A Predictive Analysis of the Clinical and Social Drivers of Emergent Presentation in Vestibular Schwannoma Management

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INTRODUCTION

- Vestibular schwannomas (VS) are typically managed through elective referral, yet a subset of patients present emergently, suggesting delays in routine diagnosis.[1,2]
- Social determinants of health (SDoH) including ethnicity, language, and insurance status are established drivers of healthcare disparities, but their role in emergent VS presentation is poorly defined.[3-6]

Study Objective: To identify clinical and sociodemographic predictors of emergent presentation in VS and assess the impact of emergent vs. non-emergent presentation on surgical outcomes.

METHODS

Study Design and Participants

- Retrospective cohort study at a single urban tertiary care center (2004–2024)
- 475 patients undergoing VS resection
- Stratified by referral pathway: ED (n=75) vs. Non-ED (n=400)

Variables

- **SDoH:** Ethnicity, primary language, Insurance type
- **Clinical:** Age, sex, BMI, Charlson Comorbidity Index, NF2 diagnosis, segmented tumor volume (cm³), pretreatment hydrocephalus

Outcome Measures

- Extent of resection (GTR vs. STR)
- Length of hospital stay
- Facial nerve function (HB I-II vs. III-XI) at discharge/3mo/6mo
- Tumor recurrence/progression

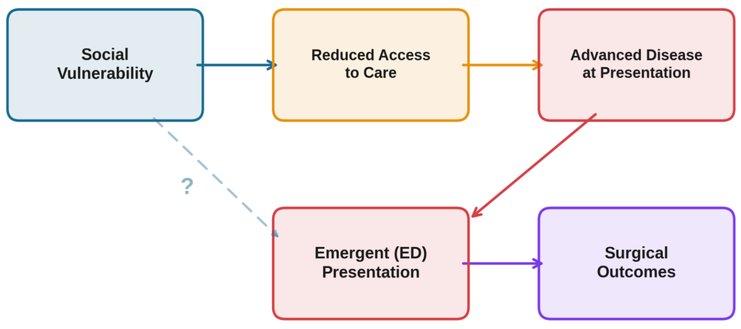

Figure 1. Hypothesized conceptual framework. Directed acyclic graph illustrating the proposed relationship between social vulnerability, disease severity, emergent presentation, and surgical outcomes in VS patients. Solid arrows represent the hypothesized mediated pathway; the dashed arrow with "?" represents the hypothesized direct pathway tested by multivariate logistic regression.

RESULTS

ED patients were disproportionately Hispanic/Latino, non-English speaking, and Medicaid-insured, and presented with higher rates of pretreatment hydrocephalus.

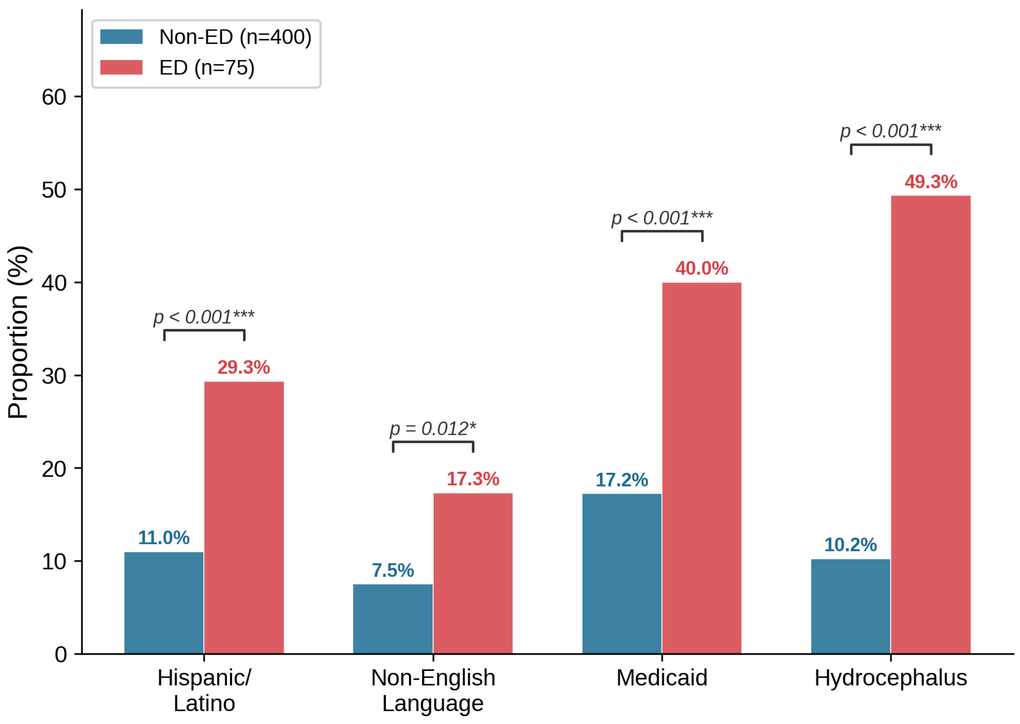

Figure 1. Social determinants of health and clinical characteristics by referral pathway. Grouped bar chart comparing the proportion of ED (red, n=75) vs. Non-ED (blue, n=400) patients across four variables: Hispanic/Latino ethnicity, non-English primary language, Medicaid insurance, and pretreatment hydrocephalus. P-values derived from chi-square tests. *p<0.05, ***p<0.001.

Pretreatment hydrocephalus was the strongest independent predictor of emergent presentation.

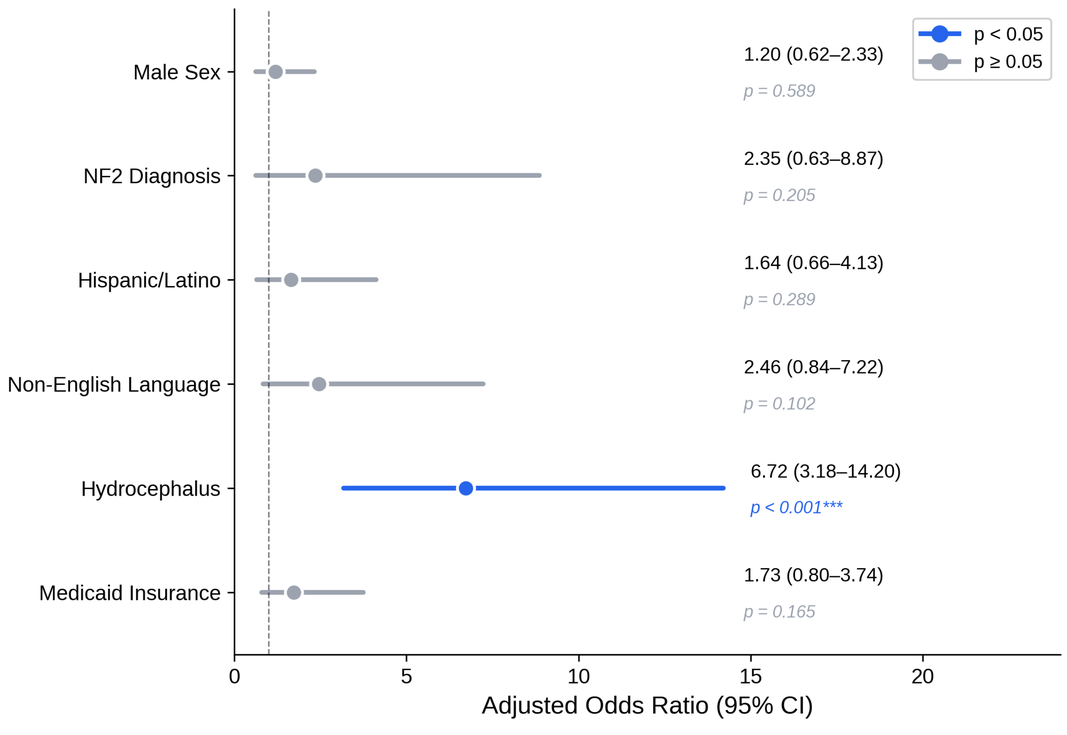

Figure 2A. Multivariate logistic regression: categorical predictors of ED referral. Forest plot showing adjusted odds ratios (aOR) with 95% confidence intervals for categorical variables. Blue indicates statistical significance (p<0.05); gray indicates non-significance. Dashed line represents the null value (aOR = 1.0). Model adjusted for all variables shown plus continuous predictors (Figure 2B). *p<0.05, ***p<0.001.

Each additional cm³ of tumor volume independently increased odds of ED presentation by 4%.

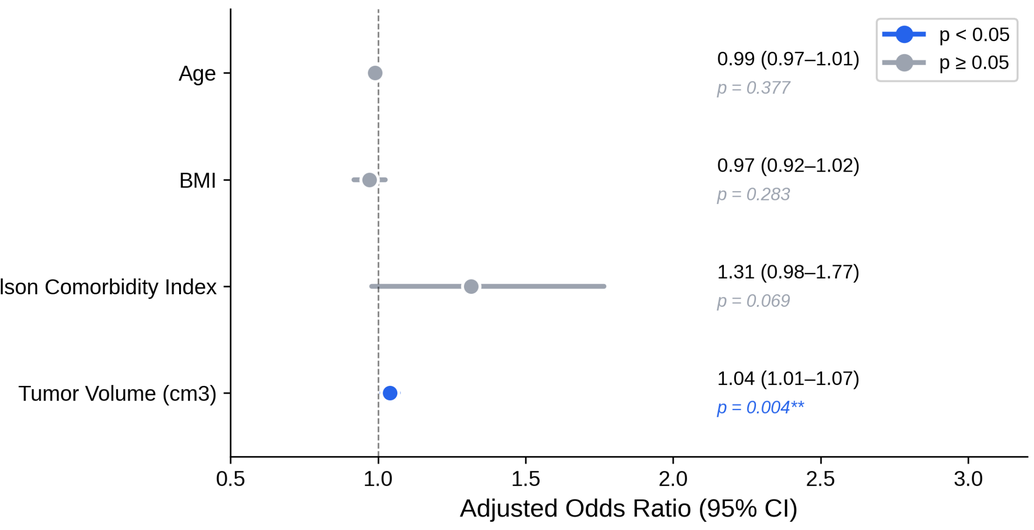

Figure 2B. Multivariate logistic regression: continuous predictors of ED referral. Forest plot showing adjusted odds ratios with 95% confidence intervals for continuous variables (per unit increase). Blue indicates statistical significance (p<0.05); gray indicates non-significance. Dashed line represents the null value (aOR = 1.0). Model adjusted for all variables shown plus categorical predictors (Figure 2A). **p<0.01.

ED patients had 3× longer surgical hospitalization than non-ED patients.

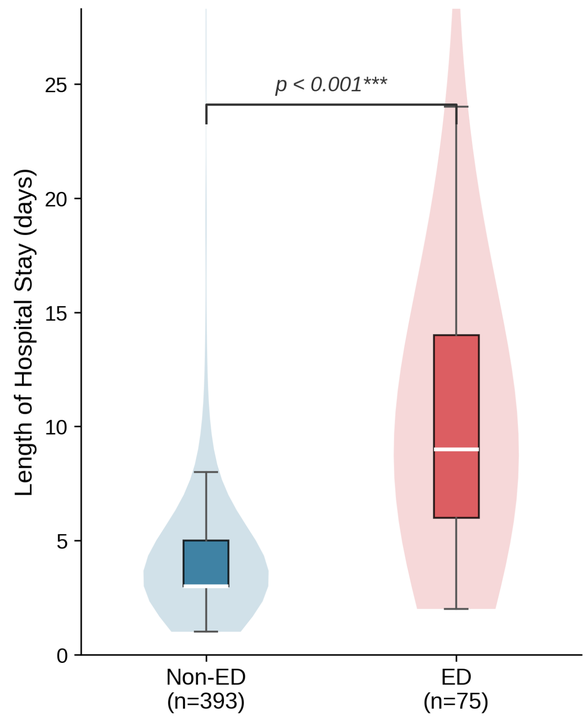

Figure 3. Length of hospital stay by referral pathway. Violin plots with overlaid box plots comparing hospital length of stay between Non-ED (blue, n=393) and ED (red, n=75) patients. White lines indicate medians; box edges represent interquartile range. P-value derived from Mann-Whitney U test. ***p<0.001.

ED patients had persistently worse facial nerve outcomes, with the greatest disparity at 3 months.

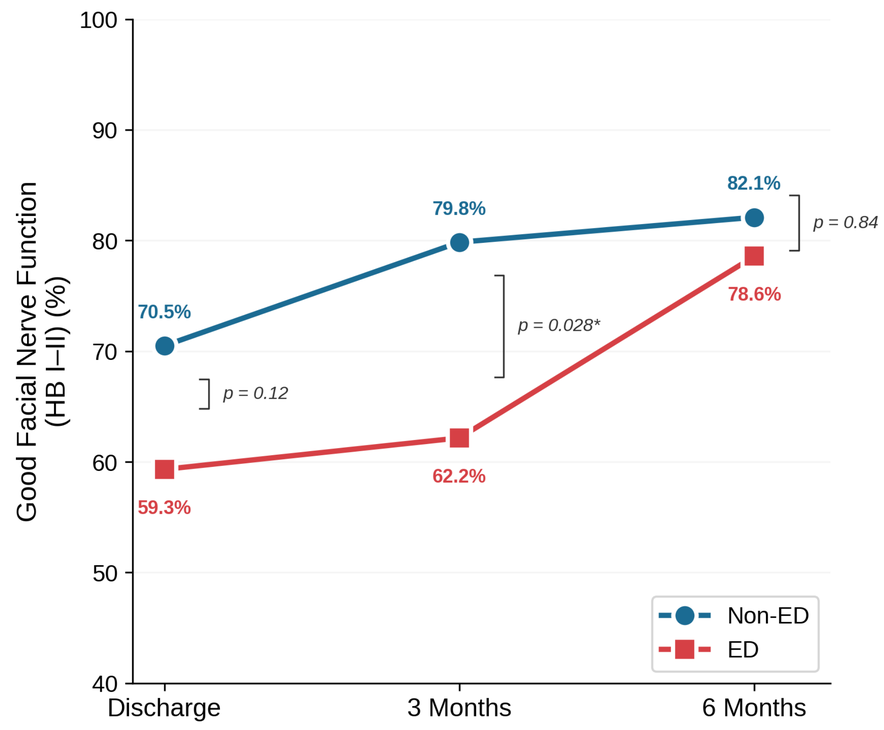

Figure 4. Facial nerve outcomes over time by referral pathway. Proportion of patients achieving good facial nerve function (House-Brackmann grade I-II) at discharge, 3 months, and 6 months for Non-ED (blue, circles) and ED (red, squares) groups. P-values derived from chi-square or Fisher's exact tests at each timepoint. *p<0.05.

CONCLUSIONS

- ED patients were disproportionately Hispanic/Latino, non-English speaking, and Medicaid-insured, with significantly larger tumors and higher rates of pretreatment hydrocephalus.
- Pretreatment hydrocephalus and tumor volume were the strongest independent predictors of ED presentation; SDoH variables were attenuated after adjustment, consistent with a mediated pathway through advanced disease.
- ED presentation was associated with 3× longer surgical hospitalization and persistently worse facial nerve outcomes through 6 months after resection, despite comparable tumor recurrence rates.
- Barriers to routine care in socially vulnerable populations may delay diagnosis until acute neurological decompensation, highlighting the need for targeted screening and improved access to outpatient neurotologic referral.

REFERENCES

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