



## Fluid signal in the mastoid is a common incidental finding on MRI of the brain

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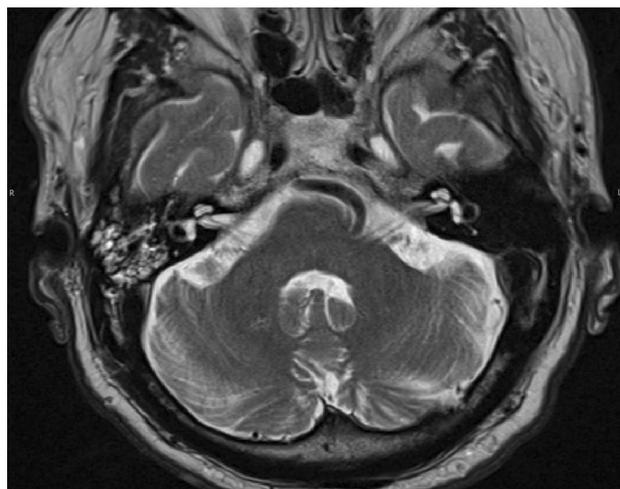
### Abstract

Incidental findings are common on patients undergoing magnetic resonance imaging (MRI) of the brain. Fluid signal in the mastoid can be such an incidental finding on MRI of the brain. In only a small number of patients, this relates to inflammatory disease of the middle ear or mastoid. In a small retrospective study, the prevalence of this finding has been studied. Fluid signal in the mastoid was found in 21 out of 84 patients (25%). Only in two patients MRI revealed a cause for the mastoid fluid (mastoid osteolysis in a patient with metastatic breast cancer and presumed recurrent cholesteatoma in another patient). Two patients reported about longstanding presbycusis. At the initial examination, none of the patients reported symptoms of an inflammatory otological disease, and clinical examination was unremarkable in all patients. In conclusion, fluid signal in the mastoid seems to be a frequent incidental finding in asymptomatic patients. A diagnosis of mastoiditis should only be made if there are distinct clinical findings.

**Keywords** Magnetic resonance imaging · Mastoid · Fluid signal · Mastoiditis

Incidental findings are present in up to 18% of asymptomatic persons undergoing magnetic resonance imaging (MRI) of the brain, of whom most are of minor significance [1]. This may lead to further workup, increased costs and worry of the patients without changing clinical management. Fluid signal in the mastoid can be such an incidental finding on MRI of the brain [2]. In only a small number of patients this relates to inflammatory disease of the middle ear or mastoid [3]. The prevalence of such incidental found opacifications of the mastoid in adults has not been reported. In a small retrospective study, all patients undergoing brain MRI for cancer staging in a 4-month period were retrospectively reviewed. All patients were examined on the same 1.5 T MRI scanner and images were viewed on a standard medical workstation. Initially, the basic T2-weighted sequences with a slice thickness of 5 mm were reviewed. The amount of fluid was visually graded ('minor'—only several mastoid cells with fluid signal or 'marked'—more than half of the mastoid cells show fluid signal). If there was a fluid signal in the mastoid,

additional sequences were reviewed for contrast enhancement, diffusion restriction or possible underlying causes (for example, tumorous obstruction of the Eustachian tube). In cases with fluid signal, a chart review of the clinical data was performed. The patient sample consisted of 84 patients [48



**Fig. 1** Incidentally found fluid signal of the right mastoid on a T2-weighted image of an 84-year-old man undergoing staging for lung cancer

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men and 26 women with a mean age of 66.6 years (range 38–94 years)]. Fluid signal in the mastoid was found in 21 patients (25%) (Fig. 1). In 7 patients there were major fluid collections and in 14 patients there were minor fluid collections. Only in two patients MRI revealed a cause for the mastoid fluid (mastoid osteolysis in a patient with metastatic breast cancer and presumed recurrent cholesteatoma in another patient). Two patients reported about longstanding presbycusis. At the initial examination, none of the patients reported symptoms of an inflammatory otological disease and clinical examination was unremarkable in all patients.

This high prevalence of fluid signal in mastoid in an adult population without clinical signs of mastoiditis is in accordance with previous reports. Meredith and Boyev were the first to report about erroneously diagnosed mastoiditis on MRI. They reported about 28 referred patients, who were diagnosed with ‘mastoiditis’ based on the finding of fluid signal on T2-weighted imaging [2]. In none of the patients signs of mastoiditis were found on clinical or laboratory examinations. In the study of Meredith and Boyev, signs of a dysfunction of the Eustachian tube explaining the fluid retention could be found in 32% of patients. In a larger study, Polat et al. reviewed 275 patients being referred because of a diagnosis of ‘mastoiditis’ on MRI [3]. Only 17.5% of these patients showed clinical otologic disease. The most common diagnosis was Eustachian tube dysfunction, followed by serous and chronic otitis media and tympanosclerosis. Only three patients showed signs of an acute otitis media. None of the patients was diagnosed with mastoiditis. Singh et al. studied the prevalence of mastoid fluid in children undergoing brain MRI [4]. In their study on 515 children without overt signs of otologic disease, 21.4% showed mastoid opacification. The prevalence was higher in younger children. These findings support the assumption that mastoid fluid is an incidental

finding without clinical significance in most cases. The impaired drainage of mastoid fluid through the Eustachian tube seems to be the most common cause of mastoid effusion. This is especially obvious in intubated intensive care unit patients, in whom a large portion shows mastoid or middle ear effusion on computed tomography and which worsens during a prolonged stay [5]. Impaired drainage is also often observed in the course of a common cold. Limitations of this study are the retrospective design, the selected group of patients and the fact that patients in the setting of cancer may have not adequately reported other symptoms.

In conclusion, fluid signal in the mastoid seems to be a frequent incidental finding in asymptomatic patients. A diagnosis of mastoiditis should only be made if there are distinct clinical findings.

### Compliance with ethical standards

**Conflict of interest** There is no conflict of interest to declare.

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