Assessment of inflammatory involvement pattern of cranial arteries in giant cell arteritis with 3 T MRI

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Introduction

Giant cell arteritis (GCA) is a chronic granulomatous vasculitis. Certainty about the correct diagnosis is needed, especially in view of the required long term treatment with corticosteroids and its side affects. Typically, the diagnosis of GCA is conformed by biopsy, usually of the temporal artery. However, the disease in the arterial wall is intermittent and not continuous and, therefore, negative biopsies are not necessarily conclusive. Recently it was demonstrated, that high resolution contrast-enhanced MR images allow for the detection of inflammation in the temporal arteries in good agreement with biopsies [1]. With a novel MRI protocol all major superficial cranial arteries can be assessed within one single examination and in this study we investigate the hypothesis, that 3 Tesla high resolution MRI can visualize the involvement pattern of mural inflammatory changes of all major superficial cranial arteries in giant cell arteritis non-invasively and in vivo.

Methods

21 successive patients suspected of having GCA were examined on a 3 Tesla MRI scanner using a dedicated eight element phased-array head-coil. Contrast enhanced, fat saturated multislice T1w SE sequences were acquired with a sub-millimeter spatial resolution of 0.2 mm $\times$ 0.3 mm (TR/TE = 500/22 ms, FoV = 200$\times$200 mm^2, acquisition matrix size = 1024$\times$728 voxels, number of excitations = 1, TA 4:52 min). A total o 126 superficial cranial arteries were analyzed on the MR images and biopsies of the temporal artery were harvested in 9 out of the 21 patients. Inflammatory changes such as mural contrast enhancement and thickening of the vessel wall were evaluated by two radiologists.

Results

MRI sharply demonstrated all major superficial cranial arteries allowing an evaluation of their lumen and vessel wall. 9 patients were found positive and 11 patients were found negative for giant cell arteritis according to the criteria of the American College of Rheumatology (ACR) [2]. In all cases of GCA, multiple cranial arteries showed MRI signs of inflammation simultaneously. In one case, the occipital arteries were inflamed while the temporal arteries were not (Fig. 1). Average wall thickness of the inflamed and unaffected arteries was 0.70 ± 0.21 mm and 0.39 ± 0.15 mm, respectively. The average lumen diameter of the inflamed and unaffected arteries were 0.53 ± 0.29 mm and 0.79 ± 0.31 mm, respectively. The differences in wall thickness and lumen diameter were statistically significant with $p < 0.001$. Compared to the ACR criteria, MRI was true positive in 8 of 9 patients and false positive in one patient. MRI was true negative in 11 of 12 patients and false negative in one patient.

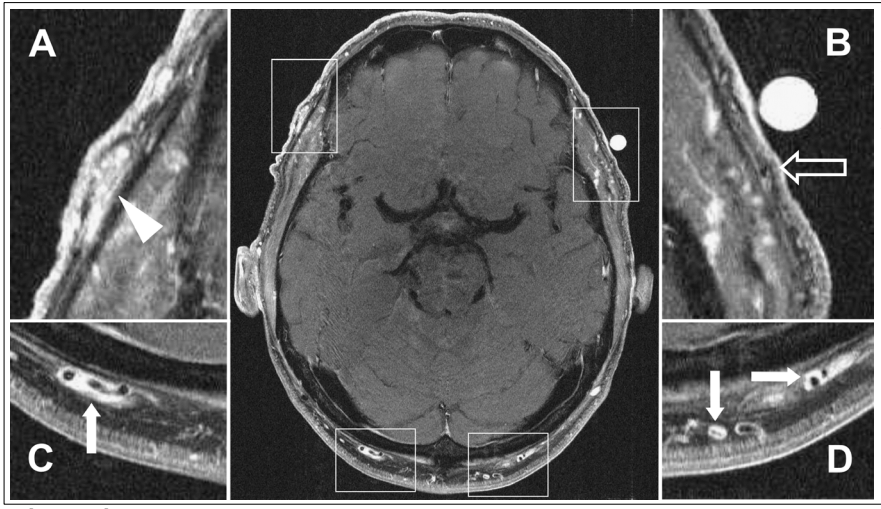

Figure 1. Contrast enhanced, fat saturated transversal T1-weighted 2D spin echo image of a 67-year-old man with giant cell arteritis, eight days after biopsy of the frontal branch of the right superficial temporal artery.

Enhancement of the right frontal branch of the superficial temporal artery is due to post operative changes (arrowhead in enlargement A). Histology revealed no inflammatory changes and a lack of giant cells.

The frontal branch of the left superficial temporal artery shows no signs of inflammation (light arrow in enlargement B). Bright contrast enhancement and mural thickening indicates arteritis of the occipital arteries on both sides (bold arrows in enlargements C and D).

Discussion

To our knowledge, this is the first prospective analysis of utilizing recent technical advances in high field 3 Tesla MR imaging for patients with giant cell arteritis. We have demonstrated the feasibility of high resolution MRI for non-invasive visualization of mural inflammatory changes in the cranial arteries. We found good agreement with histology and the clinical criteria of the ACR. The involvement pattern of all major superficial cranial arteries could be assessed in vivo. In the majority of cases, several cranial arteries were affected simultaneously with a predominant occurence in the frontal branch of the superficial temporal artery. Inflammation of the occipital arteries with spared temporal arteries was also encountered. High resolution MRI might be useful for assisting in non-invasive diagnosis and biopsy site selection for an artery with the most prominent mural inflammation, and monitoring of therapy .

References: 1. Bley TA et al., AJR 2005, in press. 2. Hunder GG et al., Arthritis & Rheumatism 33:1122, 1990