REPORT

Individualized Nursing Support for Pulmonary Rehabilitation Participation Following Esophagectomy: A Case Report Guided by the Patient Health Engagement Model

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Abstract

Esophagectomy is the cornerstone of curative-intent treatment for resectable esophageal cancer, but postoperative course is frequently complicated by pain, impaired airway clearance, reduced respiratory function, and high risk of pulmonary complications (PPCs), which prolong recovery, increase morbidity and mortality, and can delay oncologic care. Early pulmonary rehabilitation is a core component of enhanced recovery after esophagectomy, yet patient participation is often limited by pain, drainage tubes, fear of movement, and insufficient understanding. The Patient Health Engagement (PHE) model describes patient progression through emotional, cognitive, and behavioral readiness to participate in their own care, offering a practical framework for oncology nursing. We report a 71-year-old man with recurrent thoracic esophageal squamous cell carcinoma (rT3N1M0) who underwent minimally invasive McKeown esophagectomy. Preoperatively he had mild ventilatory impairment, poor breathing and coughing technique, and marked fear of pain, bleeding, wound disruption, and tube displacement postoperatively. On day 1, despite stable status and analgesia, he refused mobilization. PHE-guided nursing support was delivered perioperatively. His participation shifted from passive avoidance to self-initiated ambulation, with walking volume increasing from 500 steps on day 1 to over 7000 steps by day 5. A temporary regression with pleural effusion resolved after drainage and renewed support. At follow-up he continued home exercises without respiratory readmission. This case indicates engagement-oriented nursing care promotes early pulmonary rehabilitation after esophagectomy, warranting evaluation in larger cohorts.

Keywords: esophageal cancer, esophagectomy, pulmonary rehabilitation, postoperative pulmonary complications, Patient Health Engagement model, perioperative supportive care, oncology nursing.

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1 Introduction

Esophageal cancer is among the most lethal gastrointestinal malignancies, and surgical resection remains the mainstay of curative-intent treatment for locally advanced resectable disease [1, 2]. Esophagectomy, however, is one of the most physiologically demanding oncologic operations, and the postoperative course is frequently complicated by pain, impaired airway clearance, and reduced respiratory function, with postoperative pulmonary complications (PPCs) representing one of the most common and clinically significant sources of morbidity and mortality after surgery, as documented in both institutional and national registry studies [1, 2]. Reducing pulmonary complications is therefore an important outcome target within perioperative and supportive care for patients undergoing esophageal cancer surgery.

Early pulmonary rehabilitation—structured breathing exercises, effective coughing, and progressive ambulation—is widely recognized as an essential component of enhanced perioperative recovery and supportive nursing care after esophagectomy [3–6]. Although structured rehabilitation programs, including both prehabilitation and postoperative protocols, are increasingly implemented, patients' actual participation across the perioperative continuum remains inconsistent [3, 7, 8]. This is particularly evident among older patients, who may face multiple postoperative drains, physical discomfort, reduced confidence, and fear of movement [9]. Concerns about pain, bleeding, wound disruption, or tube displacement can delay mobilization even when instructions have been provided and the patient's clinical condition is stable [10, 11]. Promoting pulmonary rehabilitation after esophageal cancer surgery therefore requires not only the delivery of exercise instructions, but also attention to patients' emotional responses, risk perceptions, and readiness to participate.

The Patient Health Engagement (PHE) model emphasizes that engagement in health behaviors develops progressively through emotional adaptation, cognitive understanding, and increasing self-efficacy [12]. Within supportive oncology nursing, this perspective may help nurses identify patients' changing engagement states and tailor support to their current readiness for rehabilitation. However, limited attention has been paid to how PHE-informed nursing support can be translated into perioperative pulmonary rehabilitation practice after esophageal cancer surgery. This case study describes an elderly patient with recurrent esophageal cancer who experienced fear, low initial participation, and temporary regression during postoperative recovery, and illustrates how individualized, engagement-guided nursing support facilitated progressive participation in pulmonary rehabilitation as part of perioperative supportive cancer care.

2 Case Presentation

2.1 Patient information and preoperative assessment

A 71-year-old man with a body mass index of 20.45 kg/m^2 was admitted with recurrent middle thoracic esophageal squamous cell carcinoma, clinically staged as rT3N1M0. His medical history included hypertension and a 30-year smoking history of approximately 40 cigarettes per day; he had stopped smoking 3 years earlier. Three years before this admission, he had undergone endoscopic submucosal dissection for esophageal cancer at another hospital. After tumor recurrence, he received one cycle of chemotherapy, but the response was unsatisfactory and progressive dysphagia developed.

Preoperatively, he had nutritional risk, with an unintentional weight loss of approximately 3 kg during the preceding month and a Nutritional Risk Screening 2002 score of 3. Serum albumin was generally within the normal range. His baseline walking ability was acceptable, but his mastery of pulmonary rehabilitation skills, including pursed-lip breathing and effective coughing, was poor. Pulmonary function testing showed mildly restrictive ventilatory impairment, with a vital capacity of 2.49 L, forced vital capacity of 2.68 L, forced expiratory volume in 1 second of 1.90 L, and a forced expiratory volume in 1 second/forced vital capacity ratio of 71%. Diffusing capacity was also reduced, with a transfer factor for carbon monoxide of 5.06 mmol/min/kPa.

Before surgery, the patient had limited understanding of postoperative pulmonary rehabilitation. He was concerned that early mobilization might aggravate pain, cause wound disruption or bleeding, or lead to tube displacement. His initial participation was characterized by passive acceptance, avoidance, dependence on reassurance from nurses and family members, and little active questioning. His family also tended to be overprotective and worried that postoperative activity might be unsafe.

2.2 Surgical procedure and early postoperative condition

On February 10, 2026, the patient underwent minimally invasive McKeown esophagectomy with cervical esophagogastric anastomosis. The procedures included thoracoscopic and laparoscopic esophagectomy, mediastinal, hilar, and abdominal lymph node dissection, thoracic duct ligation, partial gastrectomy, and pyloroplasty. The operation lasted approximately 5 hours, with an estimated blood loss of 100 mL. General anesthesia combined with epidural anesthesia was used.

Postoperative analgesia was provided using patient-controlled epidural analgesia (PCEA). The analgesic solution contained hydromorphone hydrochloride 2 mg and ropivacaine hydrochloride 0.2% 40 mL, diluted to a total volume of 250 mL. The background infusion rate was 3 mL/h, with a patient-controlled bolus dose of 3 mL and a lockout interval of 15 minutes. Pain was assessed using the Numeric Rating Scale. During the early postoperative period, pain was generally mild at rest, approximately 2–3 points, but increased to 4–5 points during movement and the first mobilization attempt. Thus, although pain required ongoing monitoring, the patient's reluctance to mobilize was mainly associated with anticipated pain and safety concerns rather than uncontrolled pain alone.

On postoperative day 1, the patient received intermittent low-flow oxygen through a nasal cannula, and oxygen saturation remained generally stable during bedside assessment and assisted activity. Multiple tubes were still in place, including a nasogastric feeding tube, gastrointestinal decompression tube, left cervical negative-pressure drainage tube, right chest tube, mediastinal drainage tube, urinary catheter, implanted venous access port, and epidural analgesia catheter. This combination of postoperative discomfort, tube burden, fatigue, and fear of wound disruption, bleeding, and tube displacement substantially increased his reluctance to start early mobilization.

2.3 PHE-guided individualized nursing support and rehabilitation progression

In this case, pulmonary rehabilitation participation was described using acceptance of rehabilitation activities, need for prompting, completion of breathing and coughing exercises, walking volume, self-initiated mobilization, response to setbacks, and continuation of home-based rehabilitation.

Before surgery, the patient's engagement status was considered to be between the Blackout and Arousal phases of the PHE model. Nursing support therefore focused not only on rehabilitation instruction, but also on preparing the patient and his family for participation. The nursing team explained, in simple language, the relationship between early mobilization, airway clearance, and prevention of PPCs. Pursed-lip breathing, abdominal breathing, and effective coughing were demonstrated. The patient was helped to set an initial postoperative goal of bedside standing and short-distance walking. Family members were also educated to provide emotional reassurance, assist with safe position changes, and observe drainage tubes during mobilization, rather than simply encouraging bed rest.

On postoperative day 1, despite stable bedside assessment and acceptable pain control at rest, the patient refused the first mobilization attempt. He said he was afraid that movement would "open the wound," cause internal bleeding, or pull out the tubes. The nursing team provided approximately 10 minutes of individualized bedside communication, emphasizing that mobilization would be performed under monitoring, with tubes secured and activity intensity adjusted according to pain, oxygenation, and fatigue. Family members were invited to stand beside the patient, offer reassurance, and help observe the tubes under nursing guidance. With this support, the patient completed bedside standing in the morning. After rest and reassessment, he accepted assisted ambulation in the ward in the afternoon and walked approximately 200 m.

This first successful mobilization became an important turning point. From postoperative days 2 to 5, pulmonary rehabilitation was continued daily, including breathing exercises, effective coughing, sputum expectoration, and progressive ambulation according to tolerance. Activity intensity was adjusted according to pain, fatigue, oxygenation, and tube-related discomfort. During this period, the patient gradually shifted from resistance to cooperative completion of prescribed activities, corresponding to the Adhesion phase. His walking volume increased from approximately 500 steps on postoperative day 1 to nearly 7000 steps by postoperative day 5. Sputum expectoration improved, and he required less repeated prompting from nurses and family members. Removal of the urinary catheter on postoperative day 1, the chest tube on postoperative day 2, and the gastrointestinal decompression tube on postoperative day 5 further

reduced his perceived burden during activity.

By February 15, the patient showed clear self-initiated rehabilitation behavior. He began to request ambulation actively, usually walking more than three ward rounds each time and repeating this approximately three times per day. Compared with the immediate postoperative period, he expressed less fear of pain and tube displacement and showed greater confidence in recovery. This change suggested a transition toward the Eudaimonic project phase, in which rehabilitation was increasingly perceived as part of his own recovery goal rather than merely a task required by nurses.

Rehabilitation participation was not linear. On February 23, the patient developed bilateral pleural effusion with chest tightness and exertional dyspnea. Bilateral pleural drainage was performed, and his activity level temporarily decreased. He again became hesitant to walk and worried that activity might aggravate his condition, indicating a temporary regression toward fear-based avoidance. After drainage relieved respiratory discomfort, the nursing team reassessed pain, oxygenation, fatigue, and tube safety, explained the reason for the setback, and encouraged gradual resumption of walking and breathing exercises according to tolerance. With renewed support, the patient gradually resumed daily pulmonary rehabilitation. The pleural drainage tubes were removed on the second day after drainage. A concise timeline of the patient's clinical course, engagement state, PHE phase, and nursing response is presented in Table 1.

Table 1. Timeline of clinical events, engagement state, and PHE-guided nursing support.

Time point	Clinical event	Engagement state / PHE phase	Nursing response	Rehabilitation outcome
Preoperative period	Mild restrictive ventilatory impairment; poor mastery of breathing and coughing techniques	Limited understanding, fear, and dependence on reassurance; Blackout/Arousal	Explained the purpose of pulmonary rehabilitation; demonstrated breathing and coughing techniques; set an initial mobilization goal; educated family members	Initial understanding improved, but hesitation remained
POD1, Feb 11	Multiple tubes in place; PCEA; stable oxygenation	Refused first mobilization because of fear of pain, bleeding, wound disruption, and tube displacement; Arousal	Provided individualized bedside explanation; secured tubes; involved family members in reassurance and assisted mobilization	Completed bedside standing in the morning and walked approximately 200 m in the afternoon
POD2–POD5	Gradual recovery; urinary catheter, chest tube, and gastrointestinal decompression tube removed sequentially	Resistance decreased; cooperative participation developed; Adhesion	Continued breathing exercises, effective coughing, sputum expectoration, and progressive ambulation; adjusted activity according to tolerance	Walking volume increased from approximately 500 steps to nearly 7000 steps; prompting decreased
Feb 15	Improved activity tolerance	Self-initiated ambulation; transition toward Eudaimonic project	Provided positive feedback and encouraged self-monitoring	Actively requested ambulation; walked more than three ward rounds each time, approximately three times daily
Feb 23	Bilateral pleural effusion with chest tightness and exertional dyspnea; pleural drainage performed	Temporary decline in activity and renewed fear; regression toward Arousal	Reassessed symptoms and tube safety; explained the setback; encouraged gradual restart after symptom relief	Walking and breathing exercises resumed after drainage
Discharge and follow-up	Discharged on Feb 25 after a 20-day hospital stay	Stable willingness to continue rehabilitation; Maintenance	Provided home-based rehabilitation plan and telephone follow-up	Continued walking and breathing exercises at 1-week and 1-month follow-up

2.4 Follow-up and outcomes

The patient was discharged on March 1, 2026, after a 20-day hospital stay. Before discharge, the cervical negative-pressure drainage tube and mediastinal drainage tube had been removed. His willingness to participate in pulmonary rehabilitation remained stable.

A home-based rehabilitation plan was provided, including progressive walking according to tolerance, breathing exercises, effective coughing, sputum expectoration, and observation of symptoms such as chest tightness, dyspnea, fever, or reduced exercise tolerance. The patient and his family were instructed to avoid both excessive inactivity and unsafe overexertion, and to adjust activity intensity according to fatigue, pain, and respiratory symptoms.

Telephone follow-up was conducted at 1 week and 1 month after discharge. The patient reported that he continued home-based walking and breathing exercises regularly. No rehospitalization related to respiratory deterioration was reported during follow-up. His family continued to encourage activity while helping monitor symptoms and safety.

2.5 Patient perspective

The patient reported that he had initially been afraid that early mobilization would cause bleeding, wound disruption, or tube displacement. He recalled, "There were too many tubes, and I really did not dare to get out of bed at first." After the first successful ambulation, he felt that walking was "not as frightening as expected" when nurses and family members provided support. His family also reported that they had initially preferred him to remain in bed for safety, but bedside guidance helped them understand how to assist safe mobilization rather than simply protect him from activity.

3 Discussion

This case highlights that the main challenge in postoperative pulmonary rehabilitation after esophageal cancer surgery may not be the rehabilitation protocol itself, but the patient's readiness to participate. Although early mobilization and respiratory exercises are routinely recommended after esophageal surgery, older patients often experience fear related to pain, bleeding, wound disruption, and tube displacement [8, 13]. In this patient, reluctance to stand or walk on postoperative day 1 was mainly driven by perceived risk rather than actual physical instability, as vital signs and oxygenation were stable and PCEA had already been established. This suggests that early rehabilitation barriers should be assessed not only from a physical perspective, but also in relation to the patient's emotional response, risk perception, understanding of rehabilitation, and confidence in safe activity.

The PHE model provided a useful framework for interpreting this process. Before surgery and during the first mobilization attempt, the patient showed features consistent with the Blackout/Arousal phases, including limited understanding, fear, avoidance, and dependence on external reassurance. At this stage, routine instruction alone was unlikely to be sufficient. Individualized bedside explanation, clarification of safety boundaries, tube protection, and family-assisted reassurance helped reduce uncertainty and created conditions for the patient to attempt mobilization. Therefore, the nursing intervention in this case was not limited to delivering rehabilitation instructions; it focused on preparing the patient emotionally and cognitively for participation.

A notable finding was that the first successful mobilization appeared to serve as an important turning point. After bedside explanation, family-assisted encouragement, and successful first ambulation, the patient's fear gradually decreased and willingness to cooperate increased. In the following days, walking volume increased steadily, and rehabilitation behavior progressed from externally prompted activity to more cooperative participation. This process is consistent with the view that early successful experience may strengthen self-efficacy and confidence in postoperative recovery [14, 15]. From the PHE perspective, the patient gradually moved from fear-based avoidance toward the Adhesion phase, in which he began to accept the rehabilitation plan and complete prescribed activities with decreasing external prompting.

Another important observation was that rehabilitation participation did not improve linearly. When bilateral pleural effusion occurred during recovery, activity temporarily decreased because of chest tightness and exertional dyspnea, and fear of movement reappeared. However, after drainage, symptom relief, and repeated supportive communication, participation resumed. This suggests that engagement during postoperative recovery is dynamic and may fluctuate in response to complications or symptom changes. The PHE phases should therefore not be regarded as fixed labels, but as

changing states that require continuous reassessment. Nursing support should be adjusted according to the patient's current symptoms, psychological readiness, and perceived safety, rather than relying only on a routine rehabilitation schedule.

Family involvement also played an important role in this case. At first, the family's protective attitude reflected concern for the patient's safety, but it also had the potential to reinforce avoidance and bed rest. Through bedside education, family members were guided to provide emotional support, assist with safe position changes, and observe drainage tubes during mobilization. Their role therefore shifted from overprotection to guided support for safe rehabilitation. This may be particularly relevant in clinical settings where family members are closely involved in perioperative cancer care and strongly influence patients' emotions and decisions.

These observations also have relevance for oncologic outcomes. PPCs after esophagectomy are associated with prolonged hospitalization and higher short- and long-term mortality [1, 2, 10, 11], as well as a reduced ability to tolerate or complete adjuvant treatment [1, 11]. Interventions that promote early, sustained pulmonary rehabilitation are therefore not merely rehabilitation measures but potential contributors to the broader perioperative and oncologic recovery pathway. Positioning engagement-guided nursing support within enhanced-recovery and supportive-care programs for esophageal cancer surgery may help align bedside nursing practice with measurable perioperative outcomes, an area increasingly emphasized within oncology outcomes research.

This case has several clinical implications. First, assessment before and after esophageal cancer surgery should include not only physical function, pain, and respiratory status, but also rehabilitation understanding, fear of movement, perceived risk, and family attitudes. Second, the first mobilization attempt should be treated as a key nursing intervention point; a safe and achievable first success may help reduce fear and build confidence for subsequent rehabilitation. Third, when postoperative complications occur, reduced activity should not be interpreted simply as poor adherence—nurses should reassess the patient's symptoms and engagement state, adjust rehabilitation goals, and provide renewed support. Finally, family education should be incorporated into pulmonary rehabilitation support, especially for older patients with high perceived risk and multiple postoperative tubes.

Several limitations should be acknowledged. This is a single case report from one center, and causal conclusions cannot be drawn. The improvement in rehabilitation participation may have been influenced by natural postoperative recovery, tube removal, symptom relief, family support, and other clinical factors. In addition, pulmonary rehabilitation participation was evaluated descriptively using indicators such as acceptance of rehabilitation activities, need for prompting, walking volume, self-initiated ambulation, and continuation of home-based rehabilitation, rather than a validated participation or engagement scale. Pain, oxygenation, and respiratory outcomes were based on routine clinical assessment rather than continuous standardized measurement. The follow-up period was short, and the patient's long-term adherence to home-based rehabilitation and longer-term pulmonary and oncologic outcomes remain unclear. Despite these limitations, the case shows how PHE-guided nursing support can be used at the bedside to identify engagement barriers and adjust rehabilitation support after esophageal cancer surgery.

4 Conclusion

This case study suggests that participation in pulmonary rehabilitation after esophageal cancer surgery depends not only on exercise prescription, but also on the patient's changing confidence, symptom burden, and perceived safety. In an elderly patient with postoperative pain, multiple tubes, fear of movement, and a temporary setback caused by pleural effusion, PHE model–guided individualized nursing support helped promote a transition from passive avoidance to active participation and supported renewed engagement after regression. Continuous assessment of engagement readiness, structured support for first mobilization, family education, and flexible adjustment of rehabilitation goals may be useful components of perioperative pulmonary rehabilitation nursing and supportive cancer care. Given the established link between pulmonary rehabilitation, PPC prevention, and downstream oncologic recovery, further studies with larger samples, standardized outcome measures, and longer follow-up are needed to evaluate the effectiveness and scalability of this engagement-oriented approach and its impact on perioperative and oncologic outcomes.

Data Availability Statement

Data will be made available on request.

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Conflicts of Interest

The author declares no conflicts of interest.

AI Use Statement

The authors declare that no generative AI was used in the preparation of this manuscript.

Ethical Approval and Consent to Participate

This case report was approved by the Ethics Committee of Zhejiang Cancer Hospital (Approval No. IRB-2025-1228). Written informed consent for publication of this case report was obtained from the patient. All patient-identifiable information was removed.

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