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Introduction

Large vestibular schwannomas (VS) often compress the brainstem and have variable anatomic relationships to the internal auditory canal (IAC). These factors can be identified on preoperative imaging, however their significance is unknown.

Thus, the aim of this retrospective cohort study is to quantitatively assess the impact of brainstem compression (BSC) and position relative to the IAC on surgical outcomes in VS.

Methods and Materials

We identified 116 patients with sporadic unilateral VS larger than 3 centimeters who underwent surgery at a single academic institution between 2017-2022. Patients with neurofibromatosis 2 were excluded.

MRI T1 post-contrast axial images were used for measurements. BSC was quantified by drawing a baseline from the brainstem anteriorly to the cerebellum posteriorly, then drawing a second perpendicular line to the point of maximal compression. Anterior and posterior IAC extension were measured relative to a line bisecting the IAC from porus to fundus.

Results

Greater anterior extension relative to the IAC was significantly associated with decreased likelihood of achieving a gross total resection in both univariate (OR=1.12, 95% CI 1.015-1.256, p=0.03) and partially adjusted multivariate analysis (OR=0.884, 95% CI 0.789-0.982, p=0.0256), but not after full adjustment for age and tumor size (p=0.18).

BSC and posterior extension did not impact extent of resection in univariate or multivariate analyses.

Greater BSC was significantly associated with worse facial nerve function at 2-3 weeks postoperatively (OR=1.08, 95% CI 1.01-1.16, p=0.036), but not at postoperative 1 and latest follow-up.

Anterior and posterior extension were not significantly associated with facial nerve function at any timepoints.

Posterior extension was significantly associated with increased length of hospital stay (LOS) in univariate analysis (b=217.57 minutes, 95% CI 29.76-405.37, p=0.024), but this relationship lost significance after adjusting for age and other patient-level characteristics.

Anterior extension and BSC were not significantly associated with LOS.

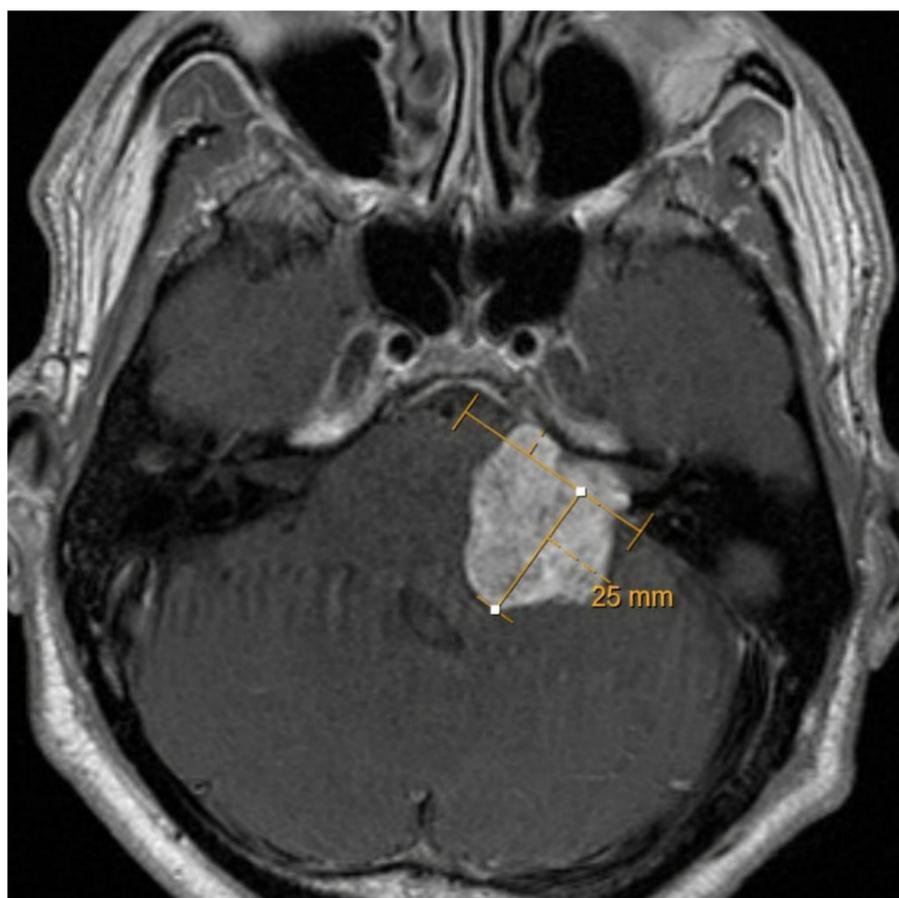


Figure 1. Example of brainstem compression measurement. BSC was measured as the point of maximal compression from the edge of the brainstem-cerebellum interface.

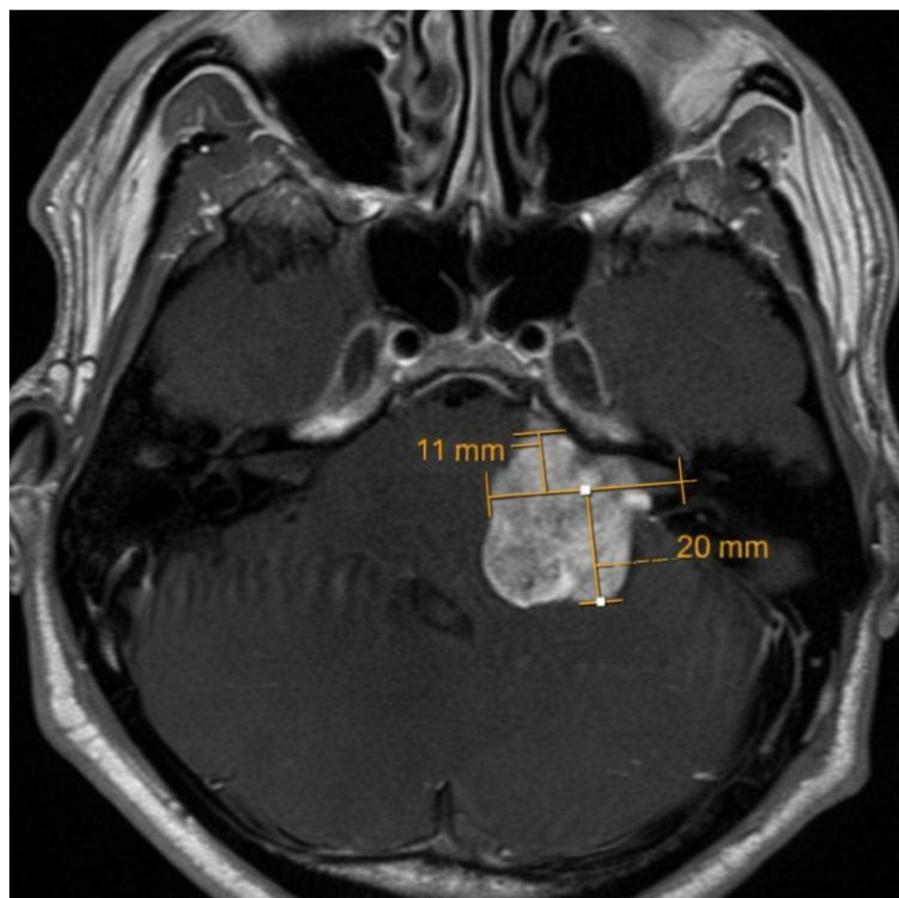


Figure 1. Example of anterior and posterior extension measurement. Maximal anterior and posterior extensions were measured relative to a line bisecting the IAC from the porus to the fundus.

Discussion

It is not known whether it is purely tumor size or the specific anatomical direction of tumor growth that determines facial nerve injury risk.

Anterior tumor extension is a particularly critical factor, since in most tumors, the facial nerve lies anteriorly; therefore, as the tumor grows anteriorly, it displaces, stretches, and distorts the nerve-tumor interface making it vulnerable to injury during dissection, which as a result may complicate gross tumor removal without damaging the nerve leading to lesser extent of tumor resection.^{1, 2, 3}

Conclusions

Anterior tumor extension and BSC are radiographic features that may influence extent of resection and transient facial nerve outcomes, respectively.

Posterior extension may impact hospital LOS, though this appears to be confounded by demographic factors.

These findings may support individualized preoperative counseling and surgical planning for patients with large VS.

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