



ORIGINAL ARTICLE / *Head and neck imaging*

Correlation of quantitative MR imaging findings with symptoms in patients with incidentally detected inflammatory sinonasal disease

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KEYWORDS

Paranasal sinus;
Sinusitis;
Magnetic resonance
imaging (MRI);
Diffusion-weighted
MRI

Abstract

Purpose: To assess the relationships between mucosal thickness, T1-weighted, T2-weighted signals and restricted diffusion on magnetic resonance imaging (MRI) with the degree of symptoms in patients with incidentally detected inflammatory sinonasal disease.

Materials and methods: Conventional and diffusion-weighted MRI of 100 patients with incidental sinonasal mucosal thickening were prospectively evaluated. There were 53 men and 47 women, with a mean age of 44.6 years \pm 15.17 (SD) (range: 18–81 years). Correlations between quantitative values (T1-signal, T2-signal and apparent diffusion coefficient [ADC]) and three different quality of life questionnaires (chronic sinusitis survey, sinonasal outcomes test-22 and nasal obstruction and septoplasty effectiveness scale [NOSE]) were searched using the Spearman correlation test.

Results: The mean SNOT-22 score was 35.81 \pm 20.36 (SD) (range: 0–83), CSS score was 4.64 \pm 3.42 (SD) (range: 0–14), and NOSE score was 5.91 \pm 4.84 (range: 0–18). All patients (100%) had maxillary sinus involvement. Ethmoidal sinus involvement was present in 57% of patients, frontal sinus involvement in 33% and sphenoidal sinus involvement in 27%. Morphologically, 40 patients (40%) had septal deviation, 41 (41%) had maxillary sinus retention cyst and 78 (78%) had hypertrophy of the conchae. No correlations were found between morphological abnormalities, quantitative values and patient scores in none of the questionnaires.

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Conclusion: Incidental morphological abnormalities or restricted diffusion of the paranasal sinuses on MRI do not correlate with the degree of symptoms in patients with incidentally detected inflammatory sinonasal disease.

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Magnetic resonance imaging (MRI) of the brain often reveals incidental pathologies, such as fluid levels, mucosal thickening and retention cysts in the paranasal sinuses. However, the clinical importance of these findings often remains uncertain for clinicians and radiologists [1,2]. These findings are sometimes handled by clinicians who are not otolaryngologists so that the patients may receive unnecessary medical treatment or have useless follow-up examinations [3].

The degrees of symptoms of patients with chronic sinusitis (CRS) are graded with different quality of life (QOL) questionnaires, like chronic sinusitis survey (CSS), sinonasal outcomes test-22 (SNOT-22) or nasal obstruction and septoplasty effectiveness scale (NOSE) [4–9]. The literature contains studies with conflicting results with respect to the relation between symptom severity and imaging findings [4–6].

Diffusion-weighted (DW) MRI has been used for the characterization of benign and malignant conditions as well as in the detection of infections [10–13]. Low apparent diffusion coefficient (ADC) values reflect restricted diffusion of water molecules in the tissues. Hence, infected sinonasal tissue may be distinguished from normal ones with this sequence.

The goal of this study was to assess the relationships between sinus mucosal thickness, signal intensity on T1-weighted and T2-weighted MRI and restricted diffusion on DW-MRI with the degree of symptoms in patients with incidentally detected inflammatory sinonasal disease.

Materials and methods

Patients

This study was approved by the ethics committee of our Institution (EK 396) and all patients gave their informed consent. This prospective study evaluated 100 patients (53 men and 47 women) with a mean age of 44.6 ± 15.17 (standard deviation [SD]) years (range: 18–81 years) who underwent cranial MRI for non-sinus related clinical symptoms. Adults over the age of 18 years were included.

The patients were searched in the cerebral MRI examinations database of our institution from January 2015 to March 2015. After cerebral MRI examination patients with mucosal thickening were asked to participate in the study and were asked to fill out three different questionnaires. The questionnaires were filled by the patient alone to avoid any influence in the quality of responses. The inclusion criteria was the presence of a mucosal thickening > 2 mm

of the maxillary sinus. Exclusion criteria include those who were referred for paranasal MR imaging for suspicion of a sinonasal disease. Patients with a known history of allergy or recent flu, those who previously had nasal surgery and those who had had medical treatment for nasal symptoms were excluded. The indications for cranial MRI are listed in Table 1.

MRI protocol

MRI examinations of the head were performed on 1.5-T unit with eight-channel head coil (Signa Excite[®], GE Medical Systems, Milwaukee, WI, USA) using a standard cranial protocol. MRI protocol comprised of a T1-weighted spin echo (SE) image (repetition time (TR)/echo time (TE) = 800/15 ms), T2-weighted (TR/TE = 4500/80 ms); fluid attenuated inversion recovery (FLAIR) image (TR/TE = 6000/150 ms and inversion time (IT) = 2000 ms) with a sectioned thickness of 5 mm, an interslice gap of 2 mm, a field of view (FOV) of 20×25 cm and matrix size of 256×256 in the transverse plane. DW-MRI was obtained in the transverse plane using single-shot echoplanar imaging (TR/TE = 10,000/108 ms; matrix size = 256×128 ; section thickness = 5 mm; interslice gap = 2 mm; FOV = 24 cm). The gradients of diffusion sequence were performed sequentially in the 3 orthogonal directions (x, y and z). DW-MRI was acquired using three b-factors of 0, 500, and 1000 s/mm². The software automatically generated the ADC maps. DW-MRI data-acquisition time was approximately 1 minute.

Image analysis

Reading and signal intensity measurements on T1-weighted, T2-weighted and DW-MR images were done in consensus by 2

Table 1 Clinical indications for magnetic resonance imaging in 100 patients.

Indication	
Headache	61 (61)
Vertigo	11 (11)
Tinnitus	8 (8)
Epilepsy	7 (7)
Cranial neuropathy	7 (7)
Vascular malformations	6 (6)

Results are expressed as raw numbers. Numbers in parentheses are percentages.

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