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Impact of the Rapid Recovery Concept on Complications and Patient Quality of Life in the Perioperative Nursing of Robot-Assisted Radical Oesophageal Cancer

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Abstract

Aim: This study evaluates the impact of Enhanced Recovery After Surgery (ERAS) nursing on postoperative complications and quality of life in patients undergoing robot-assisted minimally invasive esophagectomy (RAMIE). **Methods:** A total of 150 patients who underwent RAMIE from January 2020 to January 2022 at our hospital were randomly assigned to either the observation group or the control group, with 75 patients in each. The control group received standard perioperative management and nursing care, while the observation group was treated with ERAS nursing strategies. Interventions continued until discharge, and outcomes such as postoperative complications, quality of life, and nutritional status were compared between the groups. **Results:** The observation group exhibited a significantly lower incidence of postoperative adverse reactions compared to the control group ($P < 0.05$). Additionally, all dimension scores of the Short-Form 36 Health Survey (SF-36), including the total score, were higher in the observation group ($P < 0.05$). Furthermore, the Nutritional Risk Screening (NRS) scores for impaired nutritional status and disease severity, along with the total NRS score, were significantly lower in the observation group compared to the control group ($P < 0.05$). **Conclusion:** Implementing ERAS nursing in the perioperative care of patients undergoing RAMIE is associated with reduced postoperative complications and enhanced postoperative quality of life and nutritional status.

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#Have contributed equally to this work.

Keywords

Robot-Assisted Radical Esophageal Cancer Surgery,
Rapid Rehabilitation Surgical Nursing, Perioperative Period,
Complications, Quality of Life

1. Introduction

Esophageal cancer ranks as the eighth most prevalent malignancy worldwide and exhibits a notably high incidence and mortality rate, both globally and in China. Thoracoscopic radical esophagectomy is the primary treatment modality [1] [2]. Robot-assisted surgery offers enhanced stability, superior visualization, and better operability compared to traditional manual techniques. Recent studies suggest that robot-assisted minimally invasive esophagectomy (RAMIE) inflicts less harm on postoperative cardiopulmonary function and the recurrent laryngeal nerve. Additionally, it is associated with a higher lymph node dissection rate, expedited recovery, and is considered safer and more feasible [3] [4] [5] [6] [7].

Esophageal cancer compromises patient immunity and physiological function. Conventional perioperative nursing, with its disease-centric approach, focuses on surgical support and symptomatic care. However, extended preoperative fasting and excessive postoperative rehydration can lead to water-electrolyte imbalances and malnutrition, adversely affecting postoperative recuperation. Therefore, implementing effective and standardized nursing practices to hasten the recovery process is crucial [8] [9].

Enhanced Recovery After Surgery (ERAS) protocols grounded in evidence-based medicine, integrate rapid recovery principles within the perioperative period to establish a suite of optimized care measures. These measures include reducing preoperative fasting, minimizing intraoperative fluid administration, ensuring intraoperative thermoregulation, and providing effective postoperative analgesia. The aim is to protect the patient's internal environmental balance, enhance the intraoperative experience, and improve postoperative outcomes, thereby increasing patient satisfaction, mitigating negative psychological responses, and reducing postoperative complications [10]. ERAS has gained broad acceptance within the medical community and has been successfully implemented in the perioperative management of cervical and colon cancer, delivering outcomes that resonate with the contemporary biomedical model's demands [11] [12]. Consequently, applying ERAS protocols to perioperative care in robot-assisted minimally invasive esophagectomy (RAMIE) is anticipated to yield beneficial results. Given the scarcity of research evaluating the impact of ERAS on postoperative complications, quality of life, and nutritional status in patients undergoing RAMIE, this study will explore these areas and the findings are presented herein.

2. General Information and Methods

2.1. Inclusion and Exclusion Criteria

Inclusion Criteria: Individuals diagnosed with esophageal cancer per established criteria [13] who are scheduled for elective robot-assisted minimally invasive esophagectomy (RAMIE); patients presenting with stage I or II lymph node metastasis as classified by the Tumor Node Metastasis (TNM) staging system [14] set forth by the International Union Against Cancer, and histopathological confirmation of squamous carcinoma; patients who have been fully informed about the study and have provided consent.

Exclusion Criteria: Patients with distant metastasis; those with cognitive impairments; individuals with concurrent gastrointestinal diseases; and patients suffering from cardiopulmonary insufficiency.

2.2. Clinical Information

One hundred fifty patients who underwent robot-assisted minimally invasive esophagectomy (RAMIE) from January 2020 to January 2022 at our institution were randomly assigned into two groups of 75 each: the observation group and the control group, using the random number method. The observation group comprised 43 males and 32 females, aged 40 - 75 years (mean age 59.62 ± 7.73 years), with weights ranging from 44 to 84 kg (mean weight 64.33 ± 7.92 kg). TNM staging revealed 41 patients at stage I and 34 at stage II. Additionally, 11 patients had a familial history of cancer, and 26 had a history of smoking. The control group included 39 males and 36 females, aged 44 - 75 years (mean age 59.11 ± 7.13 years), with weights ranging from 46 to 83 kg (mean weight 65.15 ± 8.07 kg). There were 44 stage I and 31 stage II patients, with 15 having a family history of cancer and 30 with a history of smoking. No statistically significant differences in demographic data were observed between the groups ($P > 0.05$).

2.3. Treatment Methods

In both the observation and control groups, robot-assisted minimally invasive esophagectomy (RAMIE) was performed. The control group received standard perioperative nursing care which included the following:

Preoperative: Patients observed a fasting period from water and food for 8 - 12 hours underwent thorough skin cleaning and disinfection, intestinal preparation, and had thoracic, gastric, and urinary catheters placed.

Intraoperative: Vital signs were closely monitored along with other routine surgical care procedures.

Postoperative: Patients received a manual detailing postoperative recovery information and symptomatic support treatment based on their presenting symptoms. Bedside activities were encouraged 1 - 2 days post-surgery, depending on the severity of their condition, with a gradual increase to encouraging bed mobility by postoperative days 3 - 5. Enteral nutrition support was initiated during anastomotic healing, transitioning to a liquid and semi-liquid diet post-healing.

The dietary recommendations were to maintain a light diet, high in protein, and rich in vitamins.

In the observation group, Enhanced Recovery After Surgery (ERAS) nursing interventions augmented the standard care provided to the control group. These interventions were:

1) **ERAS Team Formation**: An ERAS team, comprising the attending physician and two nurses, developed individualized care plans based on each patient's condition.

2) **Admission Care**: Medical and nursing staff-oriented patients and their families to the hospital environment, assisting with pre-treatment testing. Patients received a health education booklet detailing their condition, post-operative rehabilitation, and an overview of the ERAS model, fostering confidence and cooperation in subsequent interventions. Pulmonary function exercises were initiated on the day of admission.

3) **Preoperative Nursing**: In addition to routine care, nurses engaged in detailed discussions with patients about preoperative instructions, addressing their concerns and promoting a calm demeanor through question-and-answer sessions, positive reinforcement, and mindfulness breathing techniques. Dietary guidelines included a light meal with reduced fasting times—6 hours for solids and 2 hours for liquids. Patients were instructed to ingest carbohydrate-rich fluids (200 - 400 ml) pre-anesthesia to prevent hypoglycemia. Preparations also involved skin cleaning at the surgical site and the placement of necessary catheters.

4) **Intraoperative Management**: Patients were kept warm with insulating blankets, operating rooms were maintained at 26.0˚C, body cavities were rinsed with warm saline, and fluid administration was limited to less than 1.5 liters.

5) **Postoperative Care**: Nurses provided swallowing training post-anastomosis healing to prevent aspiration pneumonia. Patients were instructed to wait for medical clearance before consuming liquids. Initial postoperative intake involved sips of boiled water, progressing to liquid and then semi-solid foods. Soft, ball-shaped foods at a temperature of approximately 37˚C were recommended to prevent esophageal stricture. The intake rate was moderated to avoid esophageal damage. Early postoperative movements, such as turning and leg flexion, were encouraged, with nurses assisting patients to ambulate within 24 hours post-surgery. Prophylactic analgesic and antiemetic treatments were administered, along with postoperative health education. Psychological support was a priority, with strategies in place to bolster patient confidence and timely mental attitude adjustments through encouragement and counseling.

2.4. Evaluation Criteria

2.4.1. Post-Operative Complications

The incidence of complications, including pulmonary infections, recurrent laryngeal nerve injury, anastomotic fistulae, and incisional infections, was monitored and documented in both groups for three months following surgery [15].

2.4.2. Quality of Life Scale (Short-form 36 Health Survey Scale, SF-36)

The Short Form (SF-36) Health Survey was utilized to evaluate the quality of life in patients before and after the intervention. This scale measures eight dimensions: general health, physical functioning, bodily pain, vitality, social functioning, role limitations due to emotional problems, and mental health, encompassing a total of 36 items. The scores for the SF-36, including individual dimension scores, were transformed into a percentage scale to facilitate comprehension, where higher percentages indicate a better quality of life [16].

2.4.3. Nutritional Status

Prior to the intervention, the nutritional status of patients with esophageal cancer was evaluated using the Nutritional Risk Screening (NRS) 2002 tool [17]. This assessment tool gauges nutritional levels across three domains: severity of disease, impaired nutritional status, and age. Scores for disease severity and impaired nutritional status range from 0 to 3, with higher scores indicating greater severity. Age is scored as 0 for patients aged ≤ 70 years and 1 for patients > 70 years. The aggregate of these scores constitutes the total NRS score, with a score >3 signifying a significant nutritional risk in the patient.

2.5. Statistical Treatment

Data analysis was performed using SPSS 18.0 statistical software. Categorical data were presented as frequencies and analyzed using the Chi-square (χ^2) test, while continuous data were expressed as mean ± standard deviation ($\bar{x} \pm s$) and analyzed using the t-test. A P-value of less than 0.05 was considered to indicate statistical significance.

3. Results

3.1. Comparison of the Occurrence of Postoperative Complications between the Two Groups

Table 1 demonstrates that the observation group experienced a significantly lower rate of postoperative complications compared to the control group ($P < 0.05$).

3.2. Comparison of SF-36 Scores between the Two Groups before and after the Intervention

Table 2 indicates that there was no significant difference in the SF-36 scores and overall scores between the two groups prior to the intervention ($P > 0.05$). However, post-intervention, both groups showed significant improvements in their SF-36 and total scores compared to their pre-intervention scores ($P < 0.05$). Furthermore, the observation group's scores were significantly higher than those of the control group post-intervention ($P < 0.05$).

3.3. Comparison of NRS Scores between the Two Groups before and after the Intervention

Table 3 reveals that prior to the intervention, and there was no significant dif-

ference in the Nutritional Risk Screening (NRS) scores—both in individual dimensions and total scores—between the two groups (P > 0.05). Post-intervention, both groups exhibited a significant reduction in impaired nutritional status, disease severity scores, and total NRS scores (P < 0.05). Additionally, the scores of the observation group were significantly lower than those of the control group (P < 0.05).

Table 1. Comparison of the incidence of postoperative complications between the two groups [cases (%), n = 75].

Group	Lung infections	Injury to the recurrent laryngeal nerve	Anastomotic fistula	Infection of the incision	Total incidence
Observation group	1 (2.50)	0 (0.00)	0 (2.50)	3 (0.00)	4 (5.00)
Control group	3 (7.50)	2 (5.00)	3 (7.50)	6 (2.50)	14 (22.50)
χ^2					6.313
P					0.012

Table 2. Comparison of SF-36 scores between the two groups before and after the intervention (score, ($\overline{x} \pm s$), n = 75).

Group		Observation group	Control group	t	P
Overall health	Pre-intervention	53.19 ± 7.28	54.23 ± 7.63	0.854	0.395
	Post-intervention	72.51 ± 8.55*	64.15 ± 8.32*	6.069	0
Physiological functions	Pre-intervention	62.24 ± 9.15	61.28 ± 9.27	0.638	0.524
	Post-intervention	74.13 ± 10.25*	66.77 ± 9.23*	4.621	0
role-physical	Pre-intervention	54.55 ± 8.28	54.37 ± 8.39	0.132	0.895
	Post-intervention	71.11 ± 10.26*	61.70 ± 7.31*	6.469	0
Somatic pain	Pre-intervention	58.46 ± 9.18	59.28 ± 9.49	0.538	0.592
	Post-intervention	71.16 ± 10.48*	63.13 ± 9.91*	4.821	0
Vitality	Pre-intervention	63.45 ± 10.37	62.56 ± 10.30	0.527	0.599
	Post-intervention	82.66 ± 11.43*	74.62 ± 12.08*	4.187	0
Social functions	Pre-intervention	65.59 ± 10.43	65.76 ± 10.98	0.097	0.923
	Post-intervention	81.22 ± 12.35*	73.13 ± 10.21*	4.372	0
Emotional functions	Pre-intervention	64.52 ± 11.60	64.33 ± 10.28	0.106	0.916
	Post-intervention	80.36 ± 12.33*	72.16 ± 10.22*	4.434	0
Mental health	Pre-intervention	55.39 ± 8.26	55.83 ± 7.66	0.338	0.736
	Post-intervention	75.26 ± 11.39*	63.34 ± 10.54*	6.652	0

Note: * indicates comparison with the same group before the intervention and $r < 0.05$.

Table 3. Comparison of NRS scale scores and total scores for each dimension in the two groups before and after the intervention (score, ($\overline{x} \pm s$), n = 75).

Group	Impaired nutritionalstatus		Disease severity		Age		Total points	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Observation group	2.23 ± 0.21	1. 18 ± 0.12*	2. 15 ± 0.29	0.97 ± 0.10*	0.27 ± 0.06	0.27 ± 0.06	4.65 ± 0.52	2.43 ± 0.31*
Control group	2.19 ± 0.26	1.40 ± 0.14*	2.11 ± 0.35	1.24 ± 0.16*	0.26 ± 0.03	0.26 ± 0.03	4.56 ± 0.50	2.90 ± 0.41*
T	1.036	10.333	0.762	12.393	1.291	1.291	1.08	7.919
P	0.302	0.000	0.447	0.000	0.199	0.199	0.282	0.000

Note: * denotes comparison with the same group before the intervention, P < 0.05.

4. Discussion

Patients with esophageal cancer often exhibit inconspicuous symptoms in the early stages. As the disease progresses, symptoms such as dysphagia, persistent chest and back pain, or ascites indicate advancement to the mid and late stages, leading to a high mortality rate, thus making surgery the treatment of choice [18]. Robot-assisted thoracoscopic surgery, both focal resection and radical, is minimally invasive, sparing the chest wall from extensive damage. The robotic system enhances the visual field more than tenfold compared to the naked eye, and its arms are flexible yet stable, allowing for the simultaneous and steady manipulation of multiple instruments. This facilitates concurrent lymph node dissection and thoracic neck anastomosis, minimizes accidental nerve and tissue damage due to tremors, and streamlines the process of radical esophagectomy [19] [20].

Enhanced Recovery After Surgery (ERAS) nursing plays a crucial role in alleviating psychological stress and correcting water-electrolyte imbalances through health education and psychological counseling. It also provides swallowing guidance to support rapid postoperative anastomotic healing, helping patients adapt to a postoperative diet, and includes preoperative carbohydrate loading. Intraoperatively, maintaining warmth and limiting transfusion volume conserves energy and reduces complications, ensuring adequate circulatory function and minimizing blood loss. Postoperative prophylactic analgesia and antiemesis, coupled with early initiation of diet and ambulation, can effectively diminish stress responses upon awakening, enhance physical function—including mobility and gastrointestinal motility—and boost patient confidence in their treatment while alleviating psychological stress. Massage therapy promotes blood circulation, preventing deep vein thrombosis and limb infections. Through psychological counseling, healthcare providers can develop personalized nursing plans based on patient feedback, facilitating the timely alleviation of distress, diminishing negative mindsets, enhancing the treatment experience, and accelerating the recovery process [21].

The findings of this study indicate a significant reduction in postoperative adverse reactions in the observation group following the intervention, aligning with the results of CAI *et al.* [22]. This decrease may be attributed to preoperative strategies such as administering carbohydrate-rich fluids and reducing fasting duration before robot-assisted minimally invasive esophagectomy (RAMIE), which mitigate the gastrointestinal stress response from anesthesia and decrease the gastric tube retention time. Temperature control and heat preservation during surgery may enhance patient circulation and alleviate cardiopulmonary strain caused by anesthesia-induced hypotension and postoperative fluid replacement. Initiating early massage and repositioning activities could expedite the removal of tubes, thus lowering the risk of infection at the tube site and enhancing patient compliance.

In line with He *et al.*'s findings [23], the SF-36 scores and overall scores were

higher in the observation group, potentially due to preoperative education and glucose intake two hours before surgery, which may lessen psychological distress and bolster patient compliance, thereby preventing hypoglycemia and preserving physical fitness. Limiting intraoperative fluids can effectively maintain internal homeostasis and support the recovery of gastrointestinal motility. Thermostatic measures during surgery create an environment conducive to wound healing and gastrointestinal function, while postoperative massage aids in swift functional recovery. Moreover, thorough preoperative explanations and empathetic communication may lessen patients' psychological burdens and promote a relaxed state of mind; a controlled operating temperature can enhance the surgical experience, and postoperative psychological counseling alongside health education could help patients adjust their mindset and improve their mood.

In the advanced stages of esophageal cancer, patients often present with significant weight loss and malnutrition, which can impair immune function. Perioperative nutritional support is crucial for improving immunity and life quality [24]. The observation group demonstrated significant reductions in NRS-determined nutritional risk, disease severity scores, and overall scores compared to the control group post-intervention, mirroring Ding *et al.*'s research [25]. The improvements may result from preoperative carbohydrate supplementation and shortened fasting times, lessening intraoperative energy deficits. Postoperative antiemetic prophylaxis and judicious.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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