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The Application of Enhanced Recovery after Surgery in Perioperative Nursing of Patients Undergoing Transoral Robotic Surgery for Oral and Pharyngeal Tumors

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Abstract

Objective: To summarize the application of enhanced recovery after surgery (ERAS) in the perioperative nursing of patients undergoing transoral robotic surgery (TORS) for oral and pharyngeal tumor resection. **Methods:** A retrospective analysis was conducted on the perioperative enhanced recovery after surgery nursing of 142 patients with oral and pharyngeal tumors who underwent transoral robotic surgery at the Cancer Center of Sun Yat-sen University from March 2022 to July 2025. This includes strengthening preoperative multi-disciplinary joint physical examination and assessment, preoperative preparation and psychological care, postoperative airway management, oral care, dietary management, etc., as well as the prevention and treatment of complications. **Results:** The average surgery time for patients was 157.3 minutes, with an average intraoperative blood loss of 77.8 mL. Ten patients (7%) underwent tracheostomy, while the remaining patients did not and showed no symptoms of airway obstruction. Postoperative bleeding occurred in nine patients (6.3%), but no damage to normal organs was observed after hemostasis. Twenty-one patients (14.8%) had postoperative pain scores greater than 4, which were alleviated after symptomatic treatment. The postoperative nasogastric tube indwelling time was (15.2 ± 10.8) days, after which all patients could eat orally. The average hospital stay was 6.5 days. **Conclusions:** For patients undergoing TORS resection of oral and pharyngeal tumors, when implementing perioperative care in enhanced recovery after surgery, strengthening postoperative airway management, oral care, dietary management, etc., as well as the prevention and treatment of complications, can ensure the surgical outcome and promote the patient's recovery.

Keywords

Transoral Robotic Surgery, Enhanced Recovery after Surgery, Oral and Pharyngeal Tumors, Perioperative Nursing

1. Introduction

Oral and pharyngeal tumors mainly occur in the soft palate, tonsils, tongue base, epiglottis area, and pharyngeal wall. These are common malignant tumors of the head and neck. Clinically, they are usually treated with open surgery to remove the tumor, chemotherapy, radiotherapy, or a combination of chemoradiotherapy [1]. However, the application of open surgery is somewhat limited due to its invasiveness and the slow recovery post-operation [2]. Transoral robotic-assisted surgery (TORS), an emerging technology first applied in head and neck surgery in 2005 [3] [4], offers numerous advantages, including minimal invasiveness, fewer complications, no scarring of the jaw and face post-surgery, faster recovery of swallowing function, reduced need for tracheostomy, and shorter hospital stays [5]-[9]. As TORS has been increasingly adopted, it has now become an important part of head and neck tumor treatment. In recent years, the concept of enhanced recovery after surgery (ERAS) has been widely applied in various surgical fields, greatly accelerating the postoperative recovery process [10] [11]. This paper reports on the perioperative care for accelerated recovery surgery implemented for 142 patients with oral and pharyngeal tumors treated with transoral robotic surgery in our hospital's head and neck surgery department from March 2022 to July 2025.

2. Clinical Data

2.1. General Information

A retrospective collection of data was conducted on 142 patients who underwent transoral robotic surgery for the removal of oral and pharyngeal tumors at the Head and Neck Surgery Department of Sun Yat-sen University Cancer Center from March 2022 to July 2025. Among them were 107 males and 35 females, aged between 16 and 74 years, with an average age of 53.2 years. Types of diseases included: 47 cases of oropharyngeal tumors, 34 cases of tonsil tumors, 42 cases of tongue base tumors, 2 cases of palate tumors, 10 cases of parapharyngeal tumors, 1 case of tumor in the retromolar area, 1 case of oropharyngeal tumor with epiglottis involvement, 1 case of tonsil and thyroid tumor, 1 case of thyroid tumor with parapharyngeal tumor, 1 case of tonsil tumor with parapharyngeal tumor, 1 case of tonsil tumor with tongue base tumor, and 1 case of oropharyngeal and parotid gland tumor. TORS was often combined with synchronous neck dissection; among the 142 patients, 106 underwent synchronous neck dissection.

Inclusion criteria:

1) The tumor can be well exposed through transoral robotic surgery;

2) Benign tumors of the oropharynx, larynx, and hypopharynx;

3) T1, T2, and selective T3 stage malignant tumors of the oropharynx, larynx, and hypopharynx;

4) No involvement of the internal carotid artery, skull base, mandible, hard palate, thyroid cartilage, cricoid cartilage, prevertebral fascia, etc., as determined by examination;

5) No distant metastasis observed;

6) Able to tolerate general anesthesia surgery;

7) Informed consent provided by the patient and family for transoral robotic surgery.

Exclusion criteria:

1) Patients with limited mouth opening;

2) Unresectable neck lymph node metastasis [12];

3) Requirement to remove more than 50% of the tongue body or the posterior pharyngeal wall, necessitating flap repair afterward;

4) Presence of severe cervical spine diseases;

5) Patients with combined heart or lung dysfunction, or severe coagulation disorders, who cannot tolerate general anesthesia surgery;

6) Inability to tolerate postoperative coughing from tongue base and laryngeal surgery [6] [13] [14];

7) History of previous oral or nasopharyngeal surgery.

2.2. Treatment Method

All patients underwent transoral robotic surgery for tumor removal. Depending on the surgical requirements, intubation anesthesia was performed either orally or nasally. The surgeries utilized the Da Vinci Si or Xi surgical robot systems, along with Dingman or Feyh-Kastenbauer (F-K) mouth gags, and 0˚or 30˚high-definition 3D endoscopes [15].

2.3. Results

All 142 patients successfully underwent TORS. The surgery time ranged from 50 to 310 minutes, with an average of 157.3 minutes. Intraoperative blood loss ranged from 5 to 1300 mL, with an average of 77.8 mL; one case experienced major bleeding of approximately 1300 mL during surgery, which was controlled with hemostasis and packed with iodoform gauze. The patient was returned to the ICU with a tracheal tube for monitoring postoperatively. In this group, 10 patients (7%) underwent tracheostomy: 7 had prophylactic tracheostomy during surgery; 2 had wound bleeding on the day of surgery and immediately underwent debridement, suturing, and tracheostomy; 1 had tracheostomy on the 4th postoperative day due to wound swelling. The remaining patients did not undergo tracheostomy and showed no signs of airway obstruction. Postoperative bleeding occurred in 9 patients (6.3%): hemostasis was achieved through bedside symptomatic treatment in 6 cases; 2 required return to the operating room on the day of surgery for deb-

ridement, suturing, and tracheostomy; 1 experienced wound bleeding on the 7th postoperative day and underwent emergency debridement and suturing. No damage to normal organs occurred after hemostasis. Postoperative pain scores exceeded 4 in 21 patients (14.8%), and their pain was relieved after symptomatic treatment. The postoperative nasogastric tube was indwelling for an average of (15.2 ± 10.8) days, and all patients could eat orally after tube removal. The length of hospital stay ranged from 3 to 18 days, with an average of 6.5 days, as shown in Table 1.

Table 1. Perioperative special treatments and postoperative complications in 142 patients with oropharyngeal tumors.

Perioperative Special Treatments and Postoperative Complications	Proportion
Tracheostomy	10/142 (7%)
Postoperative Nasogastric Feeding	142/142 (100%)
Postoperative Bleeding/Transfusion	9/142 (6.3%)
Postoperative Pain	21/142 (14.8%)

3. Nursing

3.1. Preoperative Assessment and Care

3.1.1. Multidisciplinary Joint Examination and Assessment

Transoral robotic surgery does not routinely require a tracheostomy, making preoperative assessment particularly important to prevent postoperative bleeding and asphyxiation. During the early morning briefing, the entire department's medical staff holds a preoperative discussion for the case. Anesthesiologists determine the anesthesia method and drug choice based on the patient's medical history and preoperative examinations and ensure continuous monitoring and management throughout the procedure. Surgeons inform the patient about the surgical process, potential risks, and postoperative complications. Meanwhile, nursing staff develop an ERAS (enhanced recovery after surgery) perioperative care safety plan based on the patient's medical history and surgical method, provide health education, distribute disease-related informational brochures, and address any patient concerns.

3.1.2. Preoperative Preparation

Advise patients to stop smoking for at least 1 - 2 days, maintain blood pressure below 150/90 mmHg, and control blood sugar. Diabetic patients should maintain glycated hemoglobin levels below 7% preoperatively [16]. Patients should fast for 6 hours and refrain from drinking for 2 hours before surgery [17] [18]. Non-diabetic patients may drink up to 200 ml of an electrolyte beverage 2 hours before surgery, while diabetic patients may have up to 100 ml of warm water 4 hours before surgery. On the day before surgery, prepare the skin and use mouthwash three times a day. To ensure patients have a good night's sleep before surgery,

maintain a quiet environment in the ward at night.

3.1.3. Psychological Care

A patient's psychological state can directly or indirectly affect postoperative recovery and treatment outcomes [19]. To ensure the surgery proceeds smoothly, nursing staff must understand the patient's actual psychological condition and conduct a psychological assessment. They should provide targeted psychological support and facilitate peer education by inviting patients who have recovered well and maintain a positive attitude to share their experiences. This approach can help alleviate negative emotions and reduce the psychological burden on the patient.

3.2. Postoperative Care

3.2.1. Positioning Care

After returning to the ward, the responsible nurse assesses whether the patient is conscious. If the patient is not yet awake post-surgery, they should be positioned supine with the head turned to one side. Once consciousness is regained, gradually raise the head of the bed incrementally. Within the first 2 hours post-surgery, the patient can be placed in a left lateral, supine, or right lateral position. After 2 hours, the head of the bed can be gradually elevated to prevent postoperative backache and facial edema [20].

3.2.2. Airway Care

For patients in this group, the average duration of cardiac monitoring was 6.6 hours. If there are no underlying diseases like hypertension and the patient's vital signs were stable during the surgery, cardiac monitoring continues for 2 hours post-surgery. Low-flow oxygen is administered continuously until 8 a.m. the morning after surgery. Close monitoring of the patient's postoperative respiratory status is essential, including checking oral secretions and for any signs of bleeding at the surgical site. Be vigilant for signs of respiratory distress and hypoxia, such as chest tightness, shortness of breath, cyanosis of the lips, or decreased oxygen saturation. If there are early signs of airway obstruction or asphyxia, establish an artificial airway promptly according to the patient's condition to ensure proper ventilation and normal blood oxygen saturation [21] [22]. To prevent airway infections and facilitate sputum discharge, begin administering oxygen aerosol inhalation with 8000 units of bromelain and 1 mg of budesonide suspension (Pulmicort Respules) on the first day after surgery, 2 to 3 times daily (Tid).

The purpose of performing a tracheostomy is to prevent airway asphyxiation caused by postoperative bleeding and laryngeal edema. High-risk factors for tracheostomy in TORS include: a relatively large wound involving the soft palate, tongue base, posterior pharyngeal wall, and parapharyngeal area, which may lead to local edema obstructing the airway; and a deeper wound with exposed oropharyngeal blood vessels [23]. In this group, the tracheostomy rate was 7%. To ensure patient safety and prevent airway edema from causing asphyxiation, 12 patients

were monitored in the intensive care unit with anesthesia tubes in place postoperatively. This approach reduced the tracheostomy rate and fully demonstrated the minimally invasive advantages of TORS.

3.2.3. Oral Care

Some researchers believe that the prophylactic use of antibiotics during the perioperative period can effectively reduce the incidence of postoperative incision infections [24]. In addition to using medications to prevent infection, oral care is a primary method for preventing postoperative infections in patients with oral cancer [25]. Post-surgery, the patient's oral hygiene and wound condition should be checked once per shift. When using a tongue depressor, caregivers should avoid applying excessive force or depth that might disturb the wound. Patients should be instructed to rinse their mouths with cetylpyridinium chloride mouthwash three times daily (Tid). In the morning and evening, use cotton swabs or gauze to gently clean the mouth, ensuring not to touch the wounds at the tongue base and throat.

3.2.4. Dietary Care

Due to the specific nature of the surgical site, postoperative feeding through a nasogastric tube can help prevent wound infection, bleeding, or delayed healing. For patients with larger wounds and a higher risk of bleeding, we generally recommend nasogastric feeding for two weeks [26]. Before feeding, check the external length of the gastric tube and ensure there are no loops in the mouth to confirm that the tube is positioned correctly in the stomach. The patient should be in a semi-recumbent position during feeding, with a feeding rate of 10 - 15 mL/min, and each session should not exceed 200 mL. After feeding, patients should be encouraged to get out of bed and move around to promote gastrointestinal motility and prevent reflux or aspiration of food [27]. According to Zhang Xing *et al.* [28], the average duration for which patients had a nasogastric tube in place post-surgery was (15.2 ± 10.8) days. After removing the nasogastric tube, patients should start with a liquid diet and progress to a semi-liquid diet once there is no swallowing pain. It is best to have small, frequent meals with food that is at a moderate temperature.

3.2.5. Discharge Instructions and Follow-Up

On the day of discharge, targeted discharge education is provided based on the patient's condition, educational materials are distributed, and the patient is advised to attend regular follow-up appointments. The duration from admission to discharge is approximately 6.5 days.

3.3. Observation and Management of Postoperative Complications

3.3.1. Bleeding

Postoperative bleeding remains the most common complication of TORS [29]. A meta-analysis and systematic review indicate that the incidence of bleeding after

TORS ranges from 3.1% to 19.7% [30], with risk factors including anticoagulation therapy, radiotherapy, and large tumor size. Patients are instructed to promptly spit out any abnormal oral secretions and observe the color. In cases of minor oozing, rinsing with iced saline is recommended. If bleeding increases, the patient should immediately notify the doctor for urgent compression and hemostasis treatment.

In this group, the postoperative bleeding rate was 6.3%, which is comparable to the single-center postoperative bleeding rate (7.5%) reported by Hay *et al.* [31].

In the first case, a patient with a tongue base tumor experienced neck wound bleeding and difficulty breathing 2 hours post-surgery due to coughing. This was caused by a small arterial bleed on the surface of the prevertebral fascia in the left neck area III, with an estimated blood loss of about 170 mL. To prevent hemorrhagic shock, high-flow oxygen, intravenous access, and blood volume replenishment were administered. The patient was immediately taken to the operating room for neck debridement, suturing, and tracheostomy, resulting in a successful rescue.

In the second case, a patient with left tongue and tongue base tumors experienced oral wound bleeding 4 hours post-surgery, due to an active bleed from a branch of the lingual artery, with an estimated blood loss of about 300 mL. To ensure airway patency, the patient was assisted to sit upright with the head tilted forward, provided with suctioning, high-flow oxygen, and iced saline rinses, and intravenous access was established for blood volume replenishment. The patient was promptly taken to the operating room for oral debridement, suturing, and tracheostomy, resulting in successful rescue with no airway obstruction or asphyxia.

3.3.2. Pain

Postoperative pain after TORS not only increases patient discomfort but can also trigger inflammatory responses, affecting patient comfort [31] [32]. When patients experience wound pain post-surgery, the responsible nurse assesses the pain level using the facial expression pain scale and instructs patients on how to accurately describe the nature and severity of their pain, implementing targeted pain management measures. In this group, 21 patients had postoperative pain scores greater than 4. According to medical advice, they were given Ketoprofen (50 - 100 mg) intravenously or Tramadol (100 mg) via intramuscular injection, which resulted in pain relief. When pain scores later dropped below 3, methods such as bed rest and listening to music were used to divert attention, and no analgesic treatment was given. The pain gradually subsided.

4. Development of the Nursing Plan

Based on a summary of clinical nursing experience, a perioperative ERAS (Enhanced Recovery After Surgery) nursing plan was developed, as shown in **Table 2**.

Table 2. Perioperative ERAS nursing plan.

Primary Item	Secondary Item	Tertiary Item
Preoperative Assessment and Care	Multidisciplinary Physical Examination and Assessment	Physicians from the entire department conduct a preoperative discussion on the case.
	Preoperative Consultation	The surgeon explains the surgical procedure, surgical risks, and possible postoperative complications to the patient.
	Anesthesia Consultation	The anesthesiologist determines the anesthesia method and choice of anesthetic drugs based on the patient's medical history and preoperative examination results.
	Preoperative Education	Nursing staff develop an ERAS perioperative nursing safety plan based on the patient's medical history and surgical method.
	Educational Methods	Patients watch videos and receive pamphlets related to the disease.
Preoperative Preparation	Dietary Education	1) Quit smoking for at least 1 to 2 days, maintain blood pressure below 150/90 mmHg, and for diabetic patients, keep glycated hemoglobin below 7% before surgery. 2) Prepare the surgical area and use mouthwash for oral hygiene three times a day. 3) Ensure the patient has a good sleeping environment before surgery. Fast for 6 hours and refrain from drinking for 2 hours before surgery. Nondiabetic patients may consume up to 200 ml of an electrolyte drink 2 hours before surgery, while diabetic patients may drink up to 100 ml of warm water 4 hours before surgery.
	Psychological Care	Conduct a psychological assessment of the patient, provide targeted psychological counseling, and initiate peer education.
Postoperative Care	Positioning Care	Assess if the patient is awake, and keep them in a supine position with their head turned to one side until they regain consciousness. Maintain a supine position for the first 2 hours postoperatively; after 2 hours, gradually elevate the head of the bed to a semi-recumbent position.
	Airway Care	1) If the patient has no underlying diseases and vital signs are stable during surgery, conduct cardiac monitoring for 2 hours postoperatively. 2) Monitor the patient's breathing postoperatively for signs of chest tightness, rapid breathing, cyanosis of the lips, and decreased blood oxygen saturation, which are early signs of respiratory distress and hypoxia; continue low-flow oxygen therapy until 8 a.m. on the first postoperative day. 3) Observe the patient's oral secretions and check for wound bleeding. 4) Starting on the first postoperative day, administer oxygen nebulization with 8000 U of chymotrypsin and 1 mg of budesonide suspension (Pulmicort Respules) three times a day.
	Oral Care	Inspect oral hygiene and wound condition during each shift. Do not apply excessive force or depth when using a tongue depressor to avoid touching the wound.

Continued

		Rinse the mouth with a cetylpyridinium chloride solution three times a day; use a cotton swab or gauze to clean the oral cavity gently in the morning and evening, avoiding contact with the root of the tongue and throat wounds.
	Dietary Care	Before feeding through a nasogastric tube, check the exposed length of the tube and ensure there are no loops in the oral cavity, confirming the tube is in the stomach; Position the patient in a semi-recumbent position during feeding at a rate of 10 - 15 mL/min, not exceeding 200 mL per feeding. Encourage the patient to get out of bed and move around after feeding.
	Discharge Instructions	Provide tailored discharge education based on the patient's condition, distribute educational materials, and inform the patient about regular follow-up appointments.
Observation and Management of Postoperative Complications	Bleeding	Instruct the patient to spit out any abnormal oral secretions immediately and observe the color of the secretions. If there is a slight oozing of blood, rinse with iced saline. If the bleeding gradually increases, notify a doctor immediately for urgent pressure hemostasis treatment.
	Pain	Use the Facial Expression Pain Scale to assess the patient's pain level. Guide the patient in accurately expressing the nature and intensity of wound pain and implement targeted pain management measures.

5. Conclusions

Over the past two decades, the number of individuals with oropharyngeal squamous cell carcinoma has been increasing globally, especially among younger patients with HPV-positive oropharyngeal cancer [33]-[35]. With the advancements and widespread use of surgical robots, TORS (Transoral Robotic Surgery) has been extensively applied in the treatment of oral and oropharyngeal tumors, benefiting patients. Implementing Enhanced Recovery After Surgery (ERAS) nursing can alleviate preoperative anxiety by explaining the ERAS concept to patients, providing personalized preoperative guidance, and conducting anticipatory psychological care, which can reduce patients' fear of surgery and improve anxiety. Additionally, it allows patients to understand possible postoperative discomforts and coping methods in advance, enhancing their involvement in clinical decision-making and thereby increasing compliance [36].

Currently, most literature discusses the indications, surgical techniques, and oncological outcomes of TORS in depth [37]-[39], but there are few articles on the implementation of ERAS nursing during the perioperative period. Therefore, this paper summarizes the application of ERAS in perioperative nursing for patients undergoing TORS for the removal of oral and oropharyngeal tumors. Since this is a retrospective summary, a control group without an ERAS protocol was not designed, and specific times for nasogastric tube removal after discharge could not be tracked. Thus, more detailed comparative studies and follow-ups are needed in the future.

Without performing tracheostomy, TORS highlights its minimally invasive advantages while ensuring patient safety. However, for cases with higher tumor staging and extensive neck dissection, there is a need to be vigilant about wound bleeding. This requires us to standardize and implement preoperative assessment strategies and postoperative care, strengthen postoperative airway management, oral care, dietary management, and the prevention and management of complications for patients undergoing TORS for oral and oropharyngeal tumor removal. It is believed that with the continued application of ERAS in perioperative nursing and related clinical research, the era of minimally invasive treatment for oral and oropharyngeal tumors will become brighter, thereby promoting patient recovery, improving nursing satisfaction, and providing valuable insights for clinical practice.

Conflicts of Interest

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

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