

3D VIBE Imaging of Dura Mater in Patients with Meningioma

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Purpose

Three dimensional (3D) volumetric interpolated breath-hold examination (VIBE) is a T1-weighted radio-frequency-spoiled gradient-echo MR sequence that is optimized for rapid acquisition and improved resolution through asymmetric k-space sampling and interpolation. 3D VIBE sequence is frequently used for abdominal imaging with breath holding. VIBE has been applied to brain imaging in recent studies [1-3] because of its high spatial resolution and relatively short acquisition time, however, to our knowledge, the appearances of dura mater of the brain on VIBE images have not been reported. The goal of the current study is to investigate the appearance of normal intracranial dura mater on precontrast and postcontrast 3D VIBE images in patients with meningioma.

Patients and Methods

MR Sequences and Parameters and Image Analysis: All MR imaging examinations were performed with a 1.5-T unit by using precontrast and postcontrast 3D VIBE sequence (4.42/1.77 [TR/TE], 15° flip angle). The data were acquired coronally with a field of view of 190 x 190 mm, and the slab thickness was about 210 mm. Sampling was asymmetric in the read and phase-encoding directions giving an in-plane resolution of 0.9 x 0.9 mm. Acquisition time was about 3 minutes and 40 seconds. Data obtained with 3D VIBE MR sequences were reconstructed in sagittal, transverse, and coronal planes with a section thickness of 0.9 mm. Two experienced neuroradiologists analyzed the images collaboratively.

Patients and Protocol: Twenty-five consecutive patients (3 males and 22 females, aged 12-82 years old, mean age 55.1 years) with intracranial meningioma were included in this prospective study. In 12 patients (2 males and 10 females, aged 54-74 years, mean age 61.3 years), the meningiomas were removed and histologically confirmed. MR examinations obtained postoperatively were not included for evaluation.

Normal Dura Mater: Firstly, the dura mater of the opposite side of the affected hemisphere was hypothesized as normal. In cases of midline (parasagittal or falx) tumors, the basal dura mater of both hemispheres was supposed to be normal. The identification of normal dura mater by precontrast 3D VIBE imaging was assessed by a three-score scale. A score of 2 meant continuous identification throughout the normal side; a score of 1, continuous identification with partial obscurity, a score of 0, discontinuous identification with obscurity or no identification. Secondly, on postcontrast 3D VIBE images, enhancement of the dura mater in the normal side was assessed. A score of 2 was assigned for well-enhanced dura mater of the normal side, a score of 1 for obscurely enhanced dura mater, a score of 0 for no enhanced dura mater. Thirdly, the thickness of the normal dura mater was evaluated on postcontrast VIBE images. The dura mater of the convexity was compared with that of the skull base.

Dura Mater Adjacent to Meningioma: Postcontrast 3D VIBE imaging of the 12 patients with histopathologically proven meningioma were used for analyses. Appearances of the dura mater, dural sinus, and calvarial invasion adjacent to the meningiomas were assessed.

Results

On precontrast 3D VIBE images, the identification of dura mater of the normal side was scored as 2 in no patient, scored as 1 in 24 patients (96%) (Figure 1, arrows), and scored as 0 in one patient (4%). Among the 24 patients with a score of 1, the anterior and middle fossa dura were poorly identified. On the postcontrast 3D VIBE images, the enhancement of dura mater, including anterior and middle cranial fossa, was scored as 2 in all patients (100%) (Figure 2, arrows). On postcontrast 3D VIBE images, anterior and middle cranial fossa dura was thinner than that in the convexity in 22 patients out of the 25 (88%). In the remaining three patients (12%), dura mater was the same thickness between the cranial fossas and the convexity. Among the 12 patients with histopathologically proven meningioma, postcontrast 3D VIBE images clearly visualized focal thickening of the adjacent dura mater in six patients (Figure 3, arrows), and diffuse and smooth thickening of the adjacent dura in three patients. Meningiomas existed nearby the dural sinus in four patients, and dural sinus invasion was clearly appreciated in one patient. In three patients, calvarial invasion was clearly depicted.

Conclusions

Precontrast 3D VIBE images can visualize most of normal dura mater frequently. Postcontrast 3D VIBE constantly showed enhancement of normal dura mater. The anterior and middle fossa dura were thinner than that of the convexity. Postcontrast VIBE may be useful in evaluating the relationship between meningioma and its adjacent dura mater.

References

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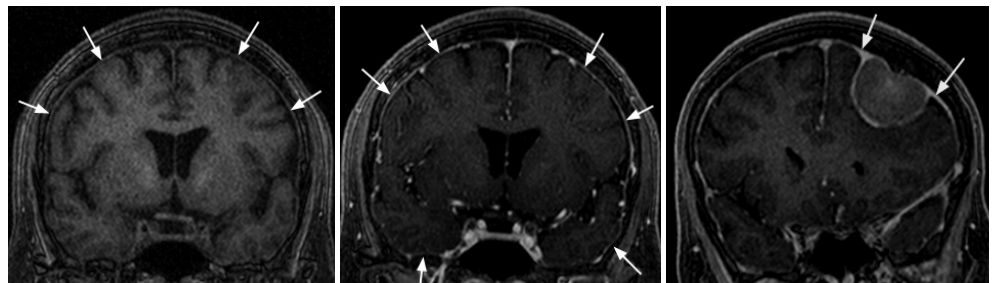


Figure 1

Figure 2

Figure 3