RESEARCH ARTICLE

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Practices and Barriers to Early Mobilization in Intensive Care Unit Post Head and Neck Cancer Surgeries: An Observational Study

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Abstract

Background: Head and neck cancer (HNC) is a growing global health concern, with rising incidence in India. Patients undergoing HNC surgery experience postoperative challenges due to altered airway anatomy and complex reconstruction. Enhanced Recovery After Surgery (ERAS) protocols recommend early mobilization (EM) to improve postoperative outcomes; however, its implementation remains inconsistent. Evidence regarding EM practices in this population is limited. This study aimed to evaluate EM practices and their barriers in post HNC surgery patients in a tertiary care setting. **Methods:** A prospective observational study was conducted among adults undergoing HNC surgery. Patients with neurological deficits or preoperative non-ambulatory status were excluded. Mobilization was assessed daily until postoperative day (POD) 5 using the ICU Mobility Scale (IMS). Barriers to EM were documented using a validated checklist and categorized into three domains. Logistic regression analyses were performed to identify factors associated with non-ambulatory status (IMS<5). Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported. A p<0.05 was considered statistically significant. **Results:** Among the 69 patients included, 69.6% patients received in-bed exercises, while 27.5% had not been mobilized on POD 1. On POD 3, 23.1% were ambulated with assistance. More than 75% of the patients were ambulated and shifted to the wards by POD 5. Major functional and clinical barrier domains included nasotracheal intubation (75.4%), respiratory distress (53.6%) and free flap reconstruction (28.9%). The system-provider domain included low prioritization of EM (46.4%) and communication gaps among healthcare professionals (7.26%). This domain was independently associated with non-ambulatory status (aOR 0.402, 95% CI 0.172–0.817, p=0.020). **Conclusion:** EM practices showed a consistent but gradual improvement over the five postoperative days. Though patient related barriers were common, the overall mobility outcomes were mainly determined by the system-provider domain of barriers. Addressing barriers to EM is crucial for enhancing its practice and ensuring adherence to EM protocols.

Keywords: Early Mobilization, Barriers, Head and neck cancer, Postoperative recovery

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Introduction

Based on GLOBOCAN 2022 statistics, head and neck cancer (HNC) ranks among the most prevalent cancers, with over 400,000 new cases of HNC diagnosed annually. A substantial majority around two-thirds of these cases are reported from Asia, with India being a major contributor [1]. HNC represents 30% of all cancer cases in India, with approximately 90% classified as squamous cell carcinoma [2, 3]. Over the last 20 years, treatment for HNC has advanced significantly, with a focus on minimizing post-treatment complications and morbidity [4, 5].

Surgical treatment for head and neck cancer often involves wide tumour excision, neck dissection, and microvascular free-flap reconstruction [6]. Primary tumour resection often uses minimally morbid reconstructive surgeries to reduce impact and restore function [7, 8]. Various flaps are utilized for reconstructive purposes, with free flaps considered the gold standard for addressing extensive defects. They allow multi-tissue transfer without positioning limits [4, 9]. Although evidence is limited, postoperative bed rest is commonly recommended due to concerns about compromising the flap's vascular integrity [10].

Bed rest, a common intervention for critically ill adults, is now a questionable therapeutic option [11]. Prolonged bed rest can cause muscle weakness, restricted joint mobility, critical illness myoneuropathy, and increased risk of deep vein thrombosis, etc [12, 13]. Fluid loss affects the cardiac system, impairing circulation [14].

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The supine position reduces ventilatory volume and secretion clearance, causing atelectasis and pneumonia [12, 14]. Furthermore, the residual effects of anaesthesia can augment the effects of bed rest by reducing functional residual capacity and, in some cases, contributing to the development of atelectasis. It also temporarily suppresses central nervous system activity, causing a controlled loss of consciousness, sensation, and motor control [15]. These combined physiological impairments could adversely impact physical and psychological function, leading to a lower quality of life [12-14]. Therefore, balancing mobility and rest is essential to improve outcomes [16].

The Enhanced Recovery After Surgery (ERAS) is broadly recognized for improving postoperative results [17]. A key principle of ERAS is early postoperative mobilization. Numerous global guidelines recommend early mobilization as a safe and feasible approach within the intensive care unit (ICU) [18]. Early mobilization, initiated within 48-72 hours of ICU admission, includes activities from bed mobility to gait training for patients with or without mechanical ventilation [19]. Numerous early mobilization protocols have been developed for diverse populations, including critically ill ICU patients, individuals with acute respiratory failure, medical ICU patients, and those undergoing major head and neck cancer surgeries [20, 21]. These interventions not only enhance physical recovery but also improve psychological well-being and overall quality of life [22-24]. However, its practice varies across different countries due to barriers like hemodynamic instability, vascular attachments, safety concerns, poor communication, staff shortage, time limits, delirium, sedation, injury risk, and workplace stress [24, 25].

Although the advantages and risks of early mobilization should be carefully considered, excessive concern should not restrict its practice [26]. The barriers may change depending on the ICU culture; hence, it is important to identify them to implement mobility programs successfully. Identifying these barriers to develop corresponding strategies can aid health care professionals in implementing early mobility into standard clinical care in the ICU [27].

The existing literature on early mobilization in the ICU addresses patient populations admitted with general medical or surgical conditions [25, 28]. However, HNC surgeries pose distinctive postoperative challenges due to alterations in the anatomy and functionality of the head and neck region, swallowing function, and airway management that differentiate this group from other surgical patients [29]. These surgeries leave several vulnerable areas across the head, neck and donor sites, leading to pain, swelling, and restricted movement [30].

For patients with free-flap reconstruction, preserving flap circulation is essential during the first few days after surgery, as even small movements of the neck or upper limb may jeopardize vascular flow [31]. Minor postoperative bleeding or hematoma formation in the neck can rapidly lead to airway compromise or compression of delicate vascular anastomoses, resulting in flap failure. Physical strain may also exacerbate chyle leaks by increasing lymphatic pressure, leading to metabolic disturbances, delayed healing, or flap necrosis [32]. Prior radiotherapy further heightens risk due to fibrosis, poor tissue perfusion, and increased susceptibility to wound dehiscence [33]. Simultaneously, these patients face a significant risk of venous thromboembolism due to immobilisation for flap preservation, creating a complex scenario where both excessive movement and excessive immobilisation carry detrimental consequences [34].

As a result, mobilization must be introduced more carefully in this group than in standard ICU patients. Mobilizing these patients often requires a gradual and more cautious approach compared to other ICU patients. Currently, there is a gap in knowledge and limited documentation regarding the barriers to and implementation of early mobilization in patients recovering from HNC surgeries. Therefore, this study aimed to evaluate early mobilization practices and perceived barriers following HNC surgeries in the postoperative ICU of a tertiary healthcare facility.

Materials and Methods

Study setting

This prospective observational study was conducted at the Postoperative Oncology ICU of Father Muller Medical College Hospital, Mangalore, a tertiary care hospital, from May 2023 to August 2024. This 8-bedded ICU followed a multidisciplinary approach to patient care involving oncologists, plastic surgeons, physicians, intensivists, pulmonologists, endocrinologists, nurses, and physiotherapists.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Committee, Father Muller Medical College (FMIEC/CCMM/426/2024). The study was explained to the potential participants and written informed consent was obtained from the participants who were eligible and voluntarily agreed to participate. Patient confidentiality was maintained throughout the study by assigning unique identification codes and securely storing all data with access limited to the research team.

Sample size

A pilot study was conducted to obtain the proportion (p) of HNC patients mobilized to standing on the second postoperative day. Sample size was calculated using the formula: $n= (Z\alpha) 2 * p (1– p) / E 2$ where Z= 1.96 at 95% C.I, p=13.3%, E-allowable error= 8% margin of error. Based on the calculations, a sample size of 69 was obtained.

Selection of Patients

The patients were selected using purposive sampling to include those meeting the predefined criteria. Patients in the postoperative ICU list were screened by the primary investigator based on the eligibility criteria, and those who fulfilled the criteria were included in the study.

Eligibility Criteria

Inclusion criteria

i. Patients who have undergone HNC surgery

ii. Patients aged 18 years and above.

Exclusion criteria

i. Patients unable to follow simple verbal commands

ii. Patients who were non-ambulatory before their surgery

iii. Patients who had neurological conditions resulting in physical impairments

Procedure

Demographic data including age, gender, diagnosis and details of surgery such as duration of surgery, flap used were collected from patient records. Patients participated in physiotherapy sessions including early mobilization airway clearance and lung expansion techniques, as part of the routine postoperative care protocol, throughout their ICU stay. Mobilization was performed by a team of cardiopulmonary physiotherapists including the primary investigator. The number of physiotherapists ranged from two to four depending on patients' assistance requirements. Following each physiotherapy session, the level of mobilization was recorded using the ICU Mobility Scale on each postoperative day (POD) until POD 5. If mobilization could not be performed or progressed, the barriers were identified and documented using a validated checklist and then categorized as modifiable or non-modifiable barriers. All assessments were performed by the primary investigator to ensure consistency. No deviations from routine clinical care were introduced for research purposes. The flowchart of participant inclusion is presented in Figure 1.

Outcome measures

The ICU Mobility Scale was selected as the primary outcome because it is a validated, reliable tool for quantifying functional mobility in critically ill patients and is sensitive to clinically meaningful changes during ICU stay [35]. Barriers to mobilization were documented concurrently with a validated checklist. The secondary outcomes comprised ICU and hospital length of stay.

ICU Mobility Scale (IMS)

The ICU Mobility Scale is free to use for assessing patient mobility in the ICU and does not require specialized training for its administration. It is designed to evaluate a patient's ability to move and perform various activities, which can help guide treatment plans and track progress over time [35]. It includes several components that assess different aspects of mobility, such as the ability to perform bed mobility tasks (moving from lying to sitting), transfers, and ambulation (with or without assistance). The patients were scored from 0 to 10, 10 being the maximum score. The scale has an intraclass correlation of 0.80, indicating high reliability. The minimal important difference is 0.80. It also exhibits acceptable floor and ceiling effects [35].

Checklist for barriers to early mobilization

A checklist for identifying barriers to early mobilization was developed following a literature search of various barriers recorded for different ICU populations. The barriers were divided into 2 categories: Patient-level barriers and Provider-level barriers. It also included a provision for adding any additional barriers not listed. A checklist of potential barriers to mobilization was developed following a review of published literature describing impediments to early activity in ICU settings [36, 37]. Content validation was established by calculating content validation index (CVI) based on the ratings provided by two experts in early mobilization [38]. This validated checklist was used to list the barriers and is presented in Table 1.

Statistical analysis

Descriptive statistics, including frequencies and percentages, were used to summarize patient demographics, mobilization grades across postoperative days, and barriers to early mobilization.

For further analysis, the barriers were stratified into three domains: Symptom-Function, Clinical Stability, and System-Provider. Symptom-Function domain included respiratory distress, pain, poor nutrition, motivation, anxiety, fatigue, obesity, lack of coordination, and new weakness. The Clinical Stability domain encompassed hemodynamic instability, deep sedation, delirium/agitation, restraints, dislodgement risk, intubation, neurological instability, low GCS, and medical procedures. System-Provider domain comprised limited staff, low EM

Table 1. Checklist for Barriers to Early Mobilization from Postoperative Day 1 to Postoperative Day 5

Patient-level barriers	Hemodynamic Instability
	Respiratory distress
	Nasotracheal intubation
	Physical restraints
	Poor nutritional status
	Low Glasgow Coma Scale
	Sedation
	Delirium/agitation
	Lack of motivation/cooperation
	Anxiety
	Pain
	Fatigue
	New immobility/ weakness
	Obesity
	Electrolyte Corrections
	Blood Transfusion
	Procedures (Eg.- bronchoscopy, wound inspection)
Provider related barriers	Limited staff
	EM not a priority
	Lack of communication
	Safety concerns about Early Mobilization
	Inadequate training to facilitate Early Mobilization
	Time constraints
	Lack of knowledge
Other Barriers	Any other barriers identified (not listed above)

prioritization, lack of support/communication/leadership, safety concerns, inadequate training/knowledge, time constraints, absent protocols, equipment/environment issues, and scheduling conflicts.

Univariate logistic regression analyses were initially performed to identify associations between demographic variables, barriers, and mobility outcome: Ambulatory (IMS≥5) versus non-ambulatory (IMS<5). Variables showing statistical significance ($p < 0.05$) in univariate analysis or those considered clinically important were subsequently entered into multivariate logistic regression models to determine independent factors associated with mobility while adjusting for potential confounding factors. Adjusted Odds Ratios (aORs) with corresponding 95% confidence intervals were calculated, and a two-tailed p value of less than 0.05 was considered statistically significant. Analyses were performed using R (version 4.4.2)

Results

Demographic and Surgical Characteristics of Patients

The study population consisted of 69 patients undergoing head and neck cancer surgery, with a male predominance (62.3%). Carcinoma of the buccal mucosa and carcinoma of the tongue were the most frequently observed diagnoses, each accounting for 34.8% of cases, followed by carcinoma of the maxilla (7.2%). Most patients underwent soft tissue resections (87%). Radial forearm free flaps (28.9%) and pectoralis major myocutaneous flaps (27.5%) were the most common flaps utilized for defect closure. Nasotracheal intubation was used for airway management in 78.3% of patients. The characteristics of the patients and surgery are listed in Table 2.

Practice of Early Mobilization

The mobilization grades varied among the patients over the period of five postoperative days (POD) and are depicted in Table 3.

POD 1

When assessing the practice of mobilization post-HNC surgeries, we observed that 19 (27.5%) patients were not mobilized at all (Grade 0), 48 (69.6%) patients performed exercises in the bed (Grade 1), 1(1.4%) patient was made to sit on the edge of the bed (Grade 3) and 1 (1.4%) patient was mobilized to walking with 2-person support (Grade 7).

Table 2 Demographic and Surgical Characteristics of Patients (N=69)

Variables	Categories	n (%)
Gender	Male	43 (62.3)
	Female	26 (37.7)
	Others	0 (0)
Primary Diagnosis	Ca Buccal mucosa	24 (34.8)
	Ca Tongue	24 (34.8)
	Ca Maxilla	5 (7.2)
Type of Incision	Transverse crease	13 (18.8)
	McFee	23 (33.3)
	Modified Schobinger	14 (20.3)
Type of Flap Used	Radial forearm free flap	20 (28.9)
	Pectoralis major myocutaneous flap	19 (27.5)
	Local flap	13 (18.8)
Resection Extent	Soft tissue	60 (87.0)
	Bone	9 (13.0)
Type of Airway	Nasotracheal	54 (78.3)
	Endotracheal	7 (10.1)
	Tracheal	4 (5.8)
Duration of Anaesthesia	< 4 hours	2 (2.9)
	4–8 hours	46 (66.7)
	> 8 hours	21 (30.4)

POD 2

As observed in Table 3, the highest extent of mobilization was grade 1, 26 (37.7%) patients were mobilized in bed, and 9 (13.0%) patients were made to ambulate with support (grade 7). 3 (4.3%) out of 69 were shifted to the wards.

POD 3

19 (27.5%) patients were transferred to the wards. Among the remaining, 15 (21.7%) patients were ambulated with 2-person support (Grade 7), and only 1(1.4%) patient was ambulated with 1-person support (Grade 8). However, 3 patients scored Grade 0 even on the third day as they could not be mobilized due to unstable vitals or supine position advised by the surgeon for free flap.

POD 4 and POD 5

More than 75% of the patients were shifted to the wards from the ICU. Except for 4 (5.8%) patients, the others who stayed in the ICU due to delayed weaning and hemodynamic instability were mobilized to standing

Table 3. Mobilization Grades Over 5 Postoperative Days Scored Using the ICU Mobility Scale (N=69)

POD	Grade 0 n (%)	Grade 1 n (%)	Grade 2-6 n (%)	Grade 7-10 n (%)	Wards Shifts (%) n (%)
POD 1	19 (27.5)	48 (69.6)	1 (1.4)	1(1.4)	0 (0)
POD 2	7 (10.1)	26 (37.1)	24 (34.7)	9 (13.0)	3 (4.3)
POD 3	3 (4.3)	12 (17.4)	19 (27.5)	16 (23.1)	19 (27.5)
POD 4	0 (0)	4 (5.8)	7 (10.0)	5 (7.2)	53 (76.8)
POD 5	0 (0)	4 (5.8)	0(0)	1 (1.4)	64 (92.7)

ICU Mobility Scale: Grade 0-Nothing -lying in the bed to Grade 10- walking independently without a gait aid); POD, Postoperative day; ICU, Intensive Care Unit

Table 4. Reported Barriers to Early Mobilization and Length of Stay of Patients who have Undergone Head and Neck Cancer Surgeries (N=69)

	Barriers	
Types of Barriers	Reported Barriers	Frequency of Reported Barriers n (%)
	Lack of patient coordination	7 (10.1)
Patient level barriers	Respiratory distress	37 (53.6)
	Pain	38 (55.1)
	Hemodynamic instability	1 (1.4)
	Deep sedation	1 (1.4)
	Lack of motivation	2 (2.8)
	Anxiety	12 (17.3)
	Fatigue	17 (24.6)
	Poor nutritional status	2 (2.8)
	Delirium	1 (1.4)
	Intubation (Nasotracheal)	52 (75.4)
	Physical restraints	1 (1.4)
	Risk of dislodgement	1 (1.4)
	Low Glasgow coma scale	1 (1.4)
	Medical procedures	1 (1.4)
Provider level barriers	EM is not a priority	32 (46.4)
	Lack of communication	5 (7.2)
	Safety concerns about early mobilization	7 (10.1)
Other barriers	Free flaps	20 (28.9)
	Surgical site bleeding	3 (4.3)
	Length of Stay	
Length of stay in Days	Intensive care unit	3 (2,4)
Median (IQR)	Hospital	10 (9,12)

and walking. The remaining 4 patients were given in-bed exercises even on day 5 postoperatively due to respiratory distress and unstable hemodynamic parameters.

Barriers to Early Mobilization

Several barriers that caused variation in the practice of early mobilization of patients who underwent surgeries for HNC were identified and are presented in Table 4.

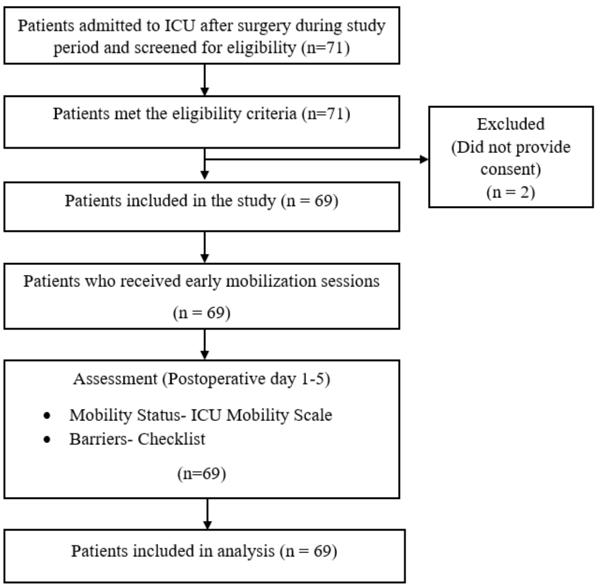

Figure 1. Flowchart of Participant Inclusion

Patient-level barriers

The barriers mainly included postoperative respiratory distress (n=37, 53.6%), pain (n=38, 55.1%), anxiety (n=12, 17.4%), and fatigue (n=17, 24.6%). Nasotracheal intubation (n=52, 75.4%) was the highest reported barrier due to concerns of airway compromise.

Provider-level barriers

Among the provider-level barriers, 'early mobilization not being a priority' scored the highest frequency of 32 (46.4%). Other barriers included safety concerns (n=7,10.1%) and communication gaps among health care professionals (n=5,7.2%).

Additional barrier identified

Although not present as a barrier in the checklist, the type of flap used for the surgery was identified as a barrier. It was observed that mobilization of patients with free flaps (n=20; 28.9%) was usually delayed compared to the patients with local or pectoralis major myocutaneous flaps, as the surgeons advised a supine position in the immediate postoperative period to prevent graft failure. In addition, 3 (4.3%) patients experienced surgical site bleeding, which was effectively managed by the surgical team. Although

Table 5. Association of Demographic and Clinical Characteristics with the Ambulation (N=69)

Variable	Non-Ambulatory (n=33)	Ambulatory (n=36)	p-value
Gender			
Female n (%)	12 (36.4%)	14 (38.9%)	0.999[a]
Male n (%)	21 (63.6%)	22 (62.9%)	
Age (years)	54.8±12.7	56.5±10.9	0.611[b]
Total Barrier Count, Median (IQR)	4.0 (3.0, 5.0)	3.0 (3.0, 4.0)	0.011[c]
Barriers: Symptom- Function domain, Median (IQR)	3.0 (1.0, 4.0)	2.0 (2.0, 3.0)	0.848[c]
Barriers: Clinical Stability domain, Median (IQR)	0.0 (0.0, 1.0)	0.0 (0.0, 0.0)	0.507[c]
Barriers:System- Provider domain, Median (IQR)	1.0 (0.0, 1.0)	0.0 (0.0, 1.0)	0.088[c]
Length of Stay: ICU, Median (IQR)	3.0 (3.0, 4.0)	3.0 (2.0, 4.0)	0.406[c]
Length of Stay: Hospital, Median (IQR)	11 (9.0, 13.0)	10.5 (9.0, 12.0)	0.721[c]

[a], Pearson's chi-square test; [b], Independent sample t test; [c], Mann-Whitney U test

Table 6 Factors Associated with Non-Ambulatory Status of the Patients in the Early Postoperative Period: Univariate and Multivariate Logistic Regression (N=69)

Variable	Unadjusted Odds Ratio (95% CI)	p-value	Adjusted Odds Ratio (95% CI)	p-value
Gender (Ref: Female)	0.898 (0.335, 2.386)	0.829	-	-
Age	1.011 (0.970, 1.054)	0.603	-	-
Barrier Count	0.658 (0.424, 0.964)	0.043	-	-
Barriers: Symptom- Function domain	0.994 (0.688, 1.434)	0.974	0.758 (0.470, 1.168)	0.224
Barriers: Clinical Stability domain	0.605 (0.238, 1.360)	0.245	0.711 (0.252, 1.795)	0.488
Barriers: System- Provider domain	0.469 (0.224, 0.867)	0.027	0.402 (0.172, 0.817)	0.02
Length of stay: ICU	0.790 (0.525, 1.061)	0.187	-	-
Length of stay: Hospital	0.933 (0.815, 1.041)	0.246	-	-

this bleeding was not a complication of mobilization, it necessitated postponing mobilization until the following day, thereby delaying the patient's progression through the mobility levels.

Length of stay

The median duration of ICU stay was 3 days (2,4) and median hospital stay was 10 days (9,12).

Association of Clinical Variables with Mobility

Of 69 postoperative ICU patients assessed for independent mobility status (IMS), 33 (47.8%) were non-ambulatory and 36 (52.2%) were ambulatory based on the highest level of mobility achieved within the first five days of the postoperative period.

Comparison of demographic and clinical characteristics by IMS group is shown in Table 5. Categorical variables including gender and postoperative complications showed no significant differences between groups. 47.8% patients were categorized as non-ambulatory based on the IMS. Postoperative complications occurred in 12.1% non-ambulatory patients compared to 5.6% in the ambulatory patients respectively (p=0.432). Median total barrier count was higher in non-ambulatory patients (4.0 [IQR 3.0-5.0]) than ambulatory patients (3.0 [IQR 3.0-4.0]; p=0.011). No differences were observed in patient factors (3.0 [1.0-4.0] vs. 2.0 [2.0-3.0]; p=0.848), clinical factors (0.0 [0.0-1.0] vs. 0.0 [0.0-0.0]; p=0.507) and system-related factors (1.0 [0.0-1.0] vs. 0.0 [0.0-1.0]; p=0.088). Age, ICU, wards or hospital lengths of stay, ICU showed no significant difference between the groups (p>0.05).

Factors associated with the non-ambulatory status of the patient

Univariate logistic regression identified the system-provider domain of barriers as significantly associated with non-ambulatory IMS (OR 0.469, 95% CI 0.224-0.867; p=0.027). No associations reached significance for gender, age, symptom-function, and clinical stability domains of barriers, postoperative complications, or lengths of stay (p>0.05). Multivariable logistic regression analysis was performed to identify independent factors associated with non-ambulatory IMS. After adjustment for potential confounders, the system-provider domain of barriers was independently associated with non-ambulatory status (aOR 0.402, 95% CI 0.172–0.817, p = 0.020) while other variables had no significant associations. The univariate and multivariate regression analyses are depicted in Table 6.

Discussion

Early mobilization is a key component of Enhanced Recovery After Surgery (ERAS) protocols; therefore, understanding its implementation in clinical practice is essential [17]. The present study was conducted to assess the practice of mobilization for patients post-HNC surgeries in the postoperative ICU and identify the barriers that were associated with mobilizing these patients. Mobility progression showed a gradual trend over the first five postoperative days, with most patients initially restricted to in-bed activities on day one, followed by stepwise advancement to sitting and assisted ambulation. Despite this progression, nearly half of the patients remained non-ambulatory as assessed on the IMS during this period. This was attributed to the various barriers, of which only the system-provider domain of barriers was found to be significantly associated with mobility.

EM practices showed a consistent but gradual improvement over the five postoperative days, with most patients remaining confined to the bed on the first day and only beginning upright activity on the second or third day. Recommendation for initiating mobilization was given by the surgeons, intensivists, and physicians, whereas physiotherapists primarily executed the intervention, with nurses providing assistance as necessary. This indicates that while mobilization was approached as a multidisciplinary effort, the level of involvement varied across different healthcare professionals. The timing and progression of mobilization were mainly based on clinical judgment rather than structured care pathways, leading to variations in practice.

These findings are consistent with existing literature on other surgical specialties, which suggests variations in the implementation of early mobilization despite having specific pathways [39]. Variations in early mobilization following abdominothoracic surgeries are observed in the timing of initiation, patient positioning, type and intensity of activities, and progression based on surgical complexity and clinical stability. Differences also exist in patient inclusion, integration of respiratory therapy, and adherence to standardized protocols, contributing to inconsistencies in mobilization practices across settings [39, 40]. These variations suggest that while mobilization is recognized as beneficial, its implementation is influenced by multiple factors within the ICU, which can act as barriers to early mobilization [41].

Several factors, including patients' medical condition, staff knowledge, training, available resources, and institutional culture, contribute to this variation [42, 43]. In this study, nasotracheal intubation, respiratory distress, postoperative pain, and low prioritization of early mobilization emerged as the most common barriers. On the first postoperative day, most patients in our study were not mobilized out of bed due to the presence of a nasotracheal tube. This finding aligns with the high prevalence of nasotracheal intubation in HNC patients observed by Nagarkar et al. [44], who reported that 92.4% of HNC patients in their retrospective analysis were intubated via the nasal airway. The necessity for effective tube management is thus paramount, as emphasized by guidelines from the American Society of Anesthesiologists on critical airway management [45]. Our study further underscores that the presence of such an airway, and the inherent concerns about compromising it, directly leads to the postponement of early out-of-bed mobilization, even if the patient is stable. This highlights a critical, non-modifiable, patient-level barrier specific to this surgical cohort.

Respiratory distress and hemodynamic instability emerged as the second major patient-related barrier in our study, consistent with findings from other ICU populations [25, 28]. For instance, hemodynamic instability was identified by Alaparthi et al. [28] and Dubb et al. [25] as a key barrier to early mobilization in both medical and surgical ICUs. In patients with HNC, Bhowmick et al. [46] outlined several common postoperative causes of respiratory distress, including pneumonia, atelectasis, pulmonary edema, bronchospasm, and acute lung injury. Respiratory distress often results in varying levels of hemodynamic instability, requiring clinical stabilization before mobilization can be safely initiated. Consequently, in our study, mobilization was given lower priority until physiological stability was achieved.

Pain, fatigue, anxiety, and lack of patient cooperation were among the other patient-related barriers that were identified. Anxiety was observed among patients who were intubated or experienced severe pain. Fatigue was another common concern, often cited by patients as a reason for their inability to initiate or complete different stages of mobilization. These findings align with those reported by Dubb et al. [25] in their review, which highlighted similar barriers across various ICU populations, not limited to surgical patients. Postoperative pain in HNC surgeries resulting from procedures such as tumor resection, neck dissection, flap harvesting, neuropathy, and care related to the surgical site can be significant, particularly in the first 48–72 hours [47]. Pain may increase anxiety and fatigue, which in turn reduces motivation and physical capacity [48]. Overall, the combined effect of physical discomfort and psychological distress negatively impacted patient cooperation and delayed mobilization [48, 49].

During this study, we recognized that the type of flap used in reconstructive surgery can also serve as a barrier to early mobilization. Delayed mobilization was observed in patients with free flaps (radial forearm free flap, anterolateral thigh flap, fibular flap). The surgeons recommended the supine position to prevent complications such as flap discoloration due to clots at the site of anastomosis [50]. Patients with donor sites in the lower limb (anterolateral thigh flap, fibular flap) complained of pain, which delayed their weight-bearing phases of mobilization.

While these findings highlight the most common barriers, the overall mobility outcomes in our cohort were mainly determined by the system-provider domain of barriers. This domain of barriers included prioritization of early mobilization, lack of standardized protocols, and communication gaps among healthcare professionals. Demographics, symptom-function, and clinical stability domains, in contrast, did not show significant associations, indicating that even clinically stable patients may fail to mobilize if systemic-provider-level barriers exist [51]. Approximately half of the patients did not achieve independent ambulation within the first five days of the postoperative period, indicating that postoperative immobility remains a common challenge in the postoperative period.

Addressing barriers to early mobilization is crucial for enhancing its practice and ensuring adherence to enhanced recovery protocols [4]. According to Dubb et al. [25], targeted strategies are an important component for prioritizing and successfully implementing early mobilization. Adequate titration of analgesics to reduce pain, managing respiratory distress with proper airway clearance and suctioning, and adequate mechanical ventilator or oxygen support are some of the strategies to address barriers of pain and respiratory complications [25]. Fatigue, anxiety, lack of motivation, and patient coordination could be addressed through preoperative physiotherapy. Pre-operative physiotherapy has been suggested to enhance physiological reserve and functional capacity and has been shown to reduce postoperative fatigue and anxiety compared to patients who did not receive it [36, 50, 52, 53].

As system-provider domains of barriers were associated with mobility in our study, key strategies for those involve adopting safety guidelines, creating standardized mobility protocols, and promoting collaborative training and communication among healthcare professionals [54]. Meta-analyses by Hodgson et al. [55] and Nydahl al. [56] have confirmed the safety of both in-bed and out-of-bed ICU mobilization, with serious events being rare. They have provided safety guides using a traffic light system. Red highlights high-risk situations requiring expert judgment, yellow indicates moderate risk, and green signifies that mobilization is generally safe [55, 56]. A standardized protocol for post-surgical HNC patients, including a traffic light system, can guide safety, using criteria across respiratory, hemodynamic, neurological, and other systems. Regular interprofessional communication regarding mobility objectives, challenges to early mobilization, and interdisciplinary rounds can enhance consistency in practice [56, 57].

Improving the practice of early mobilization can aid patients in receiving the benefits of early mobilization [26]. It not only benefits various body systems to enhance recovery [29] but also shortens the ICU and hospital stay, facilitates quicker return to work, and restores normalcy [58, 59]. Families benefit from reduced financial strain due to lower medical expenses and fewer missed workdays. A shorter hospital stay also alleviates emotional stress and caregiver burdens, allowing caregivers to resume their personal responsibilities while ensuring better support for the patient during recovery [58, 59]. For healthcare systems, shorter hospital stays optimize resource utilization and quicker bed turnover. This improves efficiency, facilitates patient care, and decreases staff workload, contributing to reduced provider burnout and better-quality care [60, 61].

While these findings underscore the importance of improving early mobilization practices, certain limitations of the present study must be considered when interpreting the findings. This study assessed early mobilization practices and identified associated barriers only up to postoperative day five, which could have limited the identification of additional barriers present in the later postoperative period. Use of purposive sampling may have introduced selection bias. As a result, we may have excluded patients with greater postoperative complexity. We also did not record clinical outcomes such as readmissions or long-term functional status; therefore, we did not determine how early mobilization influenced long term clinical outcomes. Finally, because this was a single-centre study, the findings may not apply to hospitals with different staffing patterns, ICU practices, or rehabilitation cultures.

Further studies could be done in various hospital settings to study the practice of early mobilization in patients with HNC surgeries and identify additional potential barriers during the extended postoperative recovery period. Outcome measures could be incorporated to enhance the accuracy of assessments and recording of pain, anxiety, and fatigue. Long-term functional outcomes could be studied. Early mobilization protocols that take into consideration strategies to overcome barriers could be formulated and validated. This could facilitate the execution of early mobilization and aid in the early recovery of patients

Author Contribution Statement

Vaishnavi Puranik: Conceptualization, Methodology, Data Collection, Formal Analysis, Writing—Original Draft Preparation. Cherishma Dsilva: Conceptualization, Methodology, Formal Analysis, Writing-Review & Editing. Aishwarya Gatty: Conceptualization, Methodology, Formal Analysis, Validation. Writing-Review & Editing. Rohanchandra Gatty: Conceptualization, Visualization, Writing-Review & Editing.

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Conflict of interest disclosure
Authors declare no conflict of interest.

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