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Original Research

Predictors of Vestibular Schwannoma Growth and Clinical Implications

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Abstract

Background: Vestibular schwannomas are benign tumors that slowly grow from the myelin sheath of the vestibular nerve, which is part of the vestibulocochlear nerve (cranial nerve VIII) responsible for balance and hearing. These tumors can impact hearing and balance over time. Hence; this study was conducted to assess the Predictors of Vestibular Schwannoma Growth and Clinical Implications.

Material and methods: The study was conducted to assess the Predictors of Vestibular Schwannoma Growth and Clinical Implications.The researchers gathered detailed information about each patient, including their age, sex, which side of the head was affected, where the tumor was located, and how long they were followed up.The study also looked at symptoms such as hearing loss, ringing in the ears (tinnitus), and vertigo (dizziness), which were reported by the patients themselves. The size of the tumor was carefully measured at the initial presentation, and the growth rate of the tumor was calculated over time. Tumor growth was defined as an increase of 1 mm or more per year.One key aspect of the study was exploring how hearing thresholds, particularly for high-frequency sounds, related to tumor growth parameters. This involved analyzing how the tumor's growth might affect the patient's hearing, especially in the affected ear.All the collected data was organized in Microsoft Excel for record-keeping and then analyzed using SPSS software.

Results: We found that tumor growth significantly increased the likelihood of changing the treatment strategy, with a 33-fold increase in odds of pursuing intervention. This suggests that tumor growth is a strong predictor of the need for a shift from observation to active treatment.

Conclusion: The decision to shift from observation to intervention for vestibular schwannoma is often driven by tumor growth. Factors like initial tumor size and the presence of tinnitus may help predict growth, allowing for a more tailored approach to management. Further research is needed to determine the benefits of risk-stratifying patients based on these characteristics.

Keywords: Schwannoma, Growth, Predictors

Introduction

Vestibular schwannomas (VS) are non-cancerous, gradually developing tumors that originate from the myelin sheath surrounding the vestibular nerve, a component of the vestibulocochlear nerve (cranial nerve VIII). The estimated average incidence of VS is approximately 17.4 cases per million individuals annually, accounting for about 6% to 7% of all primary brain tumors. The typical age range for diagnosis is between 57 and 61 years.[1-3] There appears to be a rising trend in the incidence of VS worldwide, likely due to advancements in radiologic diagnostic technologies and their increased availability. These tumors generally begin in the internal auditory canal but may grow and extend into the cerebellopontine angle. Such extension can lead to significant clinical issues as they may compress nearby cranial nerves and the brainstem, adversely impacting the patient's quality of life.[4- 6] This study was conducted to assess the Predictors of Vestibular Schwannoma Growth and Clinical Implications.

Material and methods

The study was conducted to assess the Predictors of Vestibular Schwannoma Growth and Clinical Implications.The study focused on patients with a suspected diagnosis of unilateral vestibular schwannoma, a type of non-cancerous tumor affecting

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the nerve responsible for balance and hearing. These patients were initially managed through observation rather than immediate treatment.To be included in the study, patients had to have at least two clinical visits within the first year of their diagnosis. The researchers gathered detailed information about each patient, including their age, sex, which side of the head was affected, where the tumor was located, and how long they were followed up.The study also looked at symptoms such as hearing loss, ringing in the ears (tinnitus), and vertigo (dizziness), which were reported by the patients themselves. The size of the tumor was carefully measured at the initial presentation, and the growth rate of the tumor was calculated over time. Tumor growth was defined as an increase of 1 mm or more per year.One key aspect of the study was exploring how hearing thresholds, particularly for high-frequency sounds, related to tumor growth parameters. This involved analyzing how the tumor's growth might affect the patient's hearing, especially in the affected ear.All the collected data was organized in Microsoft Excel for record-keeping and then analyzed using SPSS software. By examining these relationships, the study aimed to gain a better understanding of how vestibular schwannomas progress and impact patients over time.

Results

A total of 100 patients were evaluated. Mean age of the patients was 49.2 years. Majority proportion of patients were males. Reasons for change in vestibular schwannoma treatment strategy (n=48) was tumour growth, vertigo, hearing loss and patient request.

Table 1: Reasons for change in vestibular schwannoma treatment strategy (n=48)

Reason	Number	Percentage
Tumour growth	40	83.33
Vertigo	5	10.42
Hearing loss	2	4.17
Patient request	1	2.08

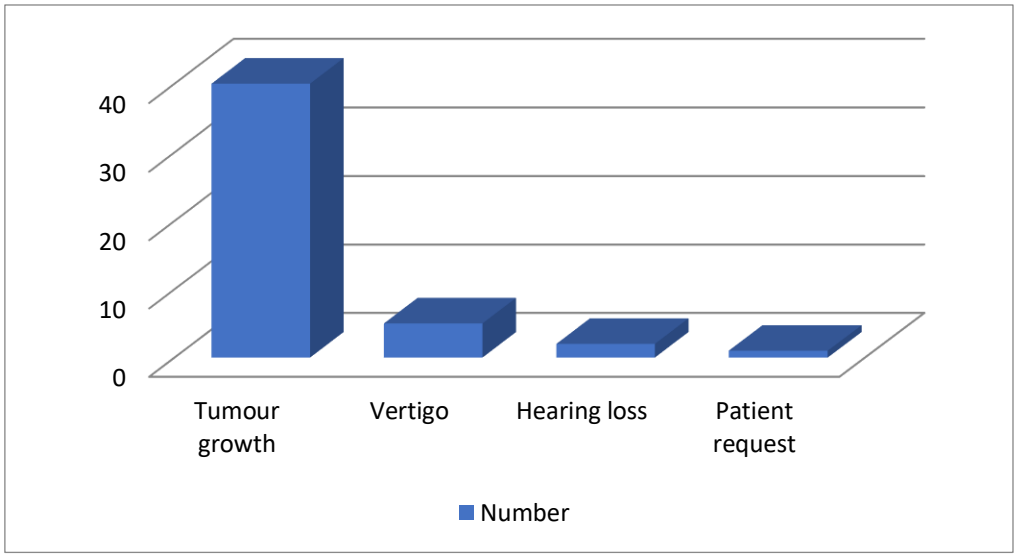

Figure-1 Reasons for change in vestibular schwannoma treatment strategy

As in Table 1and figure 1, we found that tumor growth significantly increased the likelihood of changing the treatment strategy, with a 33-fold increase in odds of pursuing intervention. This suggests that tumor growth is a strong predictor of the need for a shift from observation to active treatment. It was observed that specific patterns of hearing loss (high-frequency, low-frequency, or sloping) weren't strongly linked to tumor growth. However, a significant difference in speech discrimination scores between the affected ear and the healthy ear was associated with tumor growth, suggesting that this measure may be a useful indicator of tumor progression.

Table 2: Adjusted odds ratios of change in treatment strategy by vestibular schwannoma patient demographic, tumor, and clinical characteristics

Variable		Tumour growth Odds ratio
Age (years)		1.10
Gender	Male	1.00
	Female	1.69
Tumour size (mm)		1.23

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Side	Right	1.00
	Left	1.76
Tumour growth	No	1.00
	Yes	33
Hearing loss at presentation	No	1.00
	Yes	1.56
Tinnitus presentation	No	1.00
	Yes	0.83

Discussion

Schwannoma is the most common of all nerve sheath tumors in approximately 89% of cases. About 60% of benign schwannomas are vestibular schwannomas.[7] Schwannomas usually affect persons between the ages of 50 to 60. No sex or racial predilection is recognized. Tumors are generally located in the upper limbs, followed by the head, trunk, and flexor surfaces of the lower extremities. Other locations include the posterior mediastinum, retroperitoneum, spinal roots, bone, gastrointestinal tract, pancreas, liver, thyroid, adrenal glands, and lymph nodes.The Central Brain Tumor Registry of the United States shows that non−malignant nerve sheath tumors account for 8.6% of all central nervous system tumors reported, with no gender predominance, but a higher incidence in whites.[8] The median age at diagnosis is 56 years. The incidence is 4.4 to 5.23 cases per 100,000 adults/year; in children and adolescents, it is 0.44 cases per 100,000/year.[9] The incidence of malignant nerve sheath tumors is 0.03 cases per 100,000/year.[10] Hence; This study was conducted to assess the Predictors of Vestibular Schwannoma Growth and Clinical Implications.

A total of 100 patients were evaluated. Mean age of the patients was 49.2 years. Majority proportion of patients were males. Reasons for change in vestibular schwannoma treatment strategy (n=48) was tumour growth, vertigo, hearing loss and patient request.We found that tumor growth significantly increased the likelihood of changing the treatment strategy, with a 33-fold increase in odds of pursuing intervention. This suggests that tumor growth is a strong predictor of the need for a shift from observation to active treatment.Agrawal Y et al[10] evaluated the extent to which tumor growth influences the management of these benign tumors, and they explored symptom markers present at diagnosis that may be predictive of tumor growth. One hundred eighty patients with unilateral vestibular schwannomas diagnosed between 1997 and 2007 who were initially managed conservatively by serial observation. Tumor growth, defined as a 1 mm/year or greater increase in tumor size. They observed that tumor growth was the most important predictor of a change in treatment strategy from serial observation to microsurgical or radiosurgical treatment. They further noted in multivariate analyses that larger tumor size at diagnosis was associated with higher odds of tumor growth, such that each 1-mm increment in tumor size at presentation increased the odds of growth by 20%. They also found that the symptom marker of tinnitus at diagnosis significantly increased the odds of tumor growth nearly 3-fold. Tumor growth plays a significant role in guiding the management of vestibular schwannomas. Baser ME et al[11]assessed the relationship between VS growth rates and patient age and type of constitutional NF2 mutation; they also examined variability in VS growth rates among multiple patients in families with NF2.Gadolinium-enhanced magnetic resonance images obtained in 18 patients with inherited NF2 from 11 unrelated families were retrospectively analyzed. The patients had been observed for a median of 4 years. Volumes of the VSs were measured using a two-component box model. Single-strand conformation polymorphism analysis and Southern blot analysis were used to identify constitutional NF2 mutations. Growth rates of the VSs were highly variable, but tended to decrease with increasing patient age both at onset of signs or symptoms of NF2 and at diagnosis. The VS growth rates did not vary significantly with the type of constitutional NF2 mutation or the number of non-VS cerebral or spinal tumors. The VS growth rates were highly variable within families and did not correspond to clinical indices of NF2 disease severity, such as patient age at symptom onset and the number of non-VS cerebral and spinal tumors.The growth rates of VSs in patients with NF2 are highly variable, but tend to decrease with increasing patient age. Clinical treatment of multiple patients in families with NF2 cannot be based on the expectations of similar VS growth rates, even when other clinical aspects of disease severity are similar.

Conclusion

The decision to shift from observation to intervention for vestibular schwannoma is often driven by tumor growth. Factors like initial tumor size and the presence of tinnitus may help predict growth, allowing for a more tailored approach to management. Further research is needed to determine the benefits of risk-stratifying patients based on these characteristics.

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