The Impact of Frailty on Morbidity and Mortality Following Microvascular Reconstructive Surgery of the Head and Neck

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ABSTRACT

Importance

Frailty is a measure of physiological reserves in older adults and is being increasingly used as a predictor of surgical outcomes in our aging population.

The role of frailty in free flap surgery of the head and neck is yet unexplored and warrants investigation.

Objective

Using a modified frailty index, we hypothesized that frailty would be significantly associated with complications after free flap surgeries of the head and neck. The data derived from this study will allow surgeons to advise patients on their individual risk of adverse outcomes after surgery.

Design

We performed a retrospective cohort study of the American College of Surgeons National Quality Improvement Program (ACS-NSQIP) database and calculated a frailty score using a validated modified frailty index (mFI).

Head and neck free flap cases were extracted based on Current Procedural Terminology (CPT) codes from 2005-2014.

Conclusions

For patients undergoing head and neck free flap surgery, the highest mFI cohort was associated with increased transfusion rates, ventilator dependence >48 hours, and discharge destination other than home

BACKGROUND

- Reconstruction using microvascular free flaps has become a standard of treatment following surgical resection in head and neck cancers.[1]
- It is well known that age is a significant predictor of morbidity and mortality after these procedures, but recent data suggests that comorbidities and prior health events might have a greater role to play.[2]
- A modified frailty index was established by Velanovich et al that uses 15 variables found in ACS-NSQIP.[3] Validated by many studies, the mFI has been used in predicting complications in surgical procedures of other specialties, including those of the head and neck.[4]
- To our knowledge, the mFI has not been used as a predictor of morbidity and mortality in patients undergoing microvascular free flap surgery in the head and neck.
- We sought to establish the significance of using the mFI as a simple, straightforward way of predicting.
- We hypothesized that a greater mFI score would be a significant predictor of mortality and morbidity in patients undergoing free flap surgery.

Table 1. Variables of the modified frailty index (mFI)

Chronic obstructive pulmonary disease or recent pneumonia
Congestive heart failure
Myocardial Infarction
Percutaneous coronary intervention, prior cardiac surgery, or angina
Diabetes mellitus
Impaired sensorium
Peripheral vascular disease or ischemic rest pain
Functional status (not independent)
Hypertension requiring medication
Transient ischemic attach or cerebrovascular disease
Cerebrovascular accident with neurological deficit

MATERIALS & METHODS

Patient Database

Retrospective analysis of the ACS-NSQIP database with cases from 2005-2014.

ACS-NSQIP is a nationwide database that reports on perioperative surgical data and 30 day outcomes. Cases were extracted based on current procedural terminology codes.

Modified Frailty Index (mFI)

The mFI is an 11 point index, calculated from 15 ACS-NSQIP comorbid variables. The number of variables present in each patient was added for a total score, and patients were organized into cohorts ranging from mFI= 0 to mFI $\geq$ 3.

Statistical Methods

All statistical analyses were conducted with SPSS software.

Univariate analysis was conducted using the chi square (χ^2) test, as all variables were categorical. Binary multivariate regression was then preformed with the inclusion of significant variables (P<0.05). Variables used for adjustment were age, race, and sex.

RESULTS

Table 2. Patient Characteristics

	Total n= 613
Age	
Under 40	47 (7.7%)
41-60	231 (37.7%)
61-80	286 (46.7%)
81+	49 (8.0%)
Gender	
Male	424 (69.2%)
Female	188 (30.7%)
Unknown	1 (0.2%)
Race	
White	426 (69.4%)
Black	39 (6.4%)
Hispanic	17 (2.8%)
Asian	16 (2.6%)
Unknown	115 (18.8%)
Modified frailty index (mFI)	
0	283 (46.2%)
1	197 (32.1%)
2	98 (16.0%)
3+	35 (5.7%)

Table 3. Thirty-day outcomes

	Total n= 613		
	Yes	No	P value
Discharge destination other than home	250 (40.8%)	363 (59.2%)	**0.004**
Intraoperative or postoperative transfusion (within 72 hours)	262 (42.7%)	351 (57.3%)	**0.001**
Dependence on a ventilator >48 hours after surgery	35 (5.7%)	578 (94.3%)	**0.005**
Unplanned reoperation	103 (16.8%)	510 (83.2%)	0.990
Unplanned intubation	20 (3.3%)	593 (96.7%)	0.651
Superficial surgical site infection (SSI)	50 (8.2%)	563 (91.8%)	0.809
Deep SSI	21 (3.4%)	592 (96.6%)	0.871
Organ space SSI	4 (0.7%)	609 (99.3%)	0.308
Wound disruption	26 (4.2%)	587 (95.8%)	0.707
Pneumonia	37 (6.0%)	576 (94%)	0.078
Pulmonary embolism	6 (1.0%)	607 (99%)	**0.026**
Renal insufficiency	1 (0.2%)	612 (99.8%)	0.761
Urinary tract infection	9 (1.5%)	604 (98.5%)	0.808
Cerebrovascular accident with neurologic deficit	2 (0.3%)	611 (99.7%)	0.237
Cardiac arrest	7 (1.1%)	606 (98.9%)	**0.040**
Myocardial infarction	9 (1.5%)	604 (98.5%)	**0.001**
Graft failure	35 (5.7%)	578 (94.3%)	0.709
Deep vein thrombosis	7 (1.1%)	606 (98.9%)	0.578
Sepsis	25 (4.1%)	588 (95.9%)	0.820
Septic shock	3 (0.5%)	610 (99.5%)	0.355
Clavien-Dindo IV	108 (17.6%)	505 (82.4%)	0.092
Mortality	11 (1.8%)	602 (98.2%)	0.099

Bold indicates P <0.05

Table 4. Free flap predictors of outcomes, based on logistic regression

	Intraoperative or postoperative (within 72 hours) transfusion n = 262	Ventilator >48hr n= 35	Discharge to other than home n= 250
Age			
Under 40	Ref	Ref	Ref
41-60	0.90 (0.45-1.79)	1.12 (0.13-9.82)	0.54 (0.28-1.06)
61-80	1.11 (0.56-2.22)	1.50 (0.18-12.6)	0.64 (0.33-1.26)
81+	2.21 (0.90-5.43)	3.96 (0.42-37.6)	1.52 (0.63-3.69)
Gender (Female)	1.24 (0.86-1.79)	0.91 (0.40-2.06)	1.09 (0.76-1.58)
Race			
White	Ref	Ref	Ref
Black	**3.89 (1.86-8.11)**	0.55 (0.07-4.34)	1.43 (0.73-2.80)
Hispanic	0.82 (0.29-2.30)	2.13 (0.25-18.1)	0.66 (0.22-1.94)
Asian	0.45 (0.14-1.47)	N/A	1.09 (0.39-3.05)
Unknown	**0.60 (0.38-0.95)**	1.38 (0.56-3.41)	0.98 (0.63-1.51)
Dyspnea	1.14 (0.61-2.14)	0.12 (0.01-1.00)	1.22 (0.67-2.22)
Bleeding Disorder	1.54 (0.61-3.89)	2.24 (0.57-8.79)	0.58 (0.22-1.52)
mFI$\geq$3	**4.13 (1.77-9.66)**	**10.49 (2.721-40.41)**	**2.75 (1.27-5.96)**

Presented as OR (95% CI); Bolded indicates P <0.05
OR = Odds Ratio
Ref = Reference Value

Figure 1. Complication rate of intraoperative or postoperative (within 72 hours) transfusion relative to mFI

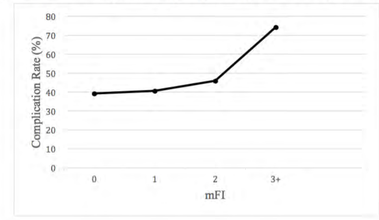


Figure 2. Complication rate of dependence on a ventilator > 48 hours relative to mFI

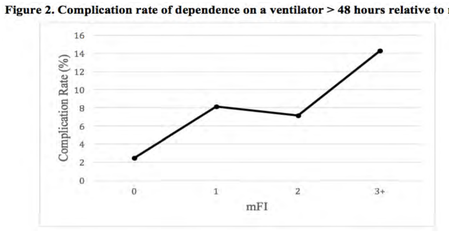
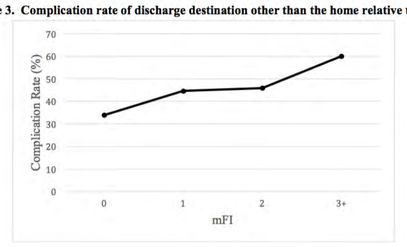


Figure 3. Complication rate of discharge destination other than the home relative to mFI



CONCLUSIONS

- Of the 1938 head and neck free flaps in NSQIP from 2005 to 2014, 613 were included in the final analysis.
- mFI score of $\geq$3 was a significant predictor of intraoperative or postoperative (within 72 hours) transfusion (OR 4.13; CI 1.77-9.66), dependence on a ventilator >48 hours after surgery (OR 10.49; CI 2.721-40.41), and discharge destination other than home (OR 2.75; CI 1.27-5.96). Frailty was not a predictor of 30 day mortality.
- mFI is a practical risk calculator.
- Frailty is an important indicator for poor outcomes after head and neck procedures.
- Such data can help inform conversations with patients and families about risks of surgery in order to improve patient outcomes in our aging population.

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