Vestibular schwannoma volume

Accurate and precise measurement of vestibular schwannoma (VS) size is key to clinical management decisions. Linear measurements are used in routine clinical practice but are prone to measurement error.

Linear measurements underestimate VS growth rate compared with volumetric measures in NF2 patients. These results provide clear, quantitative proof that diameter measures are not as sensitive to change as volumetric measurements and that volumetric measurements should be strongly considered when making VS treatment decisions [1].

Fiirgaard et al. conclude that measurement the size of acoustic neuromas is reproducible with MRI and the measurement of the maximal tumour diameter is in practice a better parameter for comparison than calculation of real volume [2].

In respect to volumetric and linear measurements of these tumors Lawson McLean et al. evaluated a) the inter-rater reliability, b) the intra-rater variability, c) the concordance of volume measurements derived from axial versus those from coronal MRI datasets, and d) the correlation of one-dimensional and volumetric measurements.

A strict MRI protocol for follow-up investigations should be adhered to in order to minimize measuring errors [3].

The ABC/2 formula is an easy method in estimating the tumor volume of vestibular schwannoma that is not inferior to planimetry method.

The derivation of the ABC/2 formula is as follows: The volume of an ellipsoid is $4/3\pi(A/2)(B/2)(C/2)$, where A, B, and C are the three diameters. If π is estimated to be 3, then the volume of an ellipsoid becomes ABC/2 [4].

Given the ease and universal accessibility of linear measurement applications, the ABC/2 methodology is a robust substitute for calculating tumor volumes, especially for larger tumors [5].

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estimated the volume of vestibular schwannomas by an ice cream cone formula using thin-sliced magnetic resonance images (MRI) and compared the estimation accuracy among different estimating formulas and between different models.

METHODS: The study was approved by a local institutional review board. A total of 100 patients with vestibular schwannomas examined by MRI between January 2011 and November 2015 were enrolled retrospectively. Informed consent was waived. Volumes of vestibular schwannomas were estimated by cuboidal, ellipsoidal, and spherical formulas based on a one-component model, and cuboidal, ellipsoidal, Linskey's, and ice cream cone formulas based on a two-component model. The estimated volumes were compared to the volumes measured by planimetry. Intraobserver reproducibility and interobserver agreement was tested. Estimation error, including absolute percentage error (APE) and percentage error (PE), was calculated. Statistical analysis included intraclass correlation coefficient (ICC), linear regression analysis, one-way analysis of variance, and paired t-tests with $P < 0.05$ considered statistically significant.

RESULTS: Overall tumor size was 4.80 ± 6.8 mL (mean ±standard deviation). All ICCs were no less than 0.992, suggestive of high intraobserver reproducibility and high interobserver agreement. Cuboidal formulas significantly overestimated the tumor volume by a factor of 1.9 to 2.4 ($P \leq 0.001$). The one-component ellipsoidal and spherical formulas overestimated the tumor volume with an APE of 20.3% and 29.2%, respectively. The two-component ice cream cone method, and ellipsoidal and Linskey's formulas significantly reduced the APE to 11.0%, 10.1%, and 12.5%, respectively (all $P < 0.001$).

CONCLUSION: The ice cream cone method and other two-component formulas including the ellipsoidal and Linskey's formulas allow for estimation of vestibular schwannoma volume more accurately than all one-component formulas [6].

1)

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2)

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3)

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4)

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5)

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6)

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