Risks Associated with Frailty in Microvascular Free Flap Head and Neck Reconstruction: A Systematic Review

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INTRODUCTION

- Microvascular free flap reconstruction (MFFR) is widely used for locally advanced resectable head and neck squamous cell carcinoma (HNSCC) to restore defects and preserve function. However, this procedure carries risks of wound complications, prolonged hospitalization, and functional decline.
- MFFR is increasingly performed in older patients, in whom frailty, a state of heightened susceptibility to adverse health outcomes due to physiologic decline[1], is a growing concern.
- The impact of frailty on immediate post-operative and long-term outcomes following MFFR for HNSCC surgery remains unclear, and this systematic review aims to synthesize existing evidence on this relationship in this population.

MATERIALS & METHODS

- Eligible studies were peer-reviewed, included a validated frailty index, and analyzed outcomes in mucosal or cutaneous HNSCC patients undergoing MFFR. Non-English publications, review articles, case reports, and studies that did not distinguish free versus pedicled flaps or primary versus salvage surgery were excluded.
- Screening, data extraction, and quality assessment (via the Newcastle-Ottawa Scale) were performed independently by two reviewers.

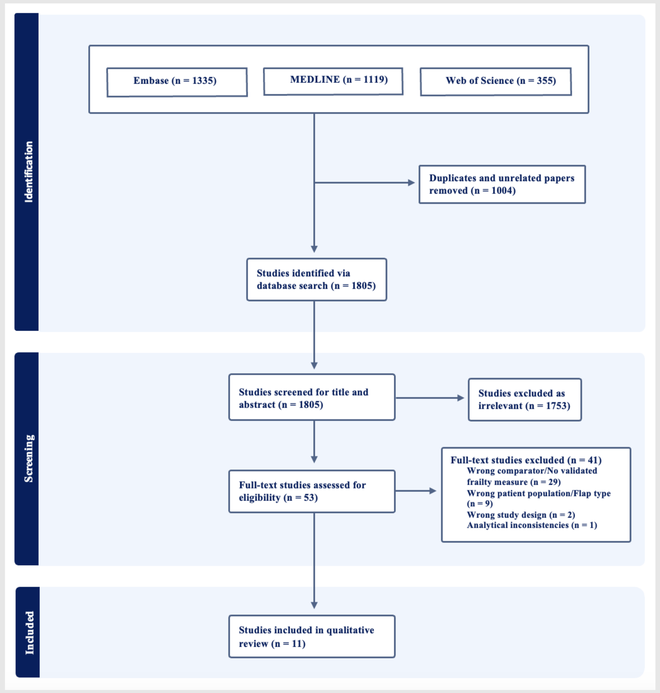

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Diagram

RESULTS

- Frailty was assessed with indices such as 5-mFI, 11-mFI, G8, RCS, PNI, RAI, and CPSMI. Patients' mean ages ranged from 59.6-83 years, and median study size was 214 [range: 64-1197]. Prevalence of frailty ranged from 21.4-60% across studies.

Table 1: Comparison between the frailty measures utilized in the included studies

Frailty Measure	Type	Included Variables
5-factor Modified Frailty Index (5-mFI)	Comorbidity-based	Diabetes, hypertension, congestive heart failure, COPD, functional dependence
11-factor Modified Frailty Index (11-mFI)	Comorbidity-based	5-mFI + history of MI, peripheral vascular disease, impaired sensorium, stroke/TIA, history of pneumonia, renal failure, etc.
Geriatric 8 (G8)	Screening tool in geriatric oncology	Food intake, weight loss, mobility, neuropsychological status, BMI, medications, age, self-rated health
Risk Classification System (RCS)	Prognostic scoring system	Age, comorbidities, ASA class, BMI, labs (albumin, hematocrit, etc.)
Prognostic Nutritional Index (PNI)	Nutrition/immunity biomarker	10 × serum albumin (g/dL) + 0.005 × total lymphocyte count (per mm³)
Risk Assessment Index (RAI)	Multidomain frailty index	Age, comorbidities, cognitive status, weight loss, functional dependence, living situation, malignancy, labs
Cervical Paraspinal Skeletal Muscle Index (CPSMI)	Imaging-based	Cross-sectional muscle area of cervical paraspinal muscles on CT/MRI, normalized to height

Table 2: Post-operative flap complications reported in studies

Flap Complications				
Publication	Measure	Effect Size	95% CI	p-value
D'Andrea et al., 2020	% (frail/non-frail)[a]	12/10	*	0.75
Luo et al., 2024	OR[b]	2.85	1.24-6.16	**0.01**
Mascarella et al., 2022	ROC comparison: AUC, Flap Failure	 5-mFI: 0.51 RAI: 0.62 CPSMI: 0.67	 0.41–0.62 0.52–0.72 0.57–0.76	0.76
Othman et al., 2024	% (frail/non-frail): Partial Flap Loss Total Flap Loss Reoperation Any Complication	 9/2.2 16.7/6.6 28.6/16.3 39.7/23.5	*	 **0.039** **0.033** **0.05** **0.019**

* = not reported; [a] flap failure; [b] infection, bleeding, or flap crisis
Abbreviations: Receiver Operating Characteristic (ROC), AUC (Area Under The Curve)

Table 3: Post-operative medical complications reported in studies

Medical Complications				
Publication	Measure	Effect Size	95% CI	p-value
Cleere et al., 2024	OR	2.61	1.45-4.69	**0.001**
D'Andrea et al., 2020	% (frail/non-frail)	46/40	*	0.47
Luo et al., 2024	OR[a]	6.57	4.34-10.03	**<0.001**
Welch et al., 2024	OR[b]: Prefrail Frail Severely Frail	 0.35 4.67 3.37	 0.05-2.40 0.97-22.47 0.22-52.91	**0.024**

* = not reported; [a] pulmonary, renal, hepatic, or cardiac complication; deep vein thrombosis, flap complications, or delirium; [b] superficial/deep/organ surgical site infections, wound disruption, pneumonia, unplanned intubation, cardiac arrest requiring CPR, DVT, sepsis, septic shock, CVA/stroke with neurological deficit

CONCLUSIONS

- Frailty was consistently linked to increased medical morbidity, prolonged hospitalization, non-home discharge, and diminished postoperative function.
- Medical complications, including pneumonia, urinary tract infection, myocardial infarction, and prolonged ventilatory support, were consistently associated with frailty, even after adjusting for age.
  - This finding suggests that frailty captures risk not explained solely by chronological age.
- Frail patients may experience inferior functional outcomes with swallowing, time to decannulation, and dependence on enteral nutrition, possibly reflecting reduced physiologic reserve and delayed recovery.
- In contrast, evidence for frailty's impact on surgical complications (flap loss, wound complications, and reoperation) was inconsistent.
  - This may be due to differences in frailty tools, outcome definitions, surgical technique, and low rates of flap failure at high-volume centers[2].
- Frailty was not associated with post-operative mortality.
- Studies incorporating nutritional or sarcopenia-based measures (e.g., skeletal muscle index) demonstrated stronger predictive power for surgical complications than frailty indices alone.
  - This finding suggests that integrating these dimensions into the development of a standardized frailty assessment could improve prognostic accuracy and support patient counseling, perioperative planning, and risk mitigation strategies.

LIMITATIONS

- Most studies were retrospective and single-center.
- Heterogeneity in frailty tools and thresholds, outcome reporting, and oncologic/treatment-related variables prevented meta-analysis.
- Long-term outcomes beyond 90 days, as well as the impact of prehabilitation, nutritional optimization, or enhanced recovery remain understudied in this patient population.

REFERENCES

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