Improved preoperative evaluation of cerebral cavernomas by high-field, high-resolution susceptibility-weighted magnetic resonance imaging at 3 Tesla –

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Introduction

To compare high-field, high-resolution, susceptibility-weighted magnetic resonance imaging (3T HR-SW-MRI) and standard (1.5T) MRI for the detection of cerebral cavernomas. To evaluate the ability of 3T HR-SW-MRI to visualize intralesional structures compared to standard (1.5T) MRI, in correlation with histopathological findings.

Material and Methods

Seventeen patients with cerebral cavernomas underwent both standard (1.5T) MRI (T1-SE, T2-TSE, T2*-GRE) and 3T HR-SW-MRI (TR/TE 43.3/9.1ms; 512x384x48 matrix; FOV 250mm; SI 72mm) at our institution. All MR images were evaluated by three radiologists in consensus for detectability, size (</>1cm), and conspicuity (good, acceptable, poor) of the lesions at both field strengths, and for the presence of hypointense intralesional tubular structures. In seven patients, MR findings were correlated with histopathological findings.

Results and Discussion

Both 3T HR-SW-MRI and standard (1.5T) MRI detected twenty-two lesions in seventeen patients; 3T HR-SW-MRI detected an additional seven lesions in six patients. On average, 3T HR-SW-MRI detected 1.706 ± 0.92 (median=1) lesions per patient, whereas standard (1.5T) MRI detected 1.235 ± 0.664 lesions per patient (p=0.016) (Tab.1). Lesion conspicuity was good in all 3T HR-SW-MR images, and good in 68.2% and acceptable in 31.8% of standard (1.5T) MR images (p=0.016). In 22 lesions detected at both field strengths, 3T HR-SW-MRI demonstrated intralesional tubular structures in 72.7% and standard (1.5T) MRI demonstrated these structures in 31.8% (p=0.001). Intralesional tubular structure correlated to conglomerates of cavernous vessel, as verified by histopathology (Fig.1a,b,c).

Conclusion

Compared to standard (1.5T) MRI, 3T HR-SW-MRI allows superior detection and characterization of cerebral cavernomas (Fig.2). Despite increased susceptibility effects, i.e., signal loss at higher magnetic field strengths, the visualization of intralesional tubular structures is feasible. This may be helpful in the diagnosis, presurgical planning, and non-invasive follow-up after gamma-knife radio-surgery.

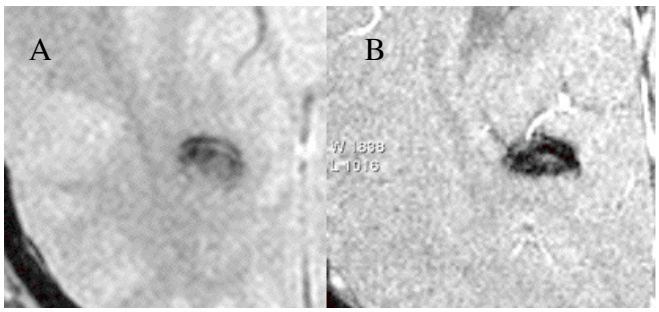
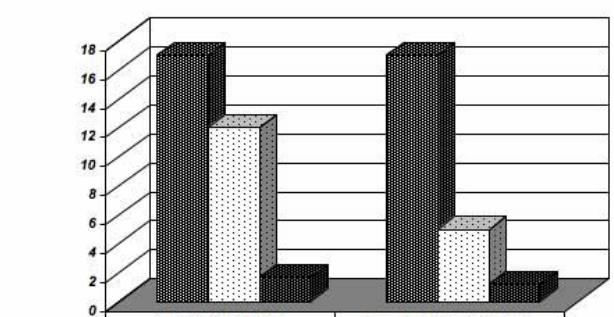


Fig.2 Compared to standard (1.5T) MRI (a), 3T HR-SW-MRI (b) allows superior detection of cerebral cavernomas.

Table 1: Lesion detection with 3T HR-SW-MRI vs. standard (1.5T) MRI



	3T HR-SW-MRI	Standard (1.5T) MRI
< 1 cm	17	17
=/> 1cm	12	5
median	1.7	1.2

Fig.1a: A 39-year-old female patient with a cerebral cavernous malformation (temporal right). Axial 3T HR-SW-MR images depicted a cerebral vascular malformation with multiple intralesional tubular structures *(a)* that corresponded to conglomerates of cavernous types of vessels in histopathological cross-sections: numerous thin-walled, vascular spaces with greatly thickened collagen without cellular stroma beyond the limiting walls *(b,* H&E staining 20x*; c,* Gieson- Elastica 20x*)*.