



Comparison of the Risk Analysis Index vs Modified Frailty Index: Outcomes in Otologic Surgery

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Introduction

- Frailty is an important predictor of postoperative surgical complications, such as mortality, particularly in older adults¹. The mFI-5 and RAI are widely used to assess perioperative surgical risk^{2,3}.
- Within otolaryngology broadly, RAI-C has demonstrated strong predictive value for postoperative complications ^{4,5}. However, otologic studies have primarily used mFI-5, with limited data on RAI-C⁶.
- Recently, RAI-A was found to have greater predictive performance than mFI-5 for some short-term otologic complications such as 30-day mortality and surgical site infections ⁷.
- The discriminant ability of RAI-C and mFI-5 in otologic surgery remains incompletely characterized. In addition, the predictive ability of both RAI-C and mFI-5 to measure physiological outcomes-like speech perception following cochlear implantation remains unexplored.

Research Questions

Aim 1: Does RAI-C better predict postoperative outcomes than mFI-5 in patients undergoing otologic surgery?

Aim 2: Do measures of frailty predict postoperative changes in measures of speech perception after cochlear implantation?

Methods

Retrospective chart review of patients in the UCLA Department of Head and Neck Surgery from 2022-2026

Inclusion Criteria

- Adults ≥18 years
- Middle/inner ear surgery (excluding skull base surgery and tympanostomy tubes)
- Cochlear implants with matched pre/post operative AZBio/CNC data

Outcomes

- 30-/90-day adverse events (composite), return to OR, readmission, ED visit
- 30-day, 90-day, and 1-year otologic complications
- Length of stay ≥1 day
- Failure of same-day discharge

Statistical Analysis

- Multivariable logistic regression adjusted for age and sex
- Frailty cutoffs: mFI-5 ≥2; RAI-C ≥31
- ROC curves assessed predictive performance
- DeLong’s test compared AUCs between RAI-C and mFI-5

Results

Baseline Patient Characteristics, Whole Cohort (n = 385).

Characteristic	Overall (n = 385)
Age, years, mean (SD)	56.3 (18.1)
Sex, n (%)	
Male	182 (47.3)
Female	203 (52.7)
Ethnicity, n (%)	
Hispanic/Latinx	81 (21.0)
Not-Hispanic/Latinx	267 (69.4)
Unknown/Not Reported	37 (9.6)
Race, n (%)	
White	220 (57.1)
African American/Black	9 (2.3)
Asian	51 (13.2)
American Indian or Other Pacific Islander	4 (1.0)
Other/Unknown/Declined to Answer	10 (2.6) / 6 (1.6) / 85 (22.1)
BMI, kg/m², mean (SD)* (n=375)	27.1 (5.9) * no BMI record for 10 patients
RAI score, mean (SD)	20.1 (10.6)
mFI-5 score, mean (SD)	0.9 (1.0)
Length of stay, days, mean (SD)	0.2 (0.8)
Length of stay, hours, mean (SD)	11.7 (18.9)

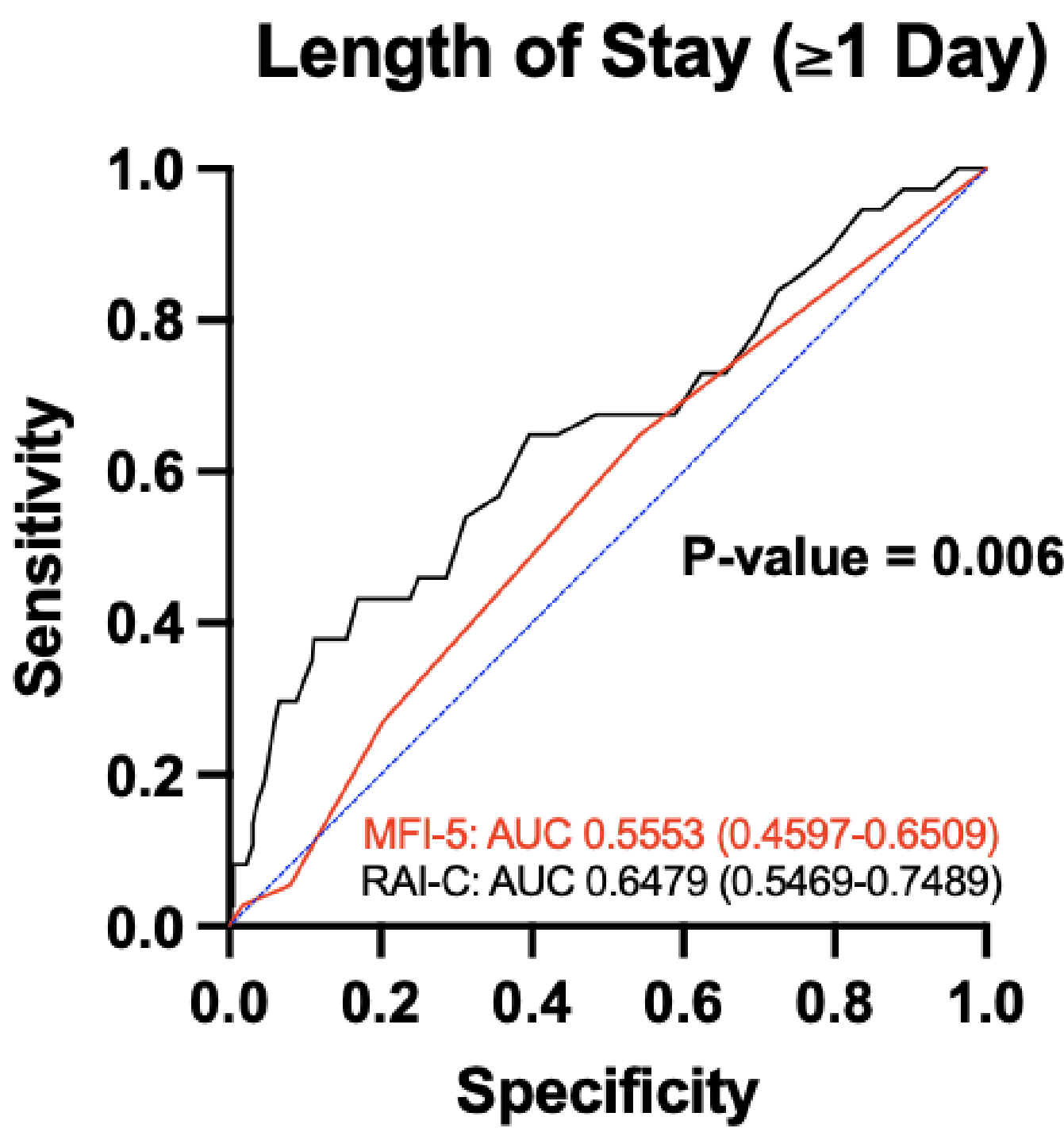
Association of RAI-C & mFI-5 with Postoperative Outcomes in the Overall Cohort (n = 385), and Auditory Score Change Following Cochlear Implantation as a Binary Predictor.

Index	Postoperative Outcome (n= 385)	OR (95% CI)	p-value	
RAI-C	30-day adverse events *	OR 2.92 (1.12–7.42)	0.0284	* Adverse Events 30-day return to OR 30-day readmission 30-day ED visit
RAI-C	Length of stay ≥ 1 day	OR 3.01 (1.32–6.74)	0.00900	
mFI-5	30-day adverse events	OR 3.01 (1.19–7.55)	0.0199	* Otology-Specific Complications Otorrhea Facial nerve weakness Vertigo Tinnitus
mFI-5	30-day otology-specific complications *	OR 1.84 (1.03–3.27)	0.0389	
mFI-5	90-day adverse events*	OR 3.89 (1.60–9.50)	0.00300	(Note: this is not a comprehensive list of all otology-specific complications)
mFI-5	90-day otology-specific complications *	OR 2.33 (1.35–4.03)	0.00220	
mFI-5	90-day return to OR	OR 3.04 (1.05–8.56)	0.0410	

Index	Auditory Test Score Change post Cochlear Implantation within 12 months	β (SE)	p-value	
mFI-5	AzBio change (n=30 pts; 32 ears)	β −0.335 (SE 0.1165)	0.0076	Patients deemed frail by an mFI-5 score ≥2 had less improvement in AzBio and CNC scores within 12 months
mFI-5	CNC change (n=65 pts; 71 ears)	β −0.158 (SE 0.0787)	0.049	
RAI-C	AzBio / CNC change	<i>Not significant</i>	—	

Comparison of AUC values between RAI-C and mFI-5 using DeLong’s Test. DeLong’s test evaluated the predictive capability of RAI-C AUC versus mFI-5 AUC across all 13 outcomes. Of all outcomes tested, a statistically significant difference in AUC was only observed for LOS ≥1 day for which RAI-C demonstrated significantly greater discriminative accuracy than mFI-5.

** Note: The diagonal dashed blue line represents random chance AUC=0.5. Curves above this line demonstrate increasing predictive power.*



Discussion

- Both RAI-C and mFI-5 were significantly associated with postoperative complication risk across several domains, although AUC values generally reflected only modest discriminative performance.
- RAI-C may better capture early postoperative risk, while mFI-5 may reflect longer-term frailty-related complications.
- Limited discriminative performance between RAI-C and mFI-5 may reflect a relatively healthy, lower-acuity otologic population with less variation in frailty relative to other otolaryngology populations^{8,9}.
- Higher mFI-5 scores were significantly associated with less speech perception improvement in both CNC and AzBio testing within 12 months.
- Our data suggests that frailty acts as a significant, independent variable that influences speech perception improvement following implantation. Frailty may be one of several factors contributing to cochlear implant speech outcomes alongside hearing loss, preoperative speech recognition, age, cognition, rehabilitation, programming, and device use¹⁰.
- Larger, longitudinal, multi-institutional cohorts are needed to clarify the role of frailty in CI audiometric score changes. Such studies will also help identify the most appropriate frailty measure for otologic risk assessment.

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