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Evaluation of the Relationship between Short and Medium Term Outcomes Using Two Different Frailty Indices in Complex Head and Neck Surgery

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Abstract

Background: Comprehensive pre-anesthetic evaluation is known to play a crucial role in predicting morbidity and mortality in the perioperative and postoperative periods. Frailty is a condition characterized by reduced physiological reserve and resistance to stressors. It results from the accumulation of deficits in multiple organ systems, leading to physiological decline and subsequent changes in pharmacodynamics and pharmacokinetics. In this study, we aimed to evaluate the frailty scores of patients who underwent head and neck surgery. **Material and Methods:** This retrospective study included patients who underwent head and neck surgery in the otolaryngology operating rooms of Ankara City Hospital over a 2-year period. The mFI-5 (Modified 5-item Frailty Index) and CFS (Clinical Frailty Scale) were used for assessment. **Results:** A total of 54 patients were included in the study, with an average age of 57.9 ± 14.4 years. The proportion of patients who underwent neck dissection was 51.9%. A moderate correlation was found between the length of hospital stay and the mFI-5 and CFS scores. Similarly, patients who developed postoperative complications and those readmitted within 30 days had higher mFI-5 and CFS scores. While the mFI-5, CFS, and ASA scores showed similar trends, ASA was not statistically significant in predicting postoperative outcomes. Due to the low number of cases and deceased patients, the relationship with mortality could not be determined. **Conclusions:** Frailty is characterized by increased vulnerability and reduced reserve. As the population ages and life expectancy continues to rise, doctors and patients will increasingly face difficult decisions regarding treatment. This is particularly true for oncological

surgery patients. Identifying patients as frail or high-risk can directly impact treatment decisions. The mFI-5 and CFS can be simple and useful tools for predicting perioperative outcomes in early and mid-term head and neck surgery.

Keywords

Frailty Index, Head and Neck Surgery

1. Introduction

Pre-anesthetic assessment is critical for predicting perioperative and postoperative risks, morbidity, and mortality [1]. Various risk assessment tools are available, including the American Society of Anesthesiologists (ASA) classification and other indices. However, frailty assessment has emerged as a superior predictor of adverse outcomes. Frailty is a clinical syndrome reflecting reduced physiological reserve and increased vulnerability to stressors [2]. Several frailty assessment tools exist, but the Modified Frailty Index-5 (mFI-5) and the Clinical Frailty Scale (CFS) have gained popularity due to their simplicity and effectiveness. The mFI-5 is a comorbidity-based tool derived from the original 11-item frailty index, evaluating five components: diabetes, hypertension, chronic obstructive pulmonary disease, congestive heart failure, and functional dependence [3]. It is efficient and easy to implement. The CFS, on the other hand, assesses frailty based on functional dependence, fatigue, and mobility on a 9-point Likert scale [4]. Both tools have shown good predictive value for postoperative outcomes, including complications, readmissions, and mortality, particularly in oncological and geriatric populations.

The Modified Frailty Index (mFI) classifies frailty based on a patient's comorbidities. Initially defined by Velanovich and colleagues as an 11-item index (mFI-11), the mFI was later modified by researchers to a 5-item index (mFI-5). Studies have shown that the mFI-5 shows an easier use by clinicians [5]. The Clinical Frailty Scale (CFS) rates a patient's symptoms, mobility, immobility, exhaustion, and the semi-quantitative assessment of the basic activities of daily living and instrumental activities of daily living on a Likert score of 1 to 9 [6]. Both of the scoring systems were frequently used in recent studies. Therefore we also used these popular scoring systems. In recent years, advancements in technology and the medical field, particularly in Oncology including head and neck neoplasms, have been recorded. The development of robotic, endoscopic, and image-guided surgical approaches is progressively enhancing treatment strategies for complex tumors in this region [7]. Frailty is reported to be associated with mortality, complications, and low tolerance to treatment in cancer patients. For this reason, it can be used as a criterion during the treatment process and in determining prognosis in oncological patients [8]. Despite the growing evidence

on frailty in surgical patients, its impact on postoperative outcomes in non-geriatric populations undergoing head and neck surgery remains underexplored. This study aims to address this gap by assessing frailty using mFI-5 and CFS in patients undergoing complex head and neck surgeries.

Method: A retrospective observational study was conducted. The study included patients who underwent major head and neck surgeries in the otolaryngology operating rooms of Ankara City Hospital between January 2020 and December 2021.

Patient Selection:

Inclusion Criteria:

- Patients aged ≥18 years;
- Undergoing major head and neck surgery (e.g., laryngectomy, parotidectomy, neck dissection).

Exclusion Criteria:

- Incomplete medical records;
- Undergoing minor procedures (e.g., biopsy, diagnostic endoscopy).

Data Collection:

- Demographic variables: Age, sex, smoking status;
- Comorbidities: Hypertension, diabetes, congestive heart failure, chronic obstructive pulmonary disease;
- Frailty assessment: mFI-5 and CFS;
- ASA physical status;
- Surgical characteristics: Tumor site, operation type, surgery duration, tracheostomy status;
- Perioperative outcomes: Hemoglobin levels, transfusion requirement, intensive care need, postoperative complications, 30-day readmission, length of hospital stay, mortality.

Statistical Analysis: Descriptive statistics were used for demographic and clinical data. Correlations were assessed using Spearman's correlation coefficient. The Mann-Whitney U test was applied to compare frailty scores across outcome groups. A p-value < 0.05 was considered statistically significant. Confounders such as comorbidities and type of surgery were not adjusted due to sample size limitations.

Results: The study included 36 male and 18 female patients, with an average age of 57.9 ± 14.4 years. Neck dissection was performed in 51.9% of patients.

Patients with postoperative complications had higher mFI-5 ($p = 0.049$) and CFS ($p = 0.024$) scores. Those readmitted within 30 days also had higher mFI-5 ($p = 0.035$) and CFS ($p = 0.022$) scores. Hospital stay correlated moderately with mFI-5 ($r = 0.407$; $p = 0.002$) and CFS ($r = 0.435$; $p = 0.001$). mFI-5 and CFS showed a strong correlation with ASA ($r = 0.703$, $p<0.001$; $r = 0.733$, $p<0.001$), but ASA was not predictive of outcomes.

Due to the small number of deaths, the association with mortality could not be determined (Tables 1-6).

Table 1. Demographic characteristics.

Age	57.9 ± 14.4	
Sex	Male	36 (66.7)
	Female	18 (33.3)
Smoking status	No	20 (37)
	Yes	34 (63)

Values are given as mean ± standard deviation or as cases and percentages.

Table 2. Distribution of scores in patients.

Parameter	Value	
ASA	1	2 (3.7)
	2	28 (51.9)
	3	22 (40.7)
	4	2 (3.7)
mFI-5	0	9 (16.7)
	1	16 (29.6)
	2	18 (33.3)
	3	8 (14.8)
	4	2 (3.7)
	5	1 (1.9)
CFS	1	2 (3.7)
	2	11 (20.4)
	3	17 (31.5)
	4	10 (18.5)
	5	6 (11.1)
	6	6 (11.1)
	7	1 (1.9)
	8	0
	9	1 (1.9)

Values are given as cases and percentages.

Table 3. Distribution of tumor sites and surgeries performed.

Tumor site	Oral cavity	1 (1.9)
	Nasopharynx	0 (0)
	Dil	5 (9.3)
	Hypopharynx	1 (1.9)
	Larynx	17 (31.5)
	Parotid gland	17 (31.5)
	Submandibular	5 (9.3)
	Nasal	1(1.9)
	Labial	7 (13)
Operation type	Laryngectomy	10 (18.5)
	Neck dissection	28 (51.9)
	Robotic	2 (3.7)
	Laser	3 (5.6)
	Tongue	4 (7.4)
	Labial	6 (11.1)
	Maxillar	1 (1.9)

Values are presented as cases and percentages.

Table 4. Distribution of preoperative and postoperative outcomes.

Surgery duration (in minutes)		284.7 ± 183.5
Hospital stay (days)		11.4 ± 8.8
Tracheostomy	No	45 (83.3)
	Yes	9 (16.7)
Reoperation	No	47 (87)
	Yes	7 (13)
Hemoglobin	Preoperative	14.3 ± 1.7
	Postoperative	13.2 ± 1.6
	Change	−1.3 ± 1.1
Need for transfusion	No	43 (79.6)
	Yes	11 (20.4)
Follow-up	Ward	32 (59.3)
	PACU	16 (29.6)
	ICU	6 (11.1)

Values are presented as cases and percentages.

Table 5. Postoperative results.

Postoperative complications	No	47 (87)
	Yes	7 (13)
30-day readmission	No	47 (87)
	Yes	7 (13)
Mortality	No	52 (96.3)
	Yes	2 (3.7)

Values are given as mean ± standard deviation or as cases and percentages.

Table 6. Comparison of scores based on postoperative outcomes.

Parameter			n	Median score (min-max)	p-value
CFS	Postoperative complications	No	47	3 (1 - 6)	0.024*
		Yes	7	5 (2 - 9)	
	Mortality	No	52	3 (1 - 6)	0.001*
		Yes	2	8 (7 - 9)	
	30-day readmission	No	47	3 (1 - 6)	0.023*
		Yes	7	5 (3 - 9)	
mFI-5	Postoperative complications	No	47	1 (0 - 5)	0.049*
		Yes	7	2 (1 - 4)	
	Mortality	No	52	2 (0 - 5)	0.169
		Yes	2	3 (2 - 4)	
	30-day readmission	No	47	1 (0 - 5)	0.035*
		Yes	7	2 (1 - 4)	

*Mann Whitney test, $p < 0.05$ is considered to be significant.

2. Discussion

Our study found that frailty, assessed using mFI-5 and CFS, is associated with postoperative complications, prolonged hospital stays, and 30-day readmissions in patients undergoing head and neck surgery.

The clinical implications are significant. Incorporating frailty assessments into preoperative evaluations can guide surgical decision-making, identify high-risk patients, and facilitate tailored perioperative care. This approach can reduce complications, shorten hospital stays, and improve patient outcomes.

A study on non-geriatric patients receiving chemotherapy for head and neck and esophageal cancers highlighted the clinical significance of frailty in terms of

treatment outcomes, suggesting that frailty observed before treatment affects treatment tolerance, complications, and mortality. It was argued that frailty should be included in clinical practice for oncological cases independent of age [8].

Most of the literature focuses on the impact of frailty on geriatric populations, with limited information on its effects on younger adults. A study found that frailty increases exponentially with age throughout adult life, not just after 65. High frailty scores in patients of the same age group were associated with higher mortality and healthcare costs. Interestingly, although the absolute death rate related to frailty increases with age, the relative risk of death due to frailty is highest among younger individuals. The same study identified a prevalence of frailty between 5.3% and 6.9% among individuals aged 18 - 64 [9]. Another study found frailty rates of 1.8%, 4.3%, 11.6%, and 20.2% respectively in age groups 18 - 34, 35 - 49, 50 - 64, and 65 and above, underscoring the need for more research on frailty's effectiveness outside the geriatric population [10]. Our study, with an average age of 57.9 ± 14.4, shows that frailty is prevalent among cancer patients regardless of age and is crucial in predicting and managing potential complications during the treatment process.

A retrospective study on patients with cancer undergoing head and neck surgery similarly found that the modified frailty index increased mortality, 30-day readmission, and hospitalization duration. While the ASA classification was significantly related to poor perioperative outcomes in that study, our research did not find statistically significant results regarding postoperative complications, which we believe is related to sample size [11].

A cross-sectional analysis of 159,301 patients undergoing surgery for head and neck cancer found a frailty index of 7.4%, advocating that frailty is an independent predictor of morbidity, mortality, hospitalization duration, and costs. It also indicated a synergistic interaction between frailty and comorbidity, showing that frail patients with comorbidities have increased risks of complications and longer hospital stays [12].

A meta-analysis evaluating the link between frailty and perioperative outcomes in head and neck surgery patients reviewed nine studies from the literature, affirming that frailty is an effective predictor of perioperative mortality and morbidity. It recommended more widespread use of frailty screenings to optimize modifiable risk factors in the preoperative period [13]. Another meta-analysis reported that various methods are used to assess frailty, but the modified frailty index is most commonly preferred, and regardless of the method used, increased frailty in a patient statistically increases complication rates. They concluded that assessing frailty in patients undergoing head and neck surgery is a useful method for risk classification [14].

Our study similarly used a 5-item mFI scoring system looking at five variables: diabetes, hypertension, chronic obstructive pulmonary disease, congestive heart failure, and functional status in 3795 patients undergoing head and neck surgery.

It found that increases in the mFI-5 were associated with longer hospital stays and higher mortality rates, and were related to reoperation and readmission [15]. Another systematic review and meta-analysis examined the effectiveness of the mFI-5 as a prognostic indicator across all surgical specialties, arguing that mFI-5 is strongly related to mortality and morbidity and is underutilized; including it in preoperative assessments would improve surgical decision-making [16].

A study assessing short-term outcomes with mFI-5 measurements in 2786 patients undergoing head and neck surgery, with an average age of 62.0 ± 11.6 years, stated that the frailty score should be used as a simple and reliable measure to predict short-term outcomes. They advocated that preoperatively determined frailty criteria would contribute to improving postoperative planning [17].

3. Conclusion

The mFI-5 and CFS are associated with increased risk, including postoperative complications, hospital stay duration, and hospital readmissions, in patients undergoing head and neck surgery in the short and medium term and can provide useful information for preoperative risk determination. Furthermore, broader studies are required to ascertain the relationship between mortality and the frailty index. Frailty, assessed using mFI-5 and CFS, is a significant predictor of postoperative complications, prolonged hospital stay, and 30-day readmissions in head and neck surgery patients. Routine frailty assessment should be integrated into preoperative evaluations to improve risk stratification and optimize perioperative management.

Conflicts of Interest

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

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