JOURNAL OF PLASTIC SURGERY AND HAND SURGERY
2022, VOL. 56, NO. 4, 229–235
https://doi.org/10.1080/2000656X.2021.1962333

ARTICLE

Modified Frailty Index (mFI) predicts 30-day complications after microsurgical breast reconstruction

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ABSTRACT

Frailty lacks a universal definition. The modified Frailty Index (mFI) using patient comorbidities can be used to measure frailty. We hypothesized that mFI predicts 30-day complications after microsurgical breast reconstruction. American College of Surgeons' (ACS) National Surgical Quality Improvement Project (NSQIP) was investigated to identify patients undergoing microsurgical breast reconstruction between 2005–2014 using Current Procedure Terminology (CPT) code, 19364. We used mFI as a measure of frailty. The patients were assigned a frailty score based on the number of preoperative comorbid conditions as defined by the mFI. Other risk indices used include age, BMI, wound class, ASA class. Stratification was performed in ascending order for each. The outcome measure was aggregate 30-day complications. Regression analysis was performed followed by Receptor Operating Characteristic (ROC) curve to determine the accuracy of each risk index in predicting 30-day complications. Of the 3237 patients 24% experienced complications. Univariate logistic regression analysis found odds ratio of complications for frailty score 1 = 22.1 (CI = 17.9–27.3, $p < 0.01$), and 2 = 28 (CI = 18.3–43, $p < 0.01$) compared to frailty score = 0. ROC curve demonstrated mFI with the highest concordance score (c-score = 0.816). Multivariable logistic regression found frailty as the strongest independent predictor of 30-day aggregate complications adjusted OR = 22.24, CI = 17.77–27.82, $p < 0.01$ when compared to other risk indices. The modified Frailty Index is a simple, reliable, and objective tool that can be used to predict postoperative complications after microsurgical breast reconstruction. The application of this tool can help microsurgeons preoperatively identify patients who are at high risk.

Abbreviations: ACS: American College of Surgeons; ASA: American Society of Anesthesiologists; BMI: body mass index; CHF: congestive heart failure; CPT: current procedural terminology; COPD: chronic obstructive pulmonary disease; CVA: cerebrovascular accident; DM: diabetes mellitus; IRB: institutional review board; mfi: modified frailty index; MI: myocardial infarction; NSQIP: national surgical quality improvement program; PVD: peripheral vascular disease; ROC: receptor operating characteristic; TIA: transient ischemic attach

ARTICLE HISTORY
Received 16 February 2021
Revised 15 July 2021
Accepted 26 July 2021

KEYWORDS
Modified Frailty Index (mFI); 30-day complications; microsurgical breast reconstruction

Introduction

Complication rates of breast reconstruction after mastectomy are reported to be as high as 30%–60% [1,2]. This is an excessively high rate of complications for a non-life saving procedure. The goal of a reconstructive procedure, in general, is to restore form and function while causing minimal complications [1–3]. The elective nature of these procedures puts both the surgeons and the patients in a difficult situation when a complication occurs. Success of reconstruction is generally regarded in terms of technical factors however the consequences for the patient should not be ignored. The ability to predict the risk of surgical complications could significantly inform the decision-making process of whether to proceed with post-mastectomy reconstruction [3].

Nearly one-third of patients undergoing autologous breast reconstruction using free flaps experience a complication within the first 30-day postoperative period [1]. Several independent risk factors have been described for complications after breast reconstruction with free flaps [1–4]. However, an individual patient seeking consultation for breast reconstruction with free flap may present with more than one of those individual risk factors. In trying to quantify patients' risks, there is a need for a scoring system that is objective, easy to use, and reliable in predicting incidence of postoperative complications. Previous studies have extensively investigated increasing age and body mass index (BMI) as potential risk factors for complications after breast reconstruction using flaps [5–7]. However, neither age nor BMI necessarily serve as a contraindication by themselves.

Frailty is generally regarded as a marker of high risk for complications [3,8,9]. Though it has long been known that older and more frail individuals have worse health outcomes due to malnutrition and weakened immune systems, there is no consensus on a definition for frailty, and there is a lack of an assessment tool to

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measure it [10]. The Canadian Study of Health and Aging has defined frailty using three approaches: rules-based, clinical deficit-based, and clinical judgement-based [11]. Their scoring system was later adopted by Velanovich *et al.* who introduced the modified Frailty Index (mFI) using the American College of Surgeons' (ACS) National Surgical Quality Improvement Program (NSQIP) [12]. The mFI has been validated to predict complications in older patients across different surgical specialties [13–17]. As such, we used it as the basis of our study.

To our knowledge, the impact of frailty on breast reconstruction with free flaps has not been studied using mFI. We examined the ACS NSQIP database to determine the association of mFI with post-operative 30-day complications. We hypothesized that mFI predicts 30-day complications after microsurgical breast reconstruction. Since mFI does not include age, BMI, wound class, or American Society of Anesthesiologists (ASA) class, we compared the predictive value of mFI with that of these additional factors to identify the factor that had the best predictive value for post-operative complications.

Methods

Study design

We obtained Institutional Review Board (IRB) approval in order to conduct this study. Patients undergoing breast reconstruction using free flaps from 2005–2014 were identified using the NSQIP database. The NSQIP is a nationally validated, risk-adjusted, outcomes-based program that collects data on a prospective systemic sample of patients undergoing any procedure [18]. The patients were identified using Current Procedural Terminology (CPT) code 19364. We included adult female patients only.

Table 1. Study participants by risk strata.

Variables	*n* (%)
Sample size	3237 (100%)
Age (years), mean ± SD	52.67 ± 12.13
Age strata	
<20 years	1 (0.0%)
20–49 years	879 (27.2%)
50–65 years	2145 (66.3%)
>65 years	212 (6.5%)
Body Mass Index (kg/m^2), mean ± SD	28.32 ± 6.32
BMI strata	
<30 kg/m^2	1961 (60.6%)
30–34.9 kg/m^2	785 (24.5%)
35–39.9 kg/m^2	328 (10.15)
40–44.9 kg/m^2	86 (2.7%)
>45 kg/m^2	33 (1%)
Comorbidities	
Diabetes	164 (5.1%)
Functional dependence	46 (1.4%)
COPD/Pneumonia	10 (0.3%)
Congestive Heart Failure	0 (0.0%)
Myocardial Infarction	0 (0.0%)
PCI/CS/Angina	5 (0.2%)
Hypertension requiring medication	739 (22.8%)
PVD/Rest pain	9 (1.4%)
Impaired sensorium	1 (0.2%)
TIA	14 (0.4%)
CVA	6 (1%)
Frailty Strata	
Frailty score = 0	2368 (73.2%)
Frailty score = 1	748 (23.1%)
Frailty score = 2	117 (3.6%)
Frailty score = 3	4 (0.1%)
Wound class strata	
Class I: Clean	2560 (79.1%)
Class II: Clean/Contaminated	514 (15.9%)
Class III: Contaminated	100 (3.1%)
Class IV: Infected	63 (1.9%)
ASA class strata	
Class I: No disturbance	129 (4%)
Class II: Mild disturbance	1571 (48.5%)
Class III: Severe disturbance	1474 (45.5%)
Class IV: Life threatening	61 (1.9%)
None assigned	2 (0.1%)

Risk scoring

As shown in Table 1, we used age, body mass index, comorbidities, wound class, and ASA class in our analysis. Since the goal of this study was to identify preoperative patient-related risk factors in determining post-operative complications, we did not use any operative variables. We hypothesized that increasing age is a predictor of complication. We stratified age in four groups (<20 years, 20–49 years, 50–65 years, and >65 years) to investigate the correlation between increasing age and complications. Similarly, BMI was stratified by increasing BMI in the obesity range (30–34.9, 35–39.9, 40–44.9, and >45), using BMI $\geq$ 30kg/m^2 as the reference for the definition of obese. The NSQIP database defines wound class as class I = clean, class II = clean/contaminated, class III = contaminated, and class IV = infected. ASA classes are defined as class I = no disturbance, class II = mild disturbance, class III = severe disturbance, and class IV = life threatening. Since wound class and ASA class are standard tools of measure, we used it as reported in the database.

Modified Frailty Index (mFI)

We used 11 preoperative variables given in the NSQIP dataset to define mFI as it had been originally described and reproduced [13,14]. This included the following: functional dependence; diabetes mellitus (DM); hypertension; congestive heart failure (CHF); myocardial infarction (MI); prior cardiac surgery, percutaneous coronary angioplasty, or history of angina; chronic obstructive pulmonary disease (COPD) or pneumonia; rest pain, gangrene secondary to peripheral vascular disease (PVD), or PVD treated with angioplasty, revascularization, or amputation; impaired sensorium within 48 h prior to the surgical procedure that is not in the context of concomitant neurologic disease such as dementia; history of transient ischemic attack (TIA) or cerebrovascular accident (CVA) without neurologic deficit; and CVA with neurologic deficits. We allotted one point to each of the above variables, ranging mFI from 0–11.

Outcome measure

The outcome measure of interest was postoperative 30-day complication. The NSQIP reports the following complications: superficial surgical site infection (infection occurring just in the area of the skin where the incision was made), wound infection (infection occurring beneath the incision area in muscle and the tissues surrounding the muscles), organ space infection (can be in any area of the body other than skin, muscle, and surrounding tissue that was involved in the surgery), dehiscence, pneumonia, reintubation, pulmonary embolism, failure to wean off ventilator, renal failure, urinary tract infection, CVA, coma, cardiac arrest, MI, intraoperative or postoperative bleeding requiring transfusion, flap failure, deep vein thrombosis, sepsis, and septic shock, as shown in Table 2 [19–21]. Since we were interested in determining incidence of complication based on preoperative risk factors, we used 30-day complications as an aggregate. We stratified the complications into systemic complications, non-systemic complications, and death to further characterize predictability.

Statistical analysis

Categorical variables were expressed as frequencies (n) with percentages, and continuous variables were expressed as means and standard deviations. We calculated BMI from the height and weight data provided in the dataset. Chi square tests and Mann-Whitney U tests were done for categorical and continuous variables, respectively. Univariable logistic regression analysis was used to quantify risk factors for 30-day complications by each stratum. The ROC curves and concordance scores (c-score) were generated to measure accuracy of mFI with complications and compared it with age, BMI, wound class, and ASA class. Multivariable logistic regression analysis was to evaluate the performance of each risk index independent of the others. All statistical analyses were performed using SAS 9.4 (Cary, NC).

Table 2. Complications.

Variables	*n* (%)
Total complications	777 (24%)
Non systemic complication	737 (22.8%)
Superficial surgical site infection	95 (2.9%)
Wound infection	55 (1.7%)
Organ space infection	15 (0.5%)
Dehiscence	64 (2.0%)
Urinary tract infection	33 (1%)
Sepsis	48 (1.5%)
Intraoperative or postoperative bleeding requiring transfusion	527 (16.3%)
Flap failure	48 (1.4%)
Deep vein thrombosis	28 (0.9%)
Systemic complication and death	115 (3.6%)
Pneumonia	45 (1.4%)
Reintubation	33 (1%)
Pulmonary embolism	19 (0.6%)
Failure to wean off ventilator	40 (1.2%)
Renal failure	1 (0%)
Cerebrovascular accident	5 (0.2%)
Coma	1 (0%)
Cardiac arrest	7 (0.2%)
Myocardial infarction	8 (0.3%)
Septic shock	7 (0.2%)
Death	6 (0.2%)

Results

Our inclusion criteria yielded 3237 patients. The mean age was 52.67 ± 12.13 years. Most patients (66.3%) were in the 50–65 years age group. The mean BMI was 28.32 ± 6.32, with most patients (60.6%) being non obese (i.e. BMI $< 30 kg/m^2$). The comorbidities were used to generate mFI scores. Hypertension and diabetes were the most common comorbidities. Computing mFI scores yielded most patients as non-frail (73.2%). Among the frail strata, the majority had a frailty score of 1 (23.1%), followed by frailty score of 2 (3.6%), frailty score of 3 (0.1%), and none with a frailty score >3 (Table 1).

We found a 30-day aggregate complication rate of 24%. The most common individual complication was intraoperative or postoperative bleeding within 72 h requiring transfusion (16.3%) (Table 2). Examining the rate of complications across different risk indices and within each stratum, we found a general trend towards increasing complications (Figure 1). To determine the associated risk of 30-day complication within each stratum, univariate logistic regression analysis was performed. We used age <20 years, BMI $< 30 kg/m^2$, frailty score of 0, wound class I, and ASA class 1 as reference groups. Compared to frailty, the odds of complications for a frailty score of 1 and 2 were 22.1 (CI = 17.9–27.3, $p < 0.01$) and 28 (CI = 18.3–43, $p < 0.01$), respectively (Table 3).

To determine the predictive value of each risk group for 30-day aggregate complication, we used the ROC curve. Univariable logistic regression found frailty to have the highest concordance

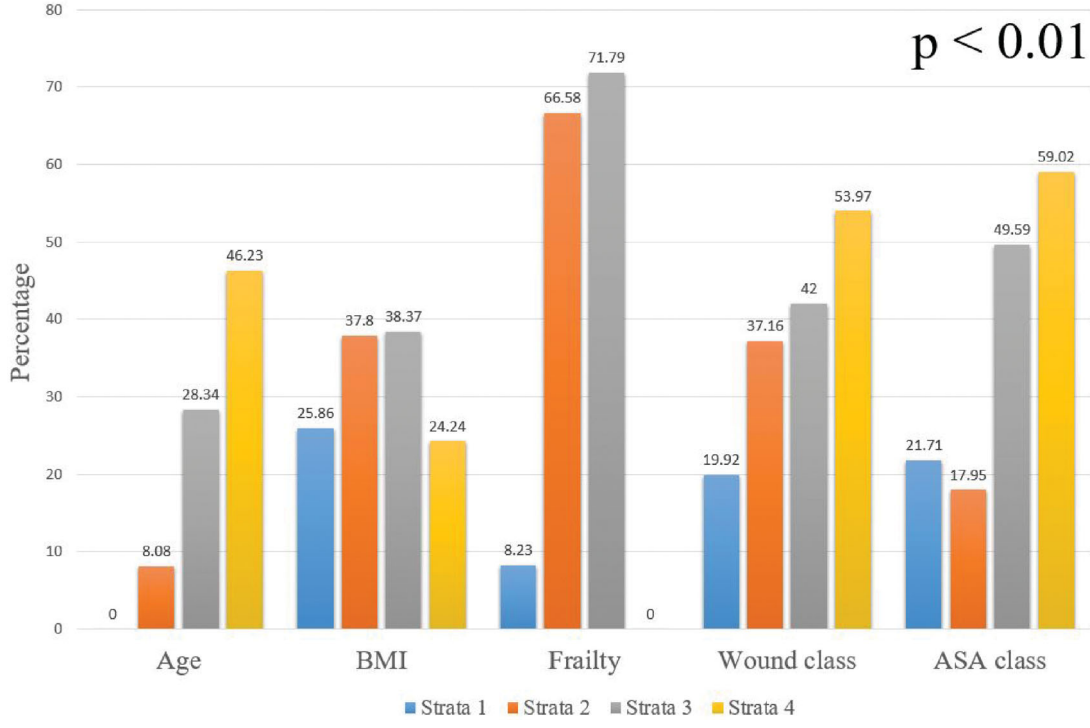

Figure 1. Rate (percentage) of complications by each risk stratum. Age strata (<20 years, 20–49 years, 50–65 years, >65 years), BMI strata (30–34.9 kg/m^2, 35–39.9 kg/m^2, 40–44.9 kg/m^2, >45 kg/m^2), Frailty strata (Frailty score = 0, Frailty score = 1, Frailty score = 2, Frailty score = 3), Wound class strata (Class I: Clean, Class II: Clean/Contaminated, Class III: Contaminated, Class IV: Infected), ASA class strata (Class I: No disturbance, Class II: Mild disturbance, Class III: Severe disturbance, Class IV: Life threatening).

Table 3. Univariate logistic regression for complications by strata.

Risk index, by strata	Odds Ratio	Confidence Interval 95%	P value
Age			
<20 years (Reference)			
20–49 years	0.26	0.00–23.90	0.98
50–65 years	1.17	0.01–106.39	0.97
>65 years	2.54	0.03–232.89	0.97
BMI			
<30 kg/m^2 (Reference)			
30–34.9 kg/m^2	**1.35**	**1.11–1.64**	**<0.01**
35–39.9 kg/m^2	**2.36**	**1.84–3.02**	**<0.01**
40–44.9 kg/m^2	**2.42**	**1.54–3.78**	**<0.01**
>45 kg/m^2	1.24	0.56–2.77	0.60
Frailty			
Frailty score = 0 (Reference)			
Frailty score = 1	**22.1**	**17.9–27.3**	**<0.01**
Frailty score = 2	**28.0**	**18.3–43.0**	**<0.01**
Frailty score = 3	1.2	0.0–32.5	0.97
Wound class strata			
Class I: Clean (Reference)			
Class II: Clean/Contaminated	**2.38**	**1.94–2.91**	**<0.01**
Class III: Contaminated	**2.91**	**1.93–4.38**	**<0.01**
Class IV: Infected	**4.71**	**2.85–7.81**	**<0.01**
ASA class strata			
Class I: No disturbance (Reference)			
Class II: Mild disturbance	0.79	0.51–1.22	0.29
Class III: Severe disturbance	1.49	0.97–2.30	0.07
Class IV: Life threatening	**5.19**	**2.69–10.05**	**<0.01**
None assigned			

Bold suggest statistical significance.

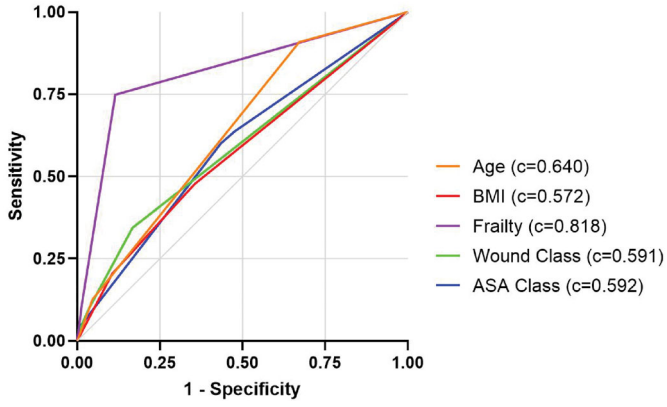

Figure 2. Receptor Operating Characteristic (ROC) curve for 30-day complications. Comparison of concordance statistics (c) in each stratified risk category. Frailty is the most predictive of complications (c-score = 0.818).

(c-score = 0.818). Frailty seems to be a better predictor of 30-day complications when compared to age, BMI, wound class, and ASA classes alone (Figure 2). Upon stratification of the complications by severity we found that mFI still holds the highest predictive value for each, better for non-systemic complications (Figure 3, Table 4). Multivariable logistic regression found frailty as the strongest independent predictor of 30-day aggregate complications adjusted OR = 22.24, CI = 17.77–27.82, $p < 0.01$ (Table 5).

Discussion

Frailty is a state of increased vulnerability for complications [22]. The American Medical Association reported that 40% of adults aged 80 years and older are frail. As the population ages, the proportion of frail patients is expected to increase [23]. Frailty is a distinct clinical entity that is often used interchangeably with "comorbidity" and "disability" [8]. Given the lack of a universal

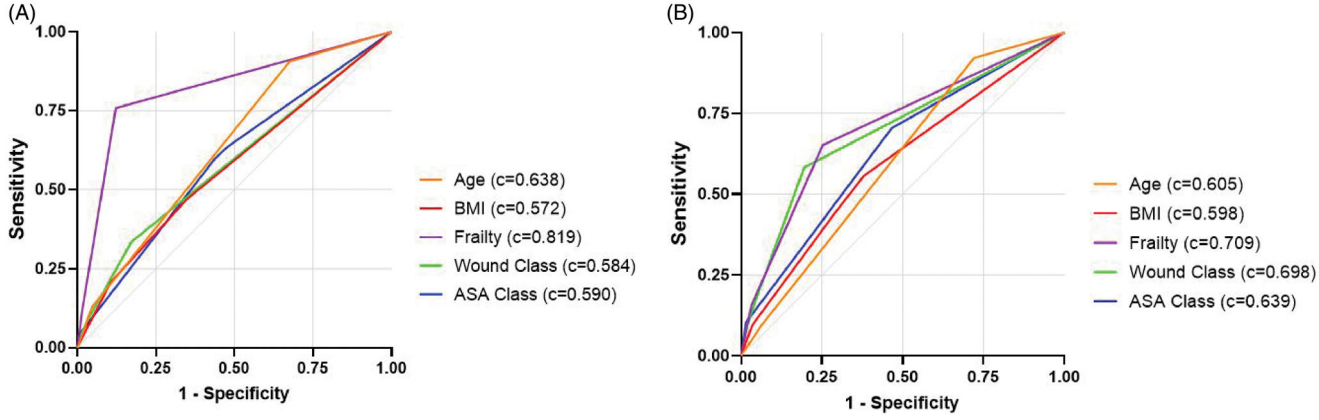

Figure 3. Receptor Operating Characteristic (ROC) curve by severity of complications. (A) Non systemic complication is an aggregate of; superficial surgical site infection, wound infection, organ space infection, dehiscence, urinary tract infection, sepsis, intraoperative or postoperative bleeding requiring transfusion, flap failure, and deep vein thrombosis. (B) Systemic complication and death is an aggregate of; pneumonia, reintubation, pulmonary embolism. failure to wean off ventilator, renal failure, cerebrovascular accident, coma, cardiac arrest, myocardial infarction, septic shock, and death. Comparison of concordance statistics (c) in each stratified risk category. Frailty is the most predictive for both; Non systemic complication (Left side) c= 0.819, and Systemic complication and death (Right side) c = 0.709.

Table 4. Univariate logistic regression by severity of complication.

	Non systemic complications			Systemic complications and death		
Risk index, by strata	Odds ratio	Confidence interval 95%	*p* Value	Odds ratio	Confidence interval 95%	*p* Value
Age						
<20 years	(Reference)					
20–49 years	0.25	0.00–23.15	0.98	(Reference)		
50–65 years	1.08	0.01–97.91	0.97	**4.48**	**2.25–8.92**	**<0.01**
>65 years	2.40	0.03–219.74	0.97	**5.29**	**2.16–12.94**	**<0.01**
BMI						
<30 kg/m2	(Reference)			(Reference)		
30–34.9 kg/m2	**1.32**	**1.09–1.61**	**<0.01**	**1.91**	**1.24–2.92**	**<0.01**
35–39.9 kg/m2	**2.39**	**1.86–3.08**	**<0.01**	**1.80**	**1.00–3.23**	**0.05**
40–44.9 kg/m2	**2.46**	**1.57–3.86**	**<0.01**	**3.84**	**1.76–8.37**	**<0.01**
>45 kg/m2	1.12	0.48–2.59	0.80	**3.75**	**1.11–12.67**	**0.03**
Frailty						
Frailty score = 0	(Reference)			(Reference)		
Frailty score = 1	**21.78**	**17.6–26.9**	**<0.01**	**4.80**	**3.18–7.26**	**<0.01**
Frailty score = 2	**27.68**	**18.2–42.2**	**<0.01**	**10.58**	**5.86–19.12**	**<0.01**
Frailty score = 3	1.36	0.05–35.9	0.97	6.38	0.24–170.09	0.98
Wound class strata						
Class I: Clean	(Reference)			(Reference)		
Class II: Clean/Contaminated	**2.22**	**1.80–2.73**	**<0.01**	**5.27**	**3.48–7.97**	**<0.01**
Class III: Contaminated	**2.59**	**1.71–3.92**	**<0.01**	**5.82**	**2.85–11.86**	**<0.01**
Class IV: Infected	**4.36**	**2.64–7.22**	**<0.01**	**9.88**	**4.74–20.56**	**<0.01**
ASA class strata						
Class I: No disturbance	(Reference)			(Reference)		
Class II: Mild disturbance	0.74	0.48–1.15	0.18	1.32	0.31–5.57	0.71
Class III: Severe disturbance	1.37	0.89–2.12	0.15	3.12	0.76–12.87	0.12
Class IV: Life threatening	**4.86**	**2.52–9.37**	**<0.01**	**15.55**	**3.36–72.02**	**<0.01**
None assigned						

Bold suggest statistical significance.

Table 5. Multivariable logistic regression analysis.

Risk index	Adjusted Odds Ratio	Confidence Interval 95%	P value
Frailty	**22.24**	**17.77-27.82**	**<0.01**
Age ≥ 50	**4.21**	**3.33-5.31**	**<0.01**
BMI ≥ 30	1.10	0.88-1.37	0.421
Advanced would class	**3.12**	**2.07-4.72**	**<0.01**
Advanced ASA class	**2.10**	**1.69-2.61**	**<0.01**

*Adjusting for all the risk indices after dichotomizing each risk index

definition of frailty, the introduction of a simple tool such as mFI, which is based on a set of preoperative patient-related comorbidities, provides an objective means of assessing the candidacy of a surgical patient and the risk of complications [14–16].

Several studies have evaluated the validity and accuracy of mFI in predicting complications after various surgical procedures [13–17]. The validation process of different frailty instruments is under debate. Until today, unfortunately, there is no uniform established standard for validation of these scales. To our knowledge, we are the first to evaluate the mFI in predicting complications after microsurgical breast reconstruction. We report that patients with a frailty score of 1 and 2 compared to patients with frailty score 0 are at 22 and 28-fold increased risk of 30-day complications. It is important to note that in our study, no patients with more than three comorbid conditions (i.e. frailty score > 3) underwent microsurgical breast reconstruction. This suggests that microsurgeons nationally are selective in their approach when offering microsurgical breast reconstruction to patients with comorbidities.

When it comes to perioperative risk stratification, plastic and reconstructive procedures are listed as low risk procedures [23–25]. This is a gross generalization, however. Although we found that the risk of perioperative cardiac complications and death are still low (<1%), the overall 30-day complication rate for free flap breast reconstruction is quite high (24%). Hence, for surgeries such as breast free flap reconstruction, it is crucial to identify the patients who are at increased risk of complications. This can help in an informed decision-making process that is objective, patient-focused, and clinically relevant in order to ensure perioperative safety and improve the quality of care for patients undergoing breast reconstruction using free flaps [9].

The incidence of breast cancer increases with age [26]. Evidence suggests that this risk increases by 10-fold after the age of 70 years as compared to the age of 30 years [27]. Although age is generally regarded as a marker of increased complications, there is no evidence to suggest that aging by itself is a contraindication to microsurgical breast reconstruction [5,28]. On the contrary, studies reporting outcomes of breast reconstruction, including autologous reconstruction, in patients older than 65 years of age suggest an increased patient satisfaction without affecting patient safety [6]. We have found that increasing age does, in fact, contribute to the risk of postoperative complications, but that mFI appears to have a much stronger predictive value.

Obesity has been found to be a risk factor for mastectomy flap necrosis [4]. However, no definitive BMI level has been described as a contraindication to microsurgical breast reconstruction. Since BMI was not part of our mFI, we used it separately to evaluate its predictive value for complications. Our findings are consistent with the literature in that higher BMI predicted higher rates of 30-day postoperative aggregate complications, although mFI had a much stronger predictive value [7].

The wound classification system has been introduced to justify the incidence of postoperative surgical site infections [29]. We hypothesized and found that a higher wound class level is associated with higher postoperative complications. Our finding is consistent with the current literature in using advanced wound class as a predictor of complications [30]. Similarly, ASA class has been used to determine perioperative morbidity and mortality [31]. We hypothesized that increasing ASA class would be associated with

higher postoperative complications. We identified an associating trend, though only ASA IV was significantly correlated with complications. Notably, the predictive value of frailty was higher than both wound class and ASA class.

The most notable finding of our study is that mFI alone has a better predictive value for 30-day complications than age, BMI, wound class, and ASA class do alone. While age is not a modifiable risk factor, several components of mFI are modifiable. For example, patients who are diabetic or hypertensive should be optimized preoperatively to mitigate risks of 30-day complications, while patients who are functionally dependent, had a recent MI, stroke, or have PVD should possibly not be offered a procedure such as microsurgical breast reconstruction. Several other authors have similarly proven frailty to be a modifiable risk factor [32–35]. Hence, it is the patient's physiology that determines one's surgical candidacy rather than one's age. We have found that the presence of comorbidities has an additive effect of overall complications. Hence, the presence of more than 3 comorbidities in patients should be considered as a relative contraindication to microsurgical breast reconstruction.

Efforts have been made to define frailty radiographically and quantify it based on muscle mass. Broyle *et al.* investigated sarcopenia as a surrogate for frailty and evaluated its impact on perioperative complications in abdominal reconstruction using free flaps. Their retrospective review of 238 patients found 38 patients (14.1%) as frail. They defined sarcopenia by a measure of the cross-sectional area of the muscles at the L3 vertebra. Sarcopenia was defined as a sarcopenic index of less than 38.5 cm^2/m^2. They did not find sarcopenia to be predictive for complications in patient undergoing abdominal-based free flaps [3]. Since most patients undergoing breast microsurgical reconstruction end up getting some sort of axial imaging, sarcopenia would had been an important risk index for post-operative complications. But our findings suggest that mFI which is based on preoperative comorbidities is the most appropriate tool to predict post-operative complications.

The major strength of our study is that the mFI was developed using a set of variables provided in the NSQIP dataset which is objective and easy to use. The large sample size helped to derive powerful conclusions, and with that it should be reproducible. Additionally, the dataset includes age, BMI, wound class, and ASA class, which we used as a means of comparison in determining the factor with the most predictive value for complications. However, the mFI does not include other risk indices such as increasing age, BMI, wound and ASA classes. Hence, we performed a multivariable logistic regression analysis to evaluate mFI as a risk index that is independent of other risk indices. And we have found that mFI is and independent and the most predictive of 30-day complications.

The main limitation of our study is its retrospective design and the origination of data from multiple anonymous sources. Hence, we cannot account for any selection bias. Some of the key details of the procedures are not reported. The CPT code is generic for autologous breast reconstruction using a microsurgical technique; it does not specify whether the flaps were abdominal-based or extra-abdominal. Furthermore, it is not known specifically whether the complications occurred at the donor site or the free flap transfer site (i.e. the breast). Although, there is a trend toward increasing odds ratio for complications with increasing frailty scores of 0 versus 1 versus 2, but the declining numbers of observations with higher frailty scores make our estimates of effect size at higher scores imprecise or impossible. Additionally, the database does not report complications beyond 30-days, hence we do not have data to analyze.

Conclusion

The modified Frailty Index (mFI) predicts incidence of 30-day complications after microsurgical breast reconstruction. The mFI is a simple, reliable, and objective tool that has a predictive value better than age, BMI, wound class, or ASA class in predicting 30-day complications. The application this of tool can help microsurgeons preoperatively identify patients who are at high risk.

Disclosure statement

No potential conflict of interest was reported by the author(s).

IRB approval

The study was approved by the Institutional Review Board, IRB # 20-092

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