BRIEF COMMUNICATION

High Resolution Three-dimensional T_2^* -weighted Imaging at 3T: Findings of Cerebellopontine Angle Schwannomas and Meningiomas

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We investigated features of 3-dimensional (3D) T_2^* -weighted images (T_2^* WI) at 3 tesla to aid differential diagnosis of cerebellopontine angle meningiomas and schwannomas. Four patients with meningiomas and eight with schwannomas underwent both magnetic resonance (MR) evaluation and surgical intervention. Using an Achieva 3T MR system (Philips, Best, Netherlands), we obtained 3D T_2^* WI, applying a principle of echo shifting with a train of observations (PRESTO) technique, a 3D fast field echo method. Parameters were: repetition time/echo time, 26/37 ms; flip angle, 10°; field of vision, 220 mm (rectangular field of vision 83.93%); matrix, 224 × 188 (reconstructed to 512); slice thickness, 0.8 mm; and sensitivity encoding reduction factor, 1.5. We evaluated data using reconstructed minimum intensity projection (mIP) axial images of 3-mm thickness.¹

Within each tumor, 2 neuroradiologists identified spotty signal voids, which they graded as either (0) absent, (I) few, or (II) numerous or throughout the tumor; they also graded flow voids suspected to represent blood vessels in the surrounding region as absent, few, or marked. For quantitative evaluation, we determined the prevalence of spotty signal voids by calculating the ratio of spotty signal void voxels to total tumor voxels on the image with solid tumor of greatest diameter. We compared MR imaging findings with histopathological findings.

Three of the 4 meningiomas were classified grade 0 and one, grade I. Two of the 8 schwannomas were classified grade I and six, grade II. Flow voids resembling vascular structures were observed in all

4 meningiomas but in only three of the 8 schwannomas. The ratios of spotty signal void voxels to whole tumor voxels were 0.5 to 8% in meningiomas (mean 3.6%) and 19.1 to 86.6% (mean 42.9%) in schwannomas (Figs. 1, 2), significantly higher in schwannomas than in meningiomas (Wilcoxon signed-rank test $P < 0.001$). In histopathological findings, intratumoral hemorrhage was absent from meningiomas but apparent in all 4 schwannomas, results consistent with previous reports.^{2,3} For detection of microhemorrhages, 3D T_2^* WI showed sensitivity of 100%, specificity of 60%, positive predictive value of 45%, and negative predictive value of 100%. Histological findings suggest intratumoral hemorrhage as the potential cause of these results.

One limitation of our study is that we did not compare 3D T_2^* WI with T_2^* images. Reports of 2D T_2^* WI show better specificity and positive predictive value. Further investigation of vascular-like flow voids is necessary.

In conclusion, on 3D T_2^* WIs, we found few spotty signal voids within meningiomas but identified many within schwannomas.

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Fig. 1. **a:** Contrast-enhanced T_1 -weighted image (T_1 WI) of meningioma in a 52-year-old woman; homogeneously stained tumor is observed in the left cerebellopontine angle. **b:** Three-dimensional T_2^* -weighted image. No spotty signal voids are present inside the tumor, and surrounding blood vessels can be observed (arrow). The photomicrograms of the tumor (not shown) revealed no obvious internal hemorrhage. Histological diagnosis was meningotheliomatous meningioma.

Fig. 2. **a:** Contrast-enhanced T_1 -weighted image (T_1 WI) of schwannoma in a 64-year-old woman; homogeneously stained tumor is observed in the left cerebellopontine angle. **b:** Three-dimensional T_2^* -weighted image shows multiple internal spotty signal voids (Grade II, arrows); surrounding blood vessels are not observed. Histological findings (not shown) showed spindle cell proliferation with palisading. Deposits of hemosiderin can be observed within tumor cells (arrows).

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