Value of Diffusion MR in Differential Diagnosis of Capillary Telangiectasia

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Introduction

Capillary telangiectasias are extremely rare vascular anomalies, which are found more often in infratentorial than in supratentorial location. Only reports with very small numbers of cases exist in the literature. Using conventional MR with T2-weighted and T1-weighted imaging (pre and post contrast) diffential diagnosis of capillary telangiectasias is sometimes difficult because they can be misinterpreted as tumor, ischemia or inflammatory disease. Especially misinterpretation as tumor is critical because it may result in unnecessary risky brain stem biopsy. The aim of our study was to assess the value of diffusion MR in addition to conventional MR in the differential diagnosis of pontine capillary telangiectasias.

Materials and Methods

A total of 148 MR examinations of patients with pontine lesions were evaluated retrospectively. The MR diagnosis – based on the MR appearance, clinical status of the patient, follow-up examinations and/or histology (in case of tumors) – revealed capillary telangiectasia (n=18), presumed microvascular disease (PMID) (n=20), multiple sclerosis (n=21), pontine myelinolysis (n=16), tumor (n=20), acute infarction (n=20), subacute infarction (n=13), or chronic infarction (n=20).

All patients were examined on a 1.5 T whole body system (Magnetom Symphony, Siemens) using a standard head coil. The retrospective evaluation included transverse slices with a slice thickness of 6 mm: T2-weighted TSE (TR 3150 ms, TE 81 ms), T1-weighted SE (493/14), diffusion MR (3300/95, b-value: 0, 500, 1000 s/mm^2), and T1-weighted SE (624/17) after application of 0.1 mmol/kg bodyweight Gd contrast agent (Magnevist, Schering or Omniscan, Amersham); for the diffusion technique trace-images (b=1000 s/mm^2) and ADC-maps were calculated automatically and evaluated separately.

Visual evaluation was done by consensus of 2 experienced neuroradiologists grading the lesion contrast relative to normal appearing pons tissue as hypo-, iso-, or hyperintense. Furthermore, regions-of-interest (ROI) measurements were performed to calculate contrast-to-noise-ratios (CNR) of all lesions relative to normal appearing pons tissue for all sequences. To find statistical significant differences between capillary telangiectasia and the remaining lesions Student´s t-test was applied for the results of the ROI measurements and Mann-Whithney-test for the results of the visual evaluation.

Results

Capillary telangiectasias were shown hypointense (11/18) or isointense (7/18) relative to normal appearing pons tissue on plain T1-weighted images, hyperintense (12/18) or isointense (6/18) on T2-weighted images, and hyperintense (18/18) on post-contrast T1-weighted images. On diffusion-weighted trace-images all telangiectasias presented with low signal intensity (18/18), but they appeared isointense (9/18) or hyperintense (9/18) on ADC-maps. Low signal intensity on diffusion-weighted images was very rare for the remaining lesions: only 1 pontine myelinolysis, 1 tumor, 4 subacute infarctions, and 19 chronic infarctions revealed also low signal intensity on diffusion-weighted images. The combination of high signal intensity on T1-weighted post-contrast images and low signal intensity on diffusion weighted images was found for all capillary telangiectasias, but only for 1/20 tumor and for 4/13 subacute infarctions. Statistics resulted in highly significant differences ($p<0.001$) for capillary telangiectasias versus PMID, multiple sclerosis, pontine myelinolysis and acute infarction on T1-weighted post-contrast and on diffusion-weighted images (see table 1).

ROI evaluation revealed a broad spectrum of CNR values for most lesions and sequences. CNR on T1-weighted post-contrast images in capillary telangiectasia ranged between 6.6 and 63.7 and did not overlap with the results for PMID (-5.2 to 5.5), acute infarction (-9.7 to 3.1), and chronic infarction (-27.1 to -1.6). CNR-results on diffusion-weighted images did not overlap between capillary telangiectasia (-39.9 to -1.7) and acute infarction (15.0 to 126.1). Statistical results for the CNR evaluation and the visual assessment were very similar, details are shown in table 1.

		T1 pre contrast		T1 post contrast		T2		diffusion-weighted		ADC	
	n	visual	CNR	visual	CNR	visual	CNR	visual	CNR	visual	CNR
PMID	20	-	-	**x, #**	**x**	-	-	**x, #**	**x**	-	-
multiple sclerosis	21	-	-	**x**	**x, #**	-	-	**x, #**	**x**	-	-
pontine myelinolysis	16	-	-	**x**	**x**	-	-	**x**	**x**	-	-
tumor	20	-	-	-	-	-	-	**x**	**x**	-	-
acute infarction	20	-	-	**x, #**	**x, #**	-	-	**x, #**	**x, #**	**x**	**x**
subacute infarction	13	-	-	-	-	-	-	-	-	-	-
chronic infarction	20	-	**x**	**x, #**	**x, #**	-	-	-	-	-	**x**

Table 1: Statistical results of visual and ROI evaluation (CNR) comparing capillary telangiectasia and other pontine lesions
n: number of patients; x: statistically significant differences ($p<0.001$), -:no statistically significant differences ($p>0.001$), #: no overlap of results between both lesion types

Discussion

The signal behavior of capillary telangiectasias on conventional MR images is well documented, but no reports exist about the signal behavior on diffusion MR. Very high signal intensity on post-contrast T1-weighted images can be interpreted in terms of a vascular anomaly with strong uptake of Gd contrast agent. Low signal intensity on diffusion-weighted images can be understood by diffusive motion of blood spins within the lesion.

Visual assessment and quantitative CNR evaluation gave very similar results concerning the differential diagnosis of this rare vasular anomaly: Quantitative evaluation was not able to contribute relevant additional information compared with a simple visual assessment; therefore, it can not be recommended for routine application.

The combination of “hyperintense signal behavior on post-contrast T1-weighted images” and “hypointense signal behavior on diffusion-weighted images” of a pontine lesion seems to be a quite reliable criterion for a capillary telangiectasia. Only 1 of our tumorous lesion showed the same behavior, but due to its location and space occupying appearance a tumor was suspected in that case and confirmed later by histology. Differential diagnosis of subacute infarction might remain difficult based on a single MR examination. However, clinical status of the patient and/or follow-up or preceeding examinations might help to differentiate between capillary telangiectasia and subacute infarction.

Diffusion MR is meanwhile available on all modern MR scanners and can be performed quickly in 1 or 2 minutes. Therefore, it seems to be a helpful adjunct to conventional MR for differential diagnosis of capillary telangiectasia and might help to avoid unnecessary brain stem biopsies which would be indicated in the case of a suspected tumor.

Conclusion

High signal intensity on T1-weighted images after application of contrast agent and low signal intensity on diffusion-weighted images of a pontine seems to be a quite reliable indication of a capillary telangiectasia. Therefore, we would recommend to apply diffusion-weighted imaging additionally to conventional MR to improve differential diagnosis of pontine lesions – especially to differentiate between tumors and capillary telangiectasias to avoid unnecessary risky brain stem biopsies.