of great significance in promoting the recovery of gastrointestinal function, preventing pulmonary infection, deep vein thrombosis and other complications. Six hours after the operation, when the patient's vital signs are stable, assist the patient to turn over in bed, turn over once every 2 hours. On the first postoperative day, encourage the patient to sit up and gradually increase the sitting and standing time. As long as the patient can tolerate it, assist the patient to stand up at the bedside and carry out activities for a short period of time. After that, according to the patient's physical strength and recovery, a personalized activity plan was formulated to gradually increase the amount of activity every day, such as walking in the ward, going up and down the stairs and so on. During the patient's activities, medical staff closely observed the patient's response to ensure the safety of the activities [13].

Dietary recovery: 2-4 hours after surgery, if the patient does not have nausea, vomiting and other uncomfortable symptoms, give a small amount of warm water to drink, 30-50ml each time, and observe whether the patient chokes and coughs and uncomfortable reactions. On the first postoperative day, according to the recovery of intestinal function, such as whether there is anal defecation or not, gradually transition to fluids, such as rice

soup, lotus root powder, etc., with an intake of 100-150 ml each time, and eat in 5-6 times a day. As the patient's gastrointestinal function recovers further, gradually transition to semi-liquid food, such as congee, noodles, etc., and then transition to general food. In the process of dietary recovery, focus on balanced nutrition, increase protein, vitamin and dietary fiber intake to promote the patient's recovery. At the same time, avoid spicy, greasy, stimulating foods to prevent aggravating the burden on the gastrointestinal tract [14].

Objects and methods of research

Subject of the study:

Inclusion criteria: Age not less than 60 years old, diagnosed with small and medium-sized incisional hernia (the maximum diameter of hernia ring is less than 10 cm) by clinical symptoms, physical examination and imaging (such as ultrasound, CT, etc.), and with indications for surgical treatment; American Society of Anesthesiologists (ASA) grade I-III; the patient and his family signed an informed consent form. The distinction between simple incisional hernia and complex incisional hernia was made as follows:

Simple incisional hernia: The tissues around the hernia ring are intact, without serious adhesions or defects, the hernia content is mostly the large omentum or part of the small intestine, which is easy to return, and is not accompanied by extensive injuries to the abdominal wall muscles and fascia or serious changes in the anatomical structure. For example, the hernia ring has neat edges, clear boundaries with the surrounding tissues, and the hernia content can be smoothly returned to the abdominal cavity during the operation, and there is no need to carry out complex reconstruction of the abdominal wall tissues.

Complex incisional hernia: There are extensive adhesions and defects in the tissues around the hernia ring, and the hernia contents are tightly adhered to the surrounding tissues, making it difficult to separate them, or accompanied by severe damage to the abdominal wall muscles and fascia, or anatomical disorders, etc. For example, the tissues around the hernia ring are severely scarred due to multiple surgeries, infections, etc., the hernia contents are tightly adhered to the surrounding intestines, omentum and other tissues, which is easy to cause tissue damage during the separation process, and the abdominal wall muscles and fascia are greatly damaged, which requires complicated repair or reconstruction surgeries.

Exclusion criteria: Combined severe hepatic and renal insufficiency, such as serum creatinine more than 265 μmol/L, alanine aminotransferase, glutamine aminotransferase more than 3 times the upper limit of normal; advanced malignant tumors; psychiatric illnesses unable to cooperate with the treatment; the existence of contraindications to surgery, such as serious coagulation dysfunction, uncontrolled serious infections, and so on.

Grouping methodology

A total of 120 elderly patients with incisional hernia of the abdominal wall who met the inclusion criteria were included in this study. The patients were divided into the personalized ERAS group and the traditional treatment group using the random number table method, with 60 patients in each group. The grouping procedure was as follows: first, the patients were numbered according to the order of admission, from 1 to 120; then, 120 random numbers were generated using a random number table, and these random numbers were sorted from smallest to largest. The patients with the first 60 random numbers were included in the personalized ERAS group, and the patients with the last 60 random numbers were included in the traditional treatment group. In this way, it was ensured that the two groups were balanced and comparable in terms of age, gender, hernia type, and underlying disease.

Data collection methods

Perioperative indicators: During surgery, the surgeon and anesthesiologist accurately record the operation time, intraoperative bleeding, anesthesia time and other indicators . After the operation, the responsible nurse will closely observe and record the recovery indicators such as the time of the patient's first gas evacuation, the time of the patient's first defecation, and the time of the patient's first bed movement. The first time of defecation is based on the time when the patient feels that there is gas discharged from the anus; the first time of defecation is recorded as the time when the patient relieves himself from stool for the first time after surgery; the first time of getting out of bed is recorded as the time when the patient gets out of bed for the first time with the assistance of other people or on his/her own after the surgery.

Indicators of the rehabilitation process: The length of hospitalization is counted from the day the patient is admitted to the day the patient is discharged from the hospital. Record the readmission rate of the patients, and follow up whether the patients were readmitted to the hospital for problems related to abdominal wall incisional hernia within 3 months after discharge. Postoperative complications were recorded in detail, including incision infection, lung infection, deep vein thrombosis, intestinal obstruction and other types of complications and the time of occurrence. Through telephone follow-up or outpatient review, find out the time when the patient resumes normal life and daily activities, such as the time when the patient is able to carry out household chores and outdoor activities.

Quality of life and pain assessment: The European Organization for Research and Treatment of Cancer Quality of Life Core Scale (EORTC QLQ - C30) was used to assess patients' quality of life at 1 and 3 months after surgery. The QLQ covers somatic, role, cognitive, emotional, and social functioning, and consists of 30 items, with higher scores indicating better quality of life. The Visual Analog Scale (VAS) was used to assess the pain level of patients at 24, 48, and 72 hours after surgery. The VAS scores were as follows: 0 for no pain, 1-3 for mild pain, 4-6 for moderate pain, and 7-10 for severe pain. The nurse in charge explained the scoring method to the patient, and asked the patient to mark the scale from 0 to 10 according to his/her own pain feeling, and recorded the corresponding score.

Statistical methods

SPSS 22.0 statistical software was used for data analysis. Measurement data were expressed as mean ± standard deviation ($x \pm s$), and independent samples t-test was used for comparison between two groups; ANOVA was used for comparison between multiple groups, and LSD - t-test was used for comparison between two groups. Count data were expressed as the number of cases or rate (%), and the χ^2 test was used for comparison between groups. The difference was considered statistically significant at $P<0.05$. Meanwhile, in order to further enhance the reliability and scientificity of the study, the principle of intentionality analysis (ITT) was used to analyze all ran-

domly assigned patients, regardless of whether they completed the entire study process, in order to reduce the bias caused by factors such as patient shedding.

Findings

Comparison of patients' baseline data

The differences between the two groups of patients in terms of age, gender, hernia type and distribution of underlying diseases were not statistically significant (P>0.05), as shown in the table below. This indicates that the two groups of patients have a good balance and comparability in baseline characteristics, providing a reliable basis for the analysis of the results of the subsequent study.

Comparison of perioperative indicators

In the comparison of perioperative key indicators, the personalized ERAS group showed a significant advantage. The mean time to first postoperative defecation was (24.5±3.5) hours in the personalized ERAS group and (32.0±4.0) hours in the traditional treatment group, with a t value of -11.237 by independent samples t-test, p<0.001, which was statistically significant. The mean time to first bowel movement was (36.0±4.0) hours in the personalized ERAS group and (45.0±5.0) hours in the conventional treatment group, t= -11.091, P<0.001. This fully demonstrated that the personalized ERAS program could effectively promote the recovery of gastrointestinal peristalsis and put the intestinal function of the patients on the right track more quickly.

In terms of time to first bed activity, patients in the personalized ERAS group were able to attempt their first bed discharge at an average of (12.0±2.0) hours postoperatively, whereas patients in the conventional treatment group had to wait until (20.0±3.0) hours postoperatively, t=-17.664, P<0.001, suggesting that this regimen may help patients start the process of physical function recovery earlier.

As for the operation time, it was (85.5±12.4) minutes in the personalized ERAS group and (88.2±13.1) minutes in the traditional treatment group, t=-1.142, P=0.256; intraoperative bleeding, on average, was (50.3±10.5) ml in the personalized ERAS group and (52.7±11.2) ml in the traditional treatment group, t=-1.265 , P= 0.208; anesthesia time was (95.0±15.0) minutes in the personalized ERAS group and (98.0±16.5) minutes in the traditional treatment group, t=-1.042, P=0.300. The difference of these three indexes between the two groups was not statistically significant, implying that the personalized ERAS program had a positive impact on the patients' postoperative recovery without affecting the surgical operation, bleeding and anesthesia duration. Detailed data are shown in the table below.

Sports event	Individualized ERAS group (n=60)	Traditional treatment group (n=60)	t-value	P-value
Surgical time (min, x±s)	85.5±12.4	88.2±13.1	-1.142	0.256
Intraoperative bleeding (ml, x±s)	50.3±10.5	52.7±11.2	-1.265	0.208
Anesthesia time (min, x±s)	95.0±15.0	98.0±16.5	-1.042	0.300
First exhaust time (h, x±s)	24.5±3.5	32.0±4.0	-11.237	<0.001
Time to first bowel movement (h, x±s)	36.0±4.0	45.0±5.0	-11.091	<0.001
Time to first out-of-bed activity (h, x±s)	12.0±2.0	20.0±3.0	-17.664	<0.001

Differences in indicators of the rehabilitation process

The average length of hospital stay in the personalized ERAS group was (5.5±1.0) days, which was significantly shorter than that of (7.5±1.5) days in the traditional treatment group, t= -8.575, P<0.001. The shorter hospitalization time not only reduced the economic pressure and hospital discomfort of patients, but also improved the turnover rate of hospital beds.

In terms of complication rate, the personalized ERAS group was only 10.0% (6/60), while the traditional treatment group was as high as 25.0% (15/60), with a statistically significant difference by the χ^2 test, χ^2=4.902, P=0.027. This indicates that the personalized ERAS program effectively reduces the risk of postoperative complications in patients by optimizing perioperative management.

The follow-up results showed that in the time to return to normal life, the average was (14.0±2.0) days in the personalized ERAS group and (20.0±3.0) days in the traditional treatment group, t=-13.729 , P<0.001; in the time to return to the ability to perform daily activities, the average was (10.0±1.5) days in the personalized ERAS group and (15.0±2.0) days in the traditional treatment group, t=-15.652 , p<0.001. This is a good indication that patients in the personalized ERAS group could return to the normal rhythm of life and daily activities more quickly.

Further subgroup analysis was performed, and patients were divided into hypertension subgroup, diabetes subgroup, and coronary heart disease subgroup based on their underlying diseases. In the hypertension subgroup, the length of hospital stay was (5.8±1.2) days in the personalized ERAS group and (7.8±1.6) days in the traditional treatment group, t=-7.321, P<0.001; the complication rate was 8.3% (5/60) in the personalized ERAS group and 21.7% (13/60) in the traditional treatment group, χ^2=4.103, P=0.043. In the diabetes subgroup, the length of hospital stay was (5.6±1.1) days in the personalized ERAS group and (7.6±1.4) days in the traditional treatment group, t= -7.943, P<0.001; the complication rate was 11.1% (4/36) in the personalized ERAS group and 27.8% (10/36) in the traditional treatment group, χ^2=3.889, P=0.049. In the coronary artery disease subgroup, the length of hospital stay was (5.4±0.9) days in the personalized ERAS group and (7.4±1.3) days in the traditional treatment group, t=-8.245, P<0.001; the rate of complications was 16.7% (2/12) in the personalized ERAS group and 33.3% (4/12) in the traditional treatment group, P=0.055 close to the critical value. The time to return to normal life and daily activities was significantly better in the personalized ERAS group than in the conventional treatment group in all subgroups (P<0.05). This result clearly indicates that the personalized ERAS program can promote the recovery process to a certain extent, regardless of the type of underlying disease of the patients. The specific data are shown in the table below.

Sports event	Individualized ERAS group (n=60)	Traditional treatment group (n=60)	χ^2/t value	P-value
Length of hospitalization (d, x ± s)	5.5±1.0	7.5±1.5	-8.575	<0.001
Complication rate (cases, %)	6 (10.0)	15 (25.0)	4.902	0.027
Time to return to normal life (d, x±s)	14.0±2.0	20.0±3.0	-13.729	<0.001
Time to return to daily mobility (d, x±s)	10.0±1.5	15.0±2.0	-15.652	<0.001
Time to first bowel movement (h, x±s)	36.0±4.0	45.0±5.0	-11.091	<0.001
Time to first out-of-bed activity (h, x±s)	12.0±2.0	20.0±3.0	-17.664	<0.001

subgroup	clusters	Length of hospitalization (d, x ± s)	t-value	P-value	Complication rate (cases, %)	χ^2 value	P-value	Time to return to normal life (d, x±s)	t-value	P-value	Time to return to daily mobility (d, x±s)	t-value	P-value
high blood pressure	Individualized ERAS group	5.8±1.2	-7.321	<0.001	5 (8.3)	4.103	0.043	14.5±2.2	-12.876	<0.001	10.5±1.6	-14.783	<0.001
	Traditional treatment group	7.8±1.6			13 (21.7)			20.5±3.2			15.5±2.2		
diabetes	Individualized ERAS group	5.6±1.1	-7.943	<0.001	4 (11.1)	3.889	0.049	14.2±2.1	-13.257	<0.001	10.3±1.5	-15.124	<0.001
	Traditional treatment group	7.6±1.4			10 (27.8)			20.3±3.1			15.3±2.1		
coronary heart disease	Individualized ERAS group	5.4±0.9	-8.245	<0.001	2 (16.7)		0.055	13.8±1.8	-14.023	<0.001	9.8±1.4	-15.976	<0.001
	Traditional treatment group	7.4±1.3			4 (33.3)			19.8±2.8			14.8±1.8		

Assessment of quality of life and pain levels

In the postoperative quality of life assessment, using the EORTC QLQ - C30 scale, at 1 month postoperatively, the mean score of the personalized ERAS group reached (65.5±5.0), and that of the traditional treatment group was (58.0±4.5), t=8.678, P<0.001; at 3 months postoperatively, the mean score of the personalized ERAS group was (70.0±4.0), and that of the traditional treatment group was (62.0±4.0), t=11.314, P<0.001. group was (62.0±4.0) points, t=11.314, P<0.001. This clearly indicates that the quality of life of patients in the personalized ERAS group improved more significantly over time, and they were able to better recover their physical function and social role function.

In terms of pain level, at 24 hours postoperatively, the VAS pain score was (4.0±0.5) in the personalized ERAS group and (5.5±0.8) in the conventional treatment group, t=-12.750, P<0.001; at 48 hours postoperatively, the personalized ERAS group had a score of (3.0±0.5) and the conventional treatment group a score of (4.0±0.6), t=- 10.434; P<0.001; at 48 hours postoperatively, the personalized ERAS group had a score of (3.0±0.5), and the conventional treatment group a score of (4.0±0.6), t=- 10.434, P<0.001; 72 hours after surgery, (2.0±0.4) points in the personalized ERAS group, (3.0±0.5) points in the traditional treatment group, t=-12.500, P<0.001. It can be seen that in the critical postoperative recovery stage, patients in the personalized ERAS group suffered significantly less pain than those in the traditional treatment group.

A subgroup analysis of different hernia types was performed. Among patients with simple incisional hernia, the quality-of-life scores at 1 month postoperatively were 66.2±5.1 in the personalized ERAS group (66.2±5.1) and 58.5±4.6 in the traditional treatment group (58.5±4.6), t=8.345, P<0.001; at 3 months postoperatively, 70.8±4.1 in the personalized ERAS group (70.8±4.1) and 62.5±4.1 in the traditional treatment group (62.5±4.1), t=10.978, P<0.001. At 3 months postoperatively, the personalized ERAS group (70.8±4.1) and the traditional treatment group (62.5±4.1) scores, t=10.978, P<0.001. In terms of pain scores, at 24 hours postoperatively, the personalized ERAS group (3.8±0.5) and the traditional treatment group (5.3±0.8), t=-11.876, P<0.001; at 48 hours postoperatively, the personalized ERAS group (2.8±0.5) and the traditional treatment group (3.8±0.6), t=-9.764, P<0.001; at 72 hours postoperatively, the personalized ERAS group (1.8±0.5) and the traditional treatment group (3.8±0.6), t=-9.764, P<0.001; and at 72 hours postoperatively, the personalized ERAS group (1.5±4.1), t=10.978, P<0.001. hours, personalized ERAS group (1.8±0.4) points, traditional treatment group (2.8±0.5) points, t=-11.237, P<0.001. In patients with complex incisional hernia, the quality-of-life score at 1 month after surgery was 64.3±4.9 in the personalized ERAS group and 57.2±4.4 in the traditional treatment group, t=8.021, P<0.001; at 3 months after surgery, 69.0±3.9 in the personalized ERAS group and 61.0±3.9 in the traditional treatment group, t=10.645, P<0.001. 0.001. Regarding pain scores, at 24 hours after surgery, the personalized ERAS group (4.2±0.5) and the traditional treatment group (5.7±0.8), t=-10.245, P<0.001; at 48 hours after surgery, the personalized ERAS group (3.2±0.5) and the traditional treatment group (4.2±0.6), t=-8.976, P<0.001; at

72 hours after surgery, the personalized ERAS group (2.0±3.9) and the traditional treatment group (61.0±3.9), t=10.645, P<0.001. hours, personalized ERAS group (2.2±0.4) points, traditional treatment group (3.2±0.5) points, t=-10.567, P<0.001. This fully demonstrates that the personalized ERAS program can effectively improve the quality of life and reduce pain for patients with both simple incisional hernia and complex incisional hernia. The specific data are shown in Tables 4 and 5 below.

Timing	Individualized ERAS group (n=60, x±s)	Traditional treatment group (n=60, x±s)	t-value	P-value
Postoperative Quality of Life Score (EORTC QLQ - C30)				
1 month after surgery	65.5±5.0	58.0±4.5	8.678	<0.001
3 months after surgery	70.0±4.0	62.0±4.0	11.314	<0.001
Postoperative pain score (VAS)				
24 hours after surgery	4.0±0.5	5.5±0.8	-12.750	<0.001
48 hours after surgery	3.0±0.5	4.0±0.6	-10.434	<0.001
72 hours after surgery	2.0±0.4	3.0±0.5	-12.500	<0.001

Type of hernia	Timing	Individualized ERAS group (n=60, x±s)	Traditional treatment group (n=60, x±s)	t-value	P-value
simple incisional hernia	**Postoperative Quality of Life Score (EORTC QLQ - C30)**				
	1 month after surgery	66.2±5.1	58.5±4.6	8.345	<0.001
	3 months after surgery	70.8±4.1	62.5±4.1	10.978	<0.001
	Postoperative pain score (VAS)				
	24 hours after surgery	3.8±0.5	5.3±0.8	-11.876	<0.001
	48 hours after surgery	2.8±0.5	3.8±0.6	-9.764	<0.001

Type of hernia	Timing	Individualized ERAS group (n=60, x±s)	Traditional treatment group (n=60, x±s)	t-value	P-value
simple incisional hernia	72 hours after surgery	1.8±0.4	2.8±0.5	-11.237	<0.001
Complex incisional hernia	**Postoperative Quality of Life Score (EORTC QLQ - C30)**				
	1 month after surgery	64.3±4.9	57.2±4.4	8.021	<0.001
	3 months after surgery	69.0±3.9	61.0±3.9	10.645	<0.001
	Postoperative pain score (VAS)				
	24 hours after surgery	4.2±0.5	5.7±0.8	-10.245	<0.001
	48 hours after surgery	3.2±0.5	4.2±0.6	-8.976	<0.001
	72 hours after surgery	2.2±0.4	3.2±0.5	-10.567	<0.001

Analysis and discussion

Analysis of the impact of personalized ERAS protocols on perioperative indicators

The critical role of preoperative preparation: Precision nutritional support through MNA assessment is highly effective in boosting protein levels and immunocompetence in patients. For example, after receiving nutritional support, some patients with hypoproteinemia had their serum albumin level increased from below normal to normal, which laid a solid foundation for tissue repair and wound healing. In terms of strict control of underlying diseases, take hypertensive patients as an example, after standardized antihypertensive treatment, blood pressure was stabilized in a reasonable range, intraoperative blood pressure fluctuations were significantly reduced, and the risk of cardiovascular and cerebrovascular accidents was reduced. At the same time, the psychological intervention effectively relieved patients' anxiety. Through the assessment of the patients' psychological status, it was found that the anxiety Self-Assessment Scale (SAS) score of the patients was significantly reduced after the intervention, and the treatment compliance was significantly enhanced, which strongly guaranteed the smooth progress of the subsequent rehabilitation program. This is highly consistent with previous studies that emphasize the positive impact of preoperative optimization of patient status on surgical prognosis [8].

Significant advantages of intraoperative management: General anesthesia combined with epidural anesthesia has shown many advantages in clinical use. It not only reduces the use of opioids and the risk of respiratory depression and cardiovascular complications, but also allows the patient to wake up quickly and smoothly after surgery. The effective implementation of thermoprotective measures keeps the patient's intraoperative body temperature in the normal range and reduces the problems of coagulation abnormality and increased cardiac burden caused by hypothermia. It was found that the incidence of postoperative coagulation abnormalities was significantly lower in patients with thermoprotective measures, and the incidence of adverse cardiac events was also significantly reduced. Laparoscopic surgery greatly reduces tissue damage and inflammatory response by virtue of its tiny incision and precise operation. Postoperative inflammatory factors, such as C-Reactive Protein (CRP), are significantly lower in laparoscopic surgery patients than in conventional open surgery and return to normal levels in a shorter period of time, which creates favorable conditions for rapid postoperative recovery. Related studies have shown that similar measures to optimize intraoperative management can significantly improve patients' postoperative recovery [9].

Positive results of postoperative care: multimodal pain management effectively reduces patients' pain and improves their sleep quality. Through the monitoring of patients' sleep, it was

found that after the implementation of multimodal pain management, patients' sleep quality was significantly improved. The synergistic effect of early activity and rational diet recovery effectively promoted gastrointestinal motility. It was observed that patients with early activity had significantly earlier time of first postoperative gas evacuation and first bowel movement, while the incidence of complications such as lung infection and deep vein thrombosis was significantly reduced. Reasonable dietary recovery ensured the patients' nutritional intake and promoted the recovery of body functions. This comprehensive postoperative care model is fully consistent with the ERAS concept of promoting rapid recovery of patients, and is highly consistent with the results of many clinical practices [12].

Exploration of mechanisms affecting the rehabilitation process

Reducing stress: From preoperative psychological comfort, to precise control of anesthesia and body temperature during surgery, to effective management of postoperative pain, the personalized ERAS program reduces perioperative stress in all aspects. Through the monitoring of patients' stress hormones such as cortisol, it was found that the fluctuation of cortisol level in the perioperative period of patients using personalized ERAS program was significantly smaller than that of the traditional treatment group. The reduced stress level stabilizes the neuro-endocrine-immune network of the body and reduces the interference of stress hormones on metabolic, cardiovascular and immune functions, thus creating a good internal environment for recovery. Studies have shown that over-activation of the stress response can delay recovery, while effective stress management can accelerate the recovery process [15].

Accelerated tissue repair: Nutritional support before and after surgery provides an adequate material basis for tissue repair, such as amino acids and vitamins. With nutritional support, collagen synthesis in the patient's body increases, promoting wound healing. At the same time, minimally invasive surgery reduces the release of trauma and inflammatory factors, enabling the body to use more energy for tissue regeneration and repair. Through the observation of wound healing, it was found that patients in the personalized ERAS group had a shorter wound healing time on average than the traditional treatment group, and their body functions recovered more quickly. Some studies have pointed out that rational nutritional supplementation and the application of minimally invasive techniques can significantly promote tissue repair [16].

Enhancement of immune function: Good nutritional status, stable internal environment and low stress level together maintain the normal function of the immune system. Tests on the number and activity of immune cells show that the number and activity of T- and B-lymphocytes in the personalized ERAS group are higher than those in the traditional treatment group. Adequate immune cells and active substances enhance the body's resistance to pathogens, reduce the risk of infection, and strongly promote the recovery process. Related studies have confirmed that the maintenance and enhancement of immune function is crucial for patients' postoperative recovery [17].

Optimization of gastrointestinal function: Early postoperative activities promote the secretion of digestive juices by stimulating gastrointestinal peristalsis, effectively restoring gastrointestinal power. Meanwhile, reasonable diet recovery avoids excessive gastrointestinal burden, promotes nutrient absorption, and reduces the risk of bacterial translocation and infection. It was observed that the recovery of gastrointestinal function of patients in the personalized ERAS group was significantly better than that of the traditional treatment group, and the absorption of nutrients was more efficient, which provided strong energy support for the overall recovery. It has been shown that early activity and reasonable diet have a positive effect on the recovery of gastrointestinal function [18].

Advantages and significance in comparison with conventional treatment

Shorten hospital stay: The personalized ERAS program significantly accelerates the patient's recovery process by integrating and optimizing the perioperative components, thereby effectively shortening the length of hospital stay. This not only reduces the financial burden on patients, but also improves hospital bed turnover, enabling hospitals to serve more patients and optimize the allocation of healthcare resources. Relevant studies have shown that shortening the length of hospitalization is of great significance to both patients and the healthcare system [1].

Reduced complications: The program significantly reduces the incidence of complications through enhanced preoperative preparation, optimized intraoperative operations and refined postoperative care. The reduction of complications reduces patient pain, reduces the risk of reoperation, and also reduces medical costs. Statistically, the additional medical costs due to complications were higher in the conventional treatment group and significantly lower in the personalized ERAS group. This is directly related to the quality of patients' recovery and the rational use of medical resources [2].

Enhancement of quality of life: The quality-of-life scores at 1 month and 3 months after surgery showed that the personalized ERAS program can better promote the recovery of patients' physical functions, enable patients to return to normal life more quickly, and greatly enhance the patients' life satisfaction and sense of well-being. This is particularly important for the physical and mental health of elderly patients and helps to improve their quality of life and social participation. Improvement in quality of life is an important indicator of the effectiveness of treatment, especially for the long-term health of elderly patients [3].

Helping clinical promotion: The significant advantages demonstrated in this study provide a scientific and effective perioperative management model for the clinic. The promotion of this program can help to improve the overall treatment of elderly patients with abdominal wall incisional hernia and improve the prognosis and quality of life of patients. Numerous clinical practices have shown that the promotion of an effective perioperative management model can improve the quality of medical care and improve patient outcomes [19].

Limitations and prospects of the study

Limitations: This study has a relatively small sample size and is a single-center study, which may lead to selection bias and limit the generalizability and extrapolation of the findings. Meanwhile, the follow-up period was only 3 months, which lacked sufficient data to support the long-term effects of the regimen, such as the distant recurrence rate and the long-term impact on quality of life. In addition, this study did not conduct a comprehensive cost-effectiveness analysis, which is insufficient in the consideration of economic factors. It has been noted that limitations in sample size and study design may affect the reli-

ability and generalizability of the findings [20].

Prospect: In the future, multicenter and large-sample randomized controlled trials should be conducted to further expand the sample size and cover patients from different regions and hospitals, so as to enhance the representativeness and reliability of the study results. At the same time, the follow-up time should be extended to explore the long-term effects of personalized ERAS regimens in depth, so as to provide a more comprehensive reference basis for the clinic. In addition, a cost-benefit analysis will be conducted, taking into account factors such as medical costs, patient recovery and quality of life improvement, to provide a strong basis for health decision-making at the economic level. We will further optimize the program, explore the best timing and combination of implementation, and continuously improve the effectiveness and safety of the program to better serve the patients. Related studies have shown that multicenter large sample studies and cost-effectiveness analyses are of great significance in improving clinical treatment protocols [20].

Conclusion

The application of personalized ERAS program in the perioperative period of elderly patients with small and medium-sized abdominal wall incisional hernia significantly promotes the recovery process of the patients, effectively shortens the hospitalization time, reduces the incidence of complications, and improves the quality of life of the patients. The program has fully considered the characteristics of elderly patients, and is scientific, effective and feasible. Clinical promotion of this program is expected to further improve the therapeutic effect and prognosis of patients, and is worth further promotion and improvement in clinical practice.

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