Tongue Strength and Frailty in Head and Neck Cancer Patients

Boris Kuyeb, MS[1]; Alberto A. Arteaga, MD[2]; Kristen Pitts, MD[3]; Christopher Spankovich, AuD, PhD[1]; Oishika Paul, MPH[1]; Gina Jefferson, MD[1]; Lana Jackson, MD[1]

[1]Department of Otolaryngology, Head & Neck Surgery University of Mississippi Medical Center, Jackson, Mississippi; [2]Departent of Otolaryngology, Head & Neck Surgery, University of Florida, Gainesville, Florida; [3]Spartanburg & Greer ENT and Allergy, Spartanburg, South Carolina.

ABSTRACT

○ Frailty is defined as an accumulation of deficits or loss of physiologic reserves. It has been significantly associated with perioperative morbidity and mortality in head and neck cancer patients. Frailty indexes that have been recently studied in head and neck cancer include the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) modified Frailty index, John Hopkins adjusted clinical groups (ACG), and the American Society of Anesthesiologists (ASA) classification system. None of these scores perform a direct physical assessment. Sarcopenia has been described as part of the frailty cycle. It can be assessed both by physical performance scales and muscle mass. Our study investigated a novel sarcopenic measurement, tongue strength, and aims to determine if it correlated with other frailty indexes and if it is predictive of perioperative outcomes/complications. Outcomes in the study included length of stay, unplanned readmission or reoperation, Clavien-Dindo IV perioperative complications, PEG tube dependence, wound complications (Figure 2). Tongue strength correlated with frailty scores, with significantly lower tongue strength in frail patients (identified with Fried Frailty Index). Lower tongue strength was significantly predictive of ICU stay. Fried frailty index was predictive of ICU stay. ASA score was associated with PEG dependence. Our study demonstrated a significant association between tongue strength and frailty. Tongue strength is a clinical tool that could be used in identifying frail patients.

INTRODUCTION

○ As longevity and incidence of head and neck cancer increases, surgeons need risk stratification tools to aid in counseling and to develop interventions to prevent complications of patients undergoing oncologic surgery.

○ The concept of frailty, first introduced by Fried et al. in early 2001 has been used as objective measure that attempts to identify population at risk for peri and postoperative outcomes[1].

○ Frailty has been significantly associated with perioperative morbidity and mortality in head and neck cancer patients, and assessment tools can be classified in phenotypic models and cumulative deficit models[2,3]. Phenotypic models have been studied in the oncologic surgery literature, but studies in the otolaryngology literature are limited[4].

○ Sarcopenia forms part of the frailty cycle and is a potential target to assess for frailty. Sarcopenia encompasses the physical domain of frailty including loss of skeletal muscle mass, strength and muscle function[5,6]. Tongue strength was assessed as a physical component of sarcopenia. In the present study, we determined if tongue strength correlated with other frailty measures. We hypothesized that tongue strength is a reliable measure of frailty in head and neck patients and is a predictor of poor outcomes in head and neck cancer patients undergoing surgery, radiation, chemotherapy, or a combination.

MATERIALS and METHODS

○ Prospective, cross-sectional study conducted between October 2017 and January 2023, including adult patients with H&N cancer, excluding melanoma, thyroid, parathyroid, esophageal primaries, and pregnant women.

○ Fried Frailty index, Johns Hopkins Adjusted Clinical Groups, the ACS National Surgical Quality Improvement Program modified Frailty Index (NSQIP mFI), ASA, and tongue strength (assessed with Iowa oral performance instrument) were obtained.

○ Correlations and regression models were used to investigate if tongue strength correlated with Frailty indexes and if tongue strength and Frailty indexes were predictive of outcomes, including hospital and ICU stay, discharge disposition, ER visits, readmission, Clavien Dindo IV complications, wound infections/dehiscence, fistula, flap failure, and unplanned PEG tube placement/dependence.

○ Regression models were adjusted to age, gender, race, BMI, educational level, current living, EAT score, smoking, alcohol, TMN prognostic group, type of surgery, and free flap at the time of surgery.
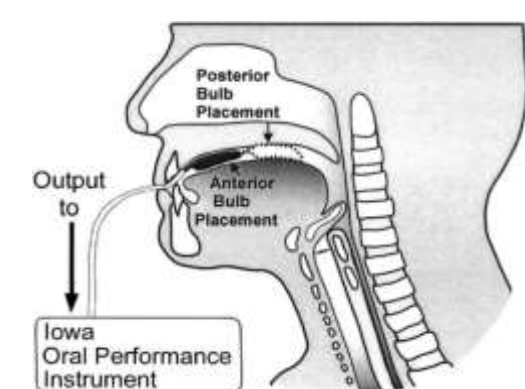

Figure 1. Measurement of peak pressure in both the anterior and posterior positions

Figure 2: Iowa Oral Performance Instrument (IOPI) with tongue bulb and connecting tube to pressure port.

RESULTS

Table 1. Demographic Characteristics of the Population

Variables	Mean or Frequency (n=45)
Age	65.60 (9.939)
Body mass Index (BMI)	25.100 (6.075)
Gender	
Male	35 (77.8%)
Female	10 (22.2%)
Race	
White	28 (62.2%)
African Americans	17 (37.8%)
Highest Education	
Grade school	2 (4.4%)
Middle school	2 (4.4%)
some high school	6 (13.3%)
Completed high school	19 (42.2%)
Some college	8 (17.8%)
Completed college	6 (13.3%)
Post grad	1 (2.2%)
Current Living	
Home	42 (93.3%)
Home health nurse	1 (2.2%)
Facility	2 (4.4%)
Smoking	
Never	8 (17.8%)
Former	23 (51.1%)
Current	14 (31.1%)
Alcohol Abuse	
Never	16 (35.6%)
Former	10 (22.2%)
TNM staging	
I	5 (11.1%)
II	7 (15.6%)
III	14 (31.1%)
IVa	18 (40%)
IVb	1 (2.2%)
Type of surgery	
Nonmajor	7 (15.6%)
Major	38 (84.4%)
Surgery Free flap	
No	12 (26.6%)
Yes	33 (73.3%)

Data presented as n (%) for categorical values and mean (SD) for continuous variables.

Table 2. Distribution of Primary and Secondary Outcomes among Surgical Categories.

Outcome	Value
Length of stay	6.89 (5.515)
ICU stay	2.11 (4.080)
Discharged disposition	
Home	38 (84.4%)
Facility	6 (13.3%)
Deceased	1 (2.2%)
Unplanned ED visits (30 days)	0.44 (0.725)
Readmission	9 (20%)
Unexpected return to OR	10 (26.4%)
Total CD IV complications	10 (22.0%)
Wound infection	14 (31.1%)
Wound Dehiscence	12 (26.7%)
Total preoperative morbidity	17 (37.7%)
Fistula	4 (8.9%)
Flap failure	3 (6.7%)
Unplanned PEG	10 (22.2%)
PEG dependent	10 (22.2%

Abbreviation: CD-IV, Clavien-Dindo grade IV classification.
Data are presented as n (%) for categorical values and mean (SD) for continuous variables.

Table 3. Frailty Characteristics of the population

Measurements	Value
Tongue strength Anterior	43.02 (21.498)
Tongue Strength Posterior	38.43 (18.737)
Fried Frailty	
Not frail	8 (17.8%)
Intermediate	21 (46.7%)
Frail	16 (35.6%)
NSQIP (out of 11)	2.44 (1.139)
Hopkins ACG (out of 10)	0.60 (0.780)
ASA score	2.82 (0.442)

Abbreviations: NSQIP, National Surgical Quality Improvement Program; ACG: Adjusted Clinical Groups; ASA: American Society of Anesthesiologists.
Data are presented as n (%) for categorical values and mean (SD) for continuous variables.

Table 4: Correlation between Tongue strength and other frailty scores. Tongue strength significantly correlated with Fried index groups, but results were statistically insignificant for NSQIP, Hopkin ACG and ASA score.

Frailty assessment	Tongue Strength-Anterior	Tongue Strength- Posterior
Freid Index score	r= -0.259, p value=.089	r= -0.302, p= .047
Freid Index group	r= -0.433, p=.003	r= -0.408, p= .006
NSQIP total	r= .066, p= .671	r= .075, p= .628
Hopkins ACG total	r= .105, p= .498	r= -0.074, p=.635
ASA score	r= -0.180, p= .242	r= -0.186, p=.227

Table 5: Multivariant regression model of Anterior Tongue Strength and ICU stay. In Model 2, Tongue strength anterior and race stayed significant with ICU stay when all individually significant variables were combined in a single model.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.022	1.328		3.782	<.001
	Tongue Strength-Anterior	-.068	.028	-.355	-2.462	.018
2	(Constant)	4.139	2.594		1.596	.119
	Tongue Strength-Anterior	-.073	.027	-.380	-2.739	.009
	Race	2.436	1.156	.287	2.108	.042
	Major ENT Surgery	-3.706	2.156	-.332	-1.719	.094
	Surgery included free flap	1.217	1.778	.133	.684	.498

a. Dependent Variable: ICU stay
1. Unadjusted model
2. Adjusted model: adjusted to age, gender, race, BMI, educational level, current living, EAT score, smoking, alcohol, TMN prognostic group, type of surgery, and free flap at the time of surgery.
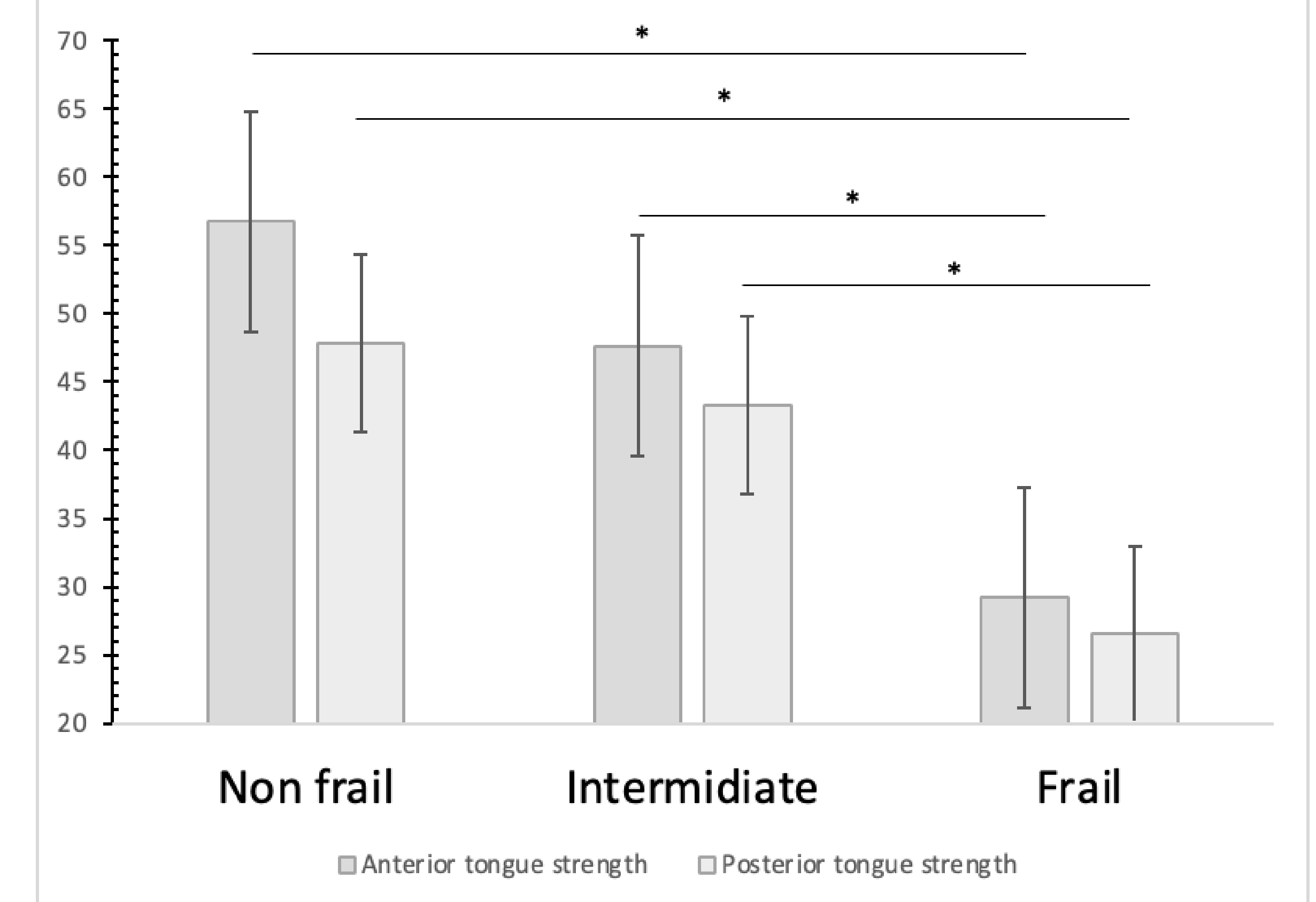

Figure 3. Tongue Strength in Fried frailty index groups. Comparison of the anterior and posterior tongue strength in relation to the different fried frailty index groups. Tongue strength for the frail group was significantly lower when compared to the non-frail group but there was no statistical difference between anterior and posterior tongue strength.

DISCUSSION

○ We were able to determine that Tongue strength was significantly correlated with the phenotypic model, Fried index group, but not to cumulative deficit models as the NSQIP total, Hopkin ACG total and ASA score.

○ Preliminary analysis revealed that tongue strength and Fried index group were significantly predictive of ICU stay.

○ Race was a significant factor affecting longer ICU stay in African American patients.

○ Tongue strength was not predictive of hospital stay, discharge disposition, ER visits, readmissions, Clavien-Dindo IV complications, wound infection, wound dehiscence, fistula, flap failure, unanticipated PEG, PEG dependence (Data not shown).

○ The study was limited by the number of patients during the study period likely due to the recent COVID-19 pandemic, which affected data collection.

○ The utility and reliability of tongue strength in H&N surgery are still being investigated.

○ Tongue strength might be an efficient tool for frailty screening with potential pre-surgical interventions.

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