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The Impact of Frailty and Age on Older Patients Undergoing Plastic Surgery at a Quaternary Center in Brazil

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Background: An aging population brings with it an older cohort of patients undergoing plastic surgery. Identifying and understanding risk factors related to surgical outcomes is critical. The literature diverges regarding the impact of age. Associated with age is the modifiable condition of frailty. This is a retrospective case control study examining the effect of age and frailty on perioperative outcomes in the plastic surgery setting.

Methods: A cohort of elderly patients undergoing plastic surgery at the Hospital das Clínicas da Faculdade de Medicina de Botucatu between 2013 and 2020 was collected to medical chart review. The independent variables analyzed were age, sex, comorbidities, surgery performed, and modified 5-item frailty index. The outcomes evaluated were perioperative and postoperative complications, rehospitalization within 1 month, and mortality within 1 month after surgery.

Results: We identified 229 patients, with a mean age of 70.1 ± 8.8 years. The majority were women (54.6%). The most prevalent comorbidities were systemic arterial hypertension (62.4%) and smoking (27.5%). Frailty score (modified 5-item frailty index) of 2 or more impacted readmission at 30 days (P = 0.012). A total of 43 (18.8%) patients were 80 years of age or older, and 28 (65.1%) were women. There were no statistical differences among the surgical outcomes among octogenarians and the younger group.

Conclusions: Frail elderly patients had higher readmission rate at 30 days of follow-up. In our cohort, frailty score was more effectively than age in predicting poorer postoperative outcomes. *(Plast Reconstr Surg Glob Open 2025;13:e6641; doi: 10.1097/GOX.0000000000006641; Published online 31 March 2025.)*

INTRODUCTION

The global population is undergoing an aging process, and projections from the World Health Organization suggest that by 2050, there will be more than 2 billion people 60 years of age and older.[1] Although this has been a historical issue for higher income countries, in recent years, aging is becoming a process that is becoming more pronounced in low- and middle-income countries such as Brazil.[2]

The implication of this phenomenon on plastic surgery is that a greater proportion of patients who undergo plastic surgery procedures are now older and potentially frailer. As older patients on average are likely to have a greater number of comorbidities and lower cardiopulmonary reserve,[3,4] this raises concerns for postoperative outcomes in patients undergoing plastic and reconstructive procedures. Furthermore, in patients 80 years of age and older, it has been shown that there is yet an increased incidence of systemic comorbidities, functional frailty, and postoperative mortality and morbidity compared with younger patients. This trend has been solidified by work

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undertaken by Takabayashi et al,[5] which classifies this demographic as "super elderly."

Distinct from comorbidities and age, another more specific risk factor predictive of postoperative morbidity and mortality is frailty. Frailty is defined as a clinical state in which there is an increase in individual vulnerability for developing dependency and/or mortality when exposed to a stressor (such as surgery).[6] Although it is relatively independent of age within the geriatric cohort, frailty is almost exclusively confined to older patients. As such, another challenge of an aging population on plastic surgery in middle-income countries is the increasing necessity to operate on frail patients.

To quantify the severity of frailty in surgical contexts, the American College of Surgeons (ACS) developed the modified 5-item frailty index (mFI-5). This scale uses data from the ACS National Surgical Quality Improvement Program and the Canadian Study of Health and Aging[7,8] which show that the presence of 5 criteria effectively predict postoperative mortality and morbidity. These 5 criteria are functional independence, diabetes (both insulin and noninsulin dependent), chronic obstructive pulmonary disease/acute pneumonia within 30 days before surgery, congestive heart failure, and medication-dependent hypertension.[8] The mFI-5, originally designed for general surgical procedures, holds a breadth of validity that includes many plastic surgery procedures such as dermolipectomy, pedicled flaps, and implant-based breast reconstruction.[9–17]

Current literature is divided based on the implication of age on postoperative outcomes within plastic surgery contexts, without a clear consensus on how plastic surgery is affected by an aging patient population.[4,18–22] Furthermore, although currently the largest change in patient demographics is occurring in low- and middle-income countries, the majority of the literature is undertaken in the context of high-income countries. To this end, the aim of this study was to analyze the interaction between age, frailty, and postoperative outcomes within a population of patients undergoing plastic surgery procedures at a single quaternary teaching center (Hospital das Clinicas da Faculdade de Medicin [HCFMB], São Paulo State University Clinical Hospital) in Botucatu, Brazil.

Takeaways

Question: What is the impact of frailty and age on the plastic surgery outcomes of elderly patients submitted to plastic surgery?

Findings: The study found that frailer patients had a higher rate of readmission within 30 days postoperatively and age did not significantly impact surgical outcomes

Meaning: Frailty is an important assessment of elderly patients submitted to plastic surgery. We recommend the wider use of the modified 5-item frailty index-5 as an easy, sensitive, and actionable indicator of frailty within plastic surgery contexts.

METHODS

Data Collection

This retrospective cohort study analyzed data taken from the electronic medical records (EMR) of elderly (60 y or older) and super elderly (80 y or older) patients admitted to Hospital das Clinicas who underwent plastic surgery procedures from January 2013 to December 2020.[3]

Inclusion and Exclusion Criteria

Inclusion criteria were age 60 years or older, not already involved in clinical research, requiring plastic surgery intervention, possessing a complete medical record for an mFI-5 score to be calculated, and not lost to follow-up at 12 months. Patients who were only seen on an outpatient basis and only had physical medical records were excluded. Both reconstructive and aesthetic patients were included.

Data Extraction

The following independent variables were analyzed: age, sex, comorbidities as per EMR, surgery performed, and mFI-5. The functional status of each patient was garnered from explicit documentation made in the EMR. The following outcome data were also analyzed: perioperative and postoperative complications, rehospitalization within 1 month of surgery, and mortality within 1 month of surgery.

Statistical Analysis

Numerical variables such as age were represented as a mean and SD and were compared using the Student *t* test or Mann-Whitney U test according to the distribution of data. Categorical variables were presented as absolute frequencies and percentages and were compared using chi-square and Fisher exact tests, requiring the calculation of odds ratios (ORs). In both cases, a *P* value of less than 0.05 was considered statistically significant. In describing associations, bivariate analysis with logistic regression was performed. Only variables whose effect had a *P* value of less than 0.1 were included in the analysis, and variables were introduced in the analyses in the order of highest OR to lowest. This report only retains variables which were statistically associated. Data analysis was performed using IBM SPSS Statistics version 24.0.0 software.

Ethics

All procedures performed in this study were in accordance with the Declaration of Helsinki of 1964 and its subsequent alterations. The local ethics committee approved this study (protocol number: 47336621.4.0000.5411).

RESULTS

A total of 229 patients older than 60 years underwent plastic surgery at HCFMB during the period analyzed. Mean age was 70.1 ± 8.8 years (range, 60–95 y). Forty-three (18.8%) of these patients were older than 80 years. The majority were women (54.6%) (Table 1). The most prevalent comorbidities were hypertension (62.4%), smoking (27.5%), diabetes (23.1%), and hypothyroidism (10.5%).

Table 1. Clinical Characteristics of Elderly Patients Undergoing Plastic Surgery at HCFMB From 2013 to 2020

Variable	N (%)
Male	104 (45.4)
Mean age ± SD	70.1 ± 8.8 y
Patients older than 80 y	43 (18.8)
Median frailty score [minimum–maximum]	1.1 [0–4]
Patients with a score ≥ 2	71 (31.0)
Patients with a score ≥ 3	17 (7.4)
Nonindependent ADL	24 (10.5)
Median time of surgery (min) [minimum–maximum]	190 [20–1080]
Median length of hospital stay (d) [minimum–maximum]	3 [2–129]
Comorbidities	
Hypertension	143 (62.4)
Smoking (current/previous)	63 (27.5)
Diabetes mellitus	53 (23.1)
Hypothyroidism	24 (10.5)
Congestive heart failure	22 (9.6)
Dyslipidemia	19 (8.3)
Alcoholism	15 (6.6)
Stroke	8 (3.5)
Obesity	7 (3.1)
Chronic obstructive pulmonary disease	6 (2.6)
Chronic kidney disease	4 (1.7)
Alzheimer disease	4 (1.7)
Parkinson disease	1 (0.4)
Surgical indications	
Cosmetic surgery	41 (17.9)
Reconstructive surgery	188 (82.1)
Neoplasia	103 (45.0)
Trauma	47 (20.5)
Soft-tissue infection/injury	27 (11.8)
Facial palsy	11 (4.8)

ADL, activities of daily living.

Frailty was identified in 71 (31%) patients who had an mFI-5 of 2 or more, and all underwent reconstructive surgery ($P < 0.001$). There was no difference between genders among this subgroup (Table 2).

Seventy (30.6%) patients had some type of complication in the postoperative period. Six (2.6%) patients required readmission within 30 days after surgery. The number of mortalities within 30 days of surgery was 10 (4.4%).

A frailty score of 2 or more was associated with readmission at 30 days ($P = 0.012$). The stepwise binary logistic regression model included age older than 80 years and mFI-5 of 2 or more. In the second block, we also investigated the effects of the interaction between these 2 variables. The model was significative [X^2 (2) = 7.521; $P = 0.023$; R^2 Nagelkerke = 0.150; Hosmer and Lemeshow test: $X^2(1) = 0.000$, $P = 1.000$], and an mFI-5 of 2 or more was a significant predictor of readmission within 30 days (OR = 10.021; 95% confidence interval: 1.018–98.615; $P = 0.048$), whereas age older than 80 years was not ($P = 0.185$), even when interacting with frailty ($P = 0.599$) (Tables 3–5). Mortality at 30 days was not statistically affected by any of the variables analyzed (Table 6).

Table 2. Prevalence of Frailty (Measured by the mFI-5) Stratified by Sex and Surgical Indication

Variable	mFI ≥ 2	
	N (%)	*P*
Sex		
Male	33 (31.7)	0.828
Female	38 (30.4)	
Surgery		
Aesthetic	1 (2.5)	< 0.001
Reconstructive	70 (37.0)	

Super Elderly Versus Elderly Subgroup Analysis

In total, 43 (18.8%) patients aged 80 years or older were identified. Of these, the majority, 28 (65.1%), were women. There was no statistical difference in gender distribution between elderly and super elderly patients ($P = 0.132$) (Table 6).

The most common surgical indication was treatment of neoplasia (72.1%), followed by trauma (20.9%). In patients between 60 and 79 years of age, neoplasia and aesthetics were the most common surgical indications (38.7% and 20%, respectively, $P < 0.001$).

Twenty-one (48.8%) super elderly patients had a score of 2 or more in mFi-5, a higher percentage when compared with patients between 60 and 79 years of age (26.9%) ($P = 0.005$). Among the mFI-5 items, the prevalence of hypertension in 33 (59.1%) patients, dependence on daily activity in 12 (27.9%), and congestive heart failure in 8 (18.6%) were significantly elevated compared with the younger group ($P = 0.032$; $P < 0.001$; $P = 0.026$) (Table 7). There were no statistical differences among the surgical outcomes.

DISCUSSION

This retrospective cohort study reveals valuable trends in demographic data and post–plastic surgery outcomes in an elderly Brazilian cohort. With a sample size of 229 patients, it represents the largest cohort study done in a middle-income country on older patients within a plastic surgery context.

In comparing postoperative complications between elderly and super elderly patients, our results revealed no significant differences in complication rates. This contrasts with findings by Shih et al, who reported a higher complication risk in patients older than 80 years undergoing plastic surgery. Their analysis, based on data from the ACS National Surgical Quality Improvement Program registry showed a complication rate of 15.9% in this specific population.[11] In our study, however, we observed a higher complication rate of 30.6%. This elevated incidence could be attributed to the inherent complexity of cases, as our institution serves as the final point of referral for plastic surgery care within our regional health sector.

Regarding frailty alone, our data demonstrated that frailty was associated with increased rates of rehospitalization at 30 days as compared with patients who scored less than 2 on the m-FI5 index. This was resoundingly reflected in the literature examining frailty and its effect of plastic surgery outcomes.[9–17]

Table 3. Association Between Independent Variables and Postoperative Complications Within Elderly Patients Undergoing Plastic Surgery at HCFMB From 2013 to 2020

Variables	Postoperative Complications, N (%)	*P*
Sex		
Male	34 (32.6)	0.328
Female	36 (28.8)	
Age more than 80 y		
Yes	14 (32.5)	0.751
No	56 (30.1)	
Fragility (mIF-5 ≥ 2)		
Yes	26 (36.6)	0.182
No	44 (27.8)	
Dependency for ADL		
Yes	11 (45.8)	0.083
No	59 (28.8)	
Type of surgery		
Aesthetics	10 (24.4)	0.343
Repair	60 (46.8)	

ADL, activities of daily living.

Table 4. Association Between Independent Variables and Rehospitalization Within 30 Days in Elderly Patients Undergoing Plastic Surgery at HCFMB From 2013 to 2020

Variables	Readmission in 30 d, N (%)	*P*
Sex		
Male	4 (3.8)	0.415
Female	2 (1.6)	
Age older than 80 y		
Yes	3 (7.0)	0.082
No	3 (1.6)	
Fragility (mIF-5 ≥ 2)		
Yes	5 (7.0)	**0.012**
No	1 (0.6)	
Dependency for ADL		
Yes	2 (8.3)	0.122
No	4 (2.0)	
Type of surgery		
Aesthetics	0 (0.0)	0.379
Repair	6 (3.2)	

ADL, activities of daily living.

Frailer patients almost exclusively underwent reconstructive surgery and not aesthetic surgery. This is due to stringent limitations within our institution on body mass index, smoking, and comorbidities that patients can have and still be eligible for nonessential cosmetic surgery. These limitations are implemented to reduce the chances of unnecessary complications and unfavorable scarring and hematoma, which are especially inappropriate within nonessential surgical settings[9–17]

When examining the association between age and frailty, our results found that patients older than 80 years of age exhibited higher rates of frailty compared with their younger counterparts as measured by the mFI-5. Among the super elderly, 21 individuals (48.8%) scored an mFI-5 of 2 or higher. Contextualized to the general population, a Brazilian study examining 166 individuals older than 80 years of age diagnosed frailty in 15.6% of

Table 5. Binary Logistic Regression Model for Variables Associated With Rehospitalization Within 30 Days in Elderly Patients Undergoing Plastic Surgery at HCFMB From 2013 to 2020

Variable	OR	*P*	95% CI
mFI-5 ≥ 2	10.021	0.048	1.018–98.615
Age > 80 y × mFI-5 ≥ 2	1.649	0.599	0.255–10.666

CI, confidence interval.

Table 6. Association Between Variables and Death Within 30 Days Postoperatively in Elderly Patients Undergoing Plastic Surgery at HCFMB From 2013 to 2020

Variables	Death in 30 d, N (%)	*P*
Sex		
Male	7 (6.7)	0.233
Female	4 (3.2)	
Age older than 80 y		
Yes	2 (4.7)	1.000
No	9 (4.8)	
Fragility (mIF-5 ≥ 2)		
Yes	3 (4.2)	1.000
No	8 (5.1)	
Dependency for ADL		
Yes	2 (8.3)	0.611
No	9 (4.4)	
Type of surgery		
Aesthetics	0 (0.0)	0.219
Repair	11 (5.8)	

ADL, activities of daily living.

cases.[12] Additionally, a systematic review by Collard et al[23] found frailty rates of 15.7% in patients 80–84 years of age and 26.1% in those older than 85. Both of these demonstrated frailty in a relatively lower proportion of patients as compared with our analysis. These discrepancies may be rationalized by noting that all studies used much more stringent criteria for the diagnosis of frailty; for example, the paper by Fried et al[24] considered individual grip strength and gait.

When frailty, defined as an mFI-5 score of 2 or more, is considered within the super elderly, our sample still contains a disproportionately high percentage of frail patients. An analysis of elderly patients undergoing pedicled flaps by Cuccolo et al identified frailty (mFI-5 > 2) in only 27.9% of patients older than 80 years of age.[17] This could be attributed to our population containing a high number of functionally dependent patients (27.9% versus Cuccolo et al's 11.7%) and once again to HCFMB's unique position as the final point of escalation for complex plastic surgery cases within São Paulo.[25] The experience of this study highlights the need for 3 important considerations when the plastic surgery care of the frail patient is considered.

First, the mFI-5 is a quick and easy test that effectively predicts a patient's propensity for frailty and poorer surgical outcomes in a plastic surgery context. The fact that it overestimates frailty within a population may lend credence to its ability to be an early detector of impending frailty. As such, the wide utilization

Table 7. Subgroup Analysis Comparing the Difference Between Patients 60–79 Years and 80+ Years Who Underwent Plastic Surgery at HCFMB, in the Period Between 2013 and 2020

General Data	<80 y, N (%)	≥80 y, N (%)	*P*
Sex			
Male	88 (85.4)	15 (14.3)	
Female	97 (77.6)	28 (22.4)	0.132
Surgery			
Aesthetics	41 (100)	0	
Reconstructive	145 (77.2)	43 (22.8)	<0.0001
mFI-5 ≥ 2	50 (26.9)	21 (48.8)	0.005
Comorbidity			
Diabetes	42 (22.6)	11 (25.6)	0.674
COPD	4 (2.2)	2 (4.7)	0.597
Hypertension	110 (59.1)	33 (76.7)	0.032
CHF	14 (7.5)	8 (18.6)	0.026
DLA	12 (6.5)	12 (27.9)	<0.001
Smoking	52 (27.6)	11 (25.6)	0.782
Hypothyroidism	20 (11.9)	4 (10.2)	0.52
Median time of surgery (min) [IQR]	200 [215]	180 [120]	0.115
Median length of hospital stay (d) [IQR]	3 [2]	3 [5]	0.689

ADL, activities of daily living; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; IQR, interquartile range.

of the mFI-5 can help recruit effective and necessary general medical, geriatric, and allied health input into patients' plastic surgical care. Rather than simply using this marker of frailty to cancel or postpone surgery, the sensitive inclusion of multidisciplinary care can help to reduce postoperative complications, morbidity, and mortality for frailer patients. Furthermore, the ease of quantifying a patient's frailty status with the mFI-5 score can help surgeons communicate with family and other patient support structures to champion an integrated healthcare model.[26–28]

Second, because frailty, as diagnosed by the mFI-5, demonstrates associations with early rehospitalization, more careful and sensitive postoperative follow-up of frailer patients should be instated. Future studies can examine the reason for hospitalizations to more specifically surveil these conditions within frail postoperative patients. The tailored perioperative care of the frail patient in such a way has also been shown to reduce the physical and psychological progression of frailty.[28]

Finally, it is worth noting that frailty is distinct from age in its modifiability. Where age is an undeniable consequence of time, frailty comprises many domains that may be optimized in the perioperative setting such that their decline is mitigated within the context of a surgery.

Limitations of our study are largely to do with the use of the mFI-5 as a measure of frailty. The score contains hypertension and diabetes, which are both associated with age and may confound the independence between frailty and age. Brazilian epidemiological studies indicated prevalence of hypertension and diabetes in older populations at 61.9%–77.8% and 21.2%–31%, respectively.[29–31] Second, the mFI-5 is not able to distinguish the stage and degree of hypertension and diabetes. Finally, the retrospective nature of this study, where data are collected and analyzed from the EMR, may introduce bias, and any associations do not imply causality.

CONCLUSIONS

Frailer patients had a higher rate of readmission within 30 days postoperatively. Furthermore, the super elderly population had a higher incidence of frailty. Finally, age did not significantly impact surgical outcomes. Our retrospective cohort study champions the wider use of the mFI-5 scale as an easy, sensitive, and actionable indicator of frailty within plastic surgery contexts. Frailty comprises many domains that may be optimized, and the mFI-5 could be a guide to better care during the preoperative and postoperative period. (**See Video [online]**, a "PRS Global Open Global Voices" video in which author Murilo Secanho, MD, MSc, discusses the main ideas and findings presented in the study, in Portuguese.)

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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