

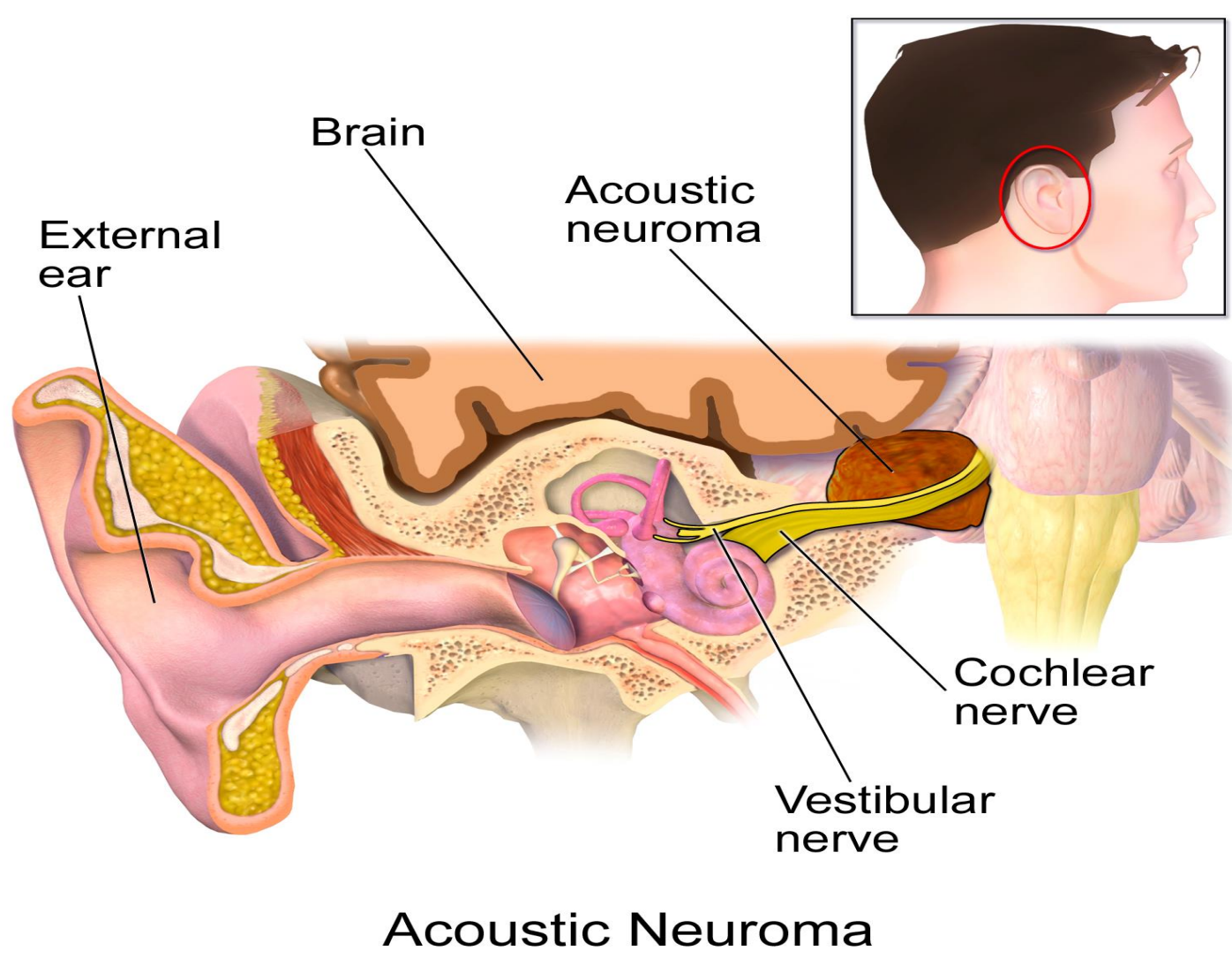
Predicting Post-Operative Outcomes of Vestibular Schwannoma Resection Utilizing the Risk Analysis Index: A Propensity-Matched National Readmissions Database Analysis

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Introduction

Vestibular Schwannomas (VS), or Acoustic Neuromas, are benign neoplasms of the vestibulocochlear nerve within the cerebellopontine angle (CPA) with an estimated annual incidence of 1:100,000. While non-invasive treatment modalities such as observation and stereotactic radiosurgery are often preferred, advanced presentations of VS utilize surgical resection as the primary intervention. Recent studies have also shown a clear indication between patient frailty, the cumulative physiological burden of comorbidities, and postoperative surgical outcomes for patients undergoing VS resection. Specifically, the Risk Analysis Index (RAI), a multifaceted frailty index quantifying preoperative patient frailty, has been shown to effectively predict postoperative surgical morbidity and mortality. This study aims to evaluate the predictive ability of the RAI for hospital and surgical outcomes following VS resection.

Risk Analysis Index



Patient Demographics

Health Comorbidities

Social History

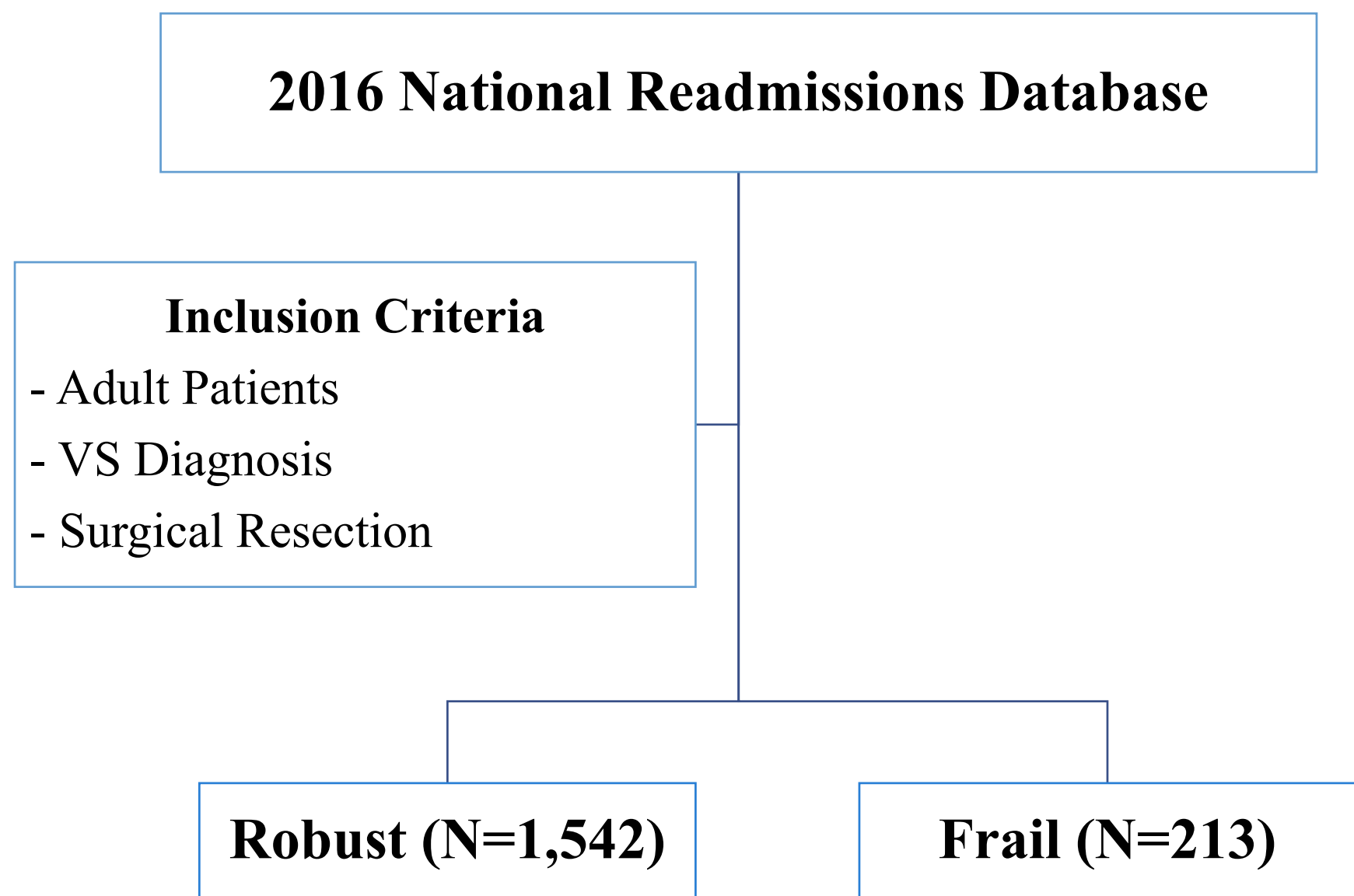
Cognitive Decline

Functional Status

Methodology

Adult patients diagnosed with VS undergoing surgical resection were selected from the 2016 National Readmissions Database (NRD) using the International Classification of Diseases, Tenth Revision (ICD-10) codes. Using nearest-neighbor propensity score matching for baseline clinical characteristics, patients were sorted by their RAI score into robust (RAI < 27) and frail (RAI ≥ 27) cohorts. Survey-weighted bivariate analysis, multi-level modeling, and receiver operating characteristic (ROC) curves were implemented. Model performance was evaluated using the Area Under the Curve (AUC), with an AUC greater than 0.7 representing an accurate and sensitive prediction. Target model outcomes consisted of extended length of stay (LOS), non-routine discharge, and postoperative surgical complications consisting of cranial nerve injury, cerebrospinal fluid leak, meningitis, neurological deficits, and hemorrhagic complications.

Figure 1) Frailty Cohort Selection



Patient Demographics

After patient selection from an estimated 16 million records, 1,755 patients undergoing resection for VS were identified, with 88% presenting as robust (R, N= 1,542), and 12% presenting as frail (F, N=213). Unadjusted bivariate analysis revealed that frail patients presented with significantly older mean age (R: 50 years, F: 69 years), higher inpatient hospital costs (R: \$170,373, F: \$194,480), and increased in-hospital LOS (R: 5 days, F: 9 days). (Table 1)

Variables	Robust	Frail	P Value
N	1542 (88%)	213 (12%)	
Female	916 (52%)	89 (5%)	<0.00001
Age (Years)	50	69	<0.00001
In-Patient Hospital Cost (\$)	170,373	194,480	0.119
Length of Stay (Days)	5	9	<0.00001
Readmission	176 (10%)	20 (1.2%)	0.5526
Non-Routine Discharge	336 (19.2%)	97 (5.5%)	<0.00001
Rate of Complications	80 (4.6%)	14 (0.8%)	0.6265

Table 1) Patient Demographics

RAI Effectively Predicts Post-Operative Outcomes

When controlling for baseline patient characteristics, propensity score matching resulted in a total cohort of 130 patients (R: N=65, F: N=65). (Figure 2) Adjusted bivariate analysis revealed similar trends in patient outcomes with significantly higher inpatient costs and in-hospital LOS for frail patients (p<0.05). Furthermore, multi-level effects modeling within the matched cohort revealed that the RAI could effectively predict extended LOS (AUC: 0.762), non-routine discharge (AUC: 0.728), and total postoperative surgical complications (AUC: 0.767). (Figure 3)

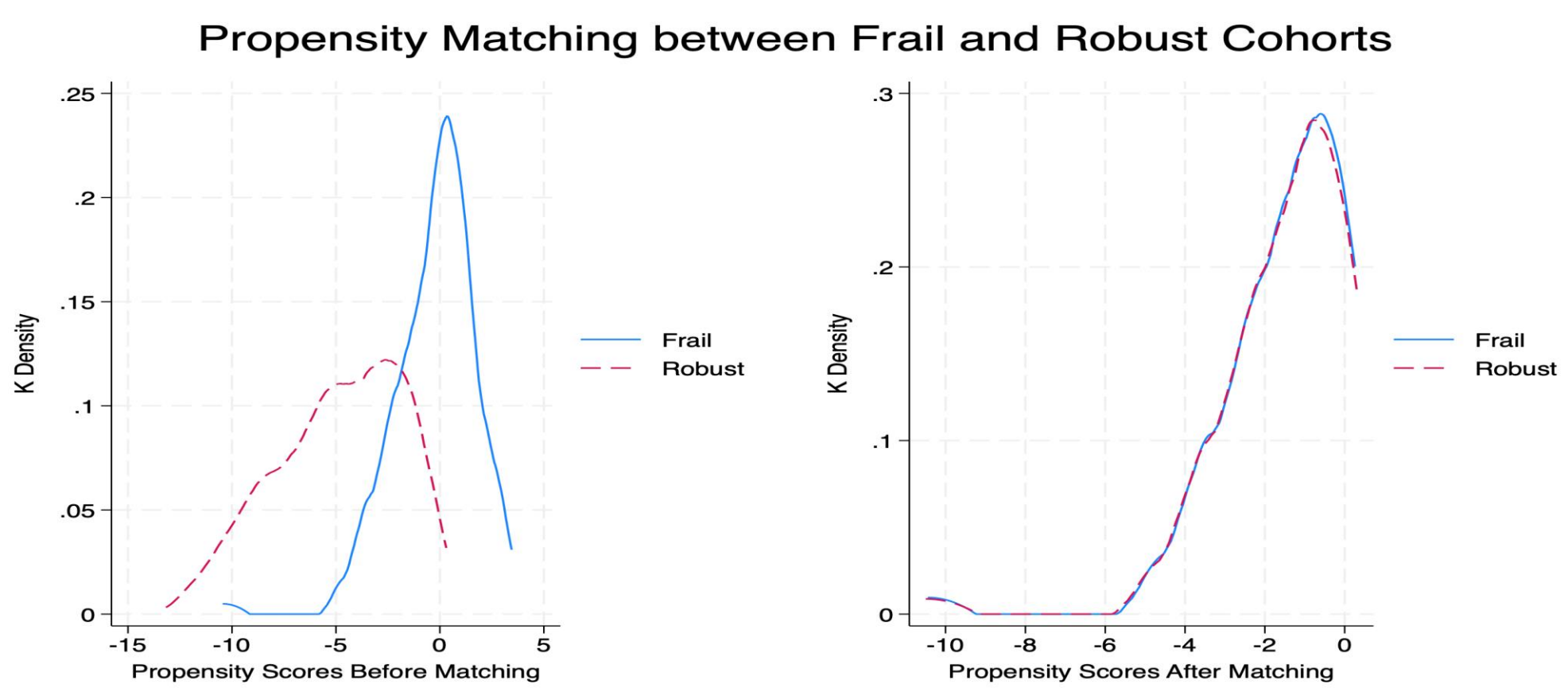


Figure 2) Propensity Matching between Frail and Robust Cohorts

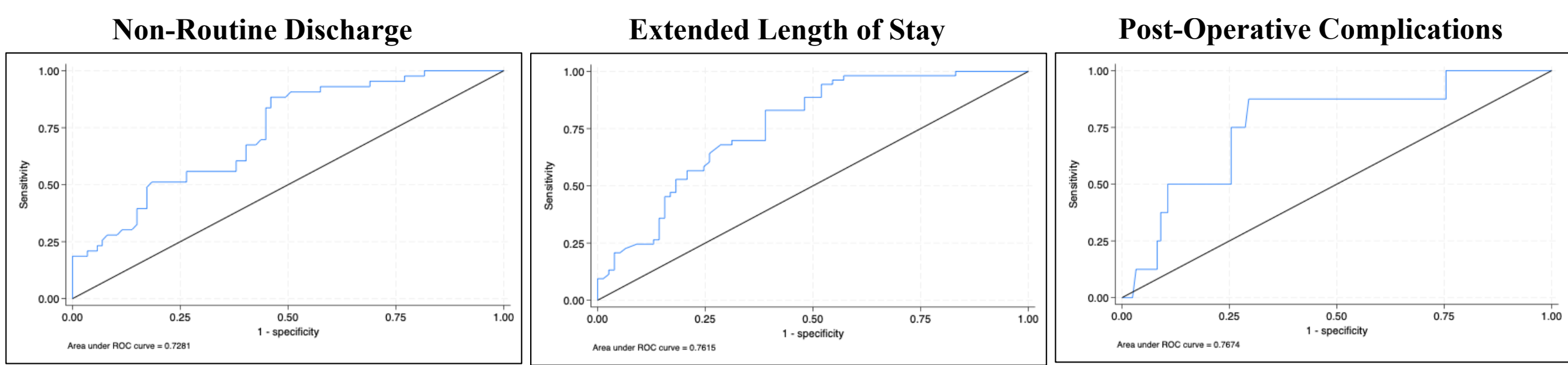


Figure 3) Area Under the Curve Analysis of Post-Operative Outcomes

Conclusion

Using a large national multicenter database, the RAI is shown to be an accurate indicator of preoperative patient frailty and is an effective predictor of extended length of stay, non-routine discharge, and postoperative surgical complications in patients undergoing VS resection. These findings provide key insights into the clinical management of VS patients and may assist in developing future studies that further elucidate the correlation between patient frailty and neurosurgical outcomes.

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