Efficacy of diffusion-weighted magnetic resonance imaging in the middle ear cholesteatoma

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ABSTRACT

Objective: This study evaluated the usefulness of diffusion-weighted magnetic resonance imaging (DWI) for detecting middle ear cholesteatoma. Methods: We performed DWI on 73 patients suspected of having middle ear cholesteatoma, including 21 revision cases. Results: The sensitivity, specificity, and positive and negative predictive values of DWI for cholesteatoma were 94.6%, 92.8%, 97.5%, and 41.9%, respectively. Of the 21 subjects who underwent revision surgery, the sensitivity, specificity, and positive and negative predictive values of DWI for residual or recurrent acquired cholesteatoma were 71.4%, 100%, 100%, and 63.6%, respectively. Cholesteatoma mass diameters were less than 5 mm in 10 out of 18 subjects with both cholesteatoma and negative DWI findings. Since DWI clearly showed high specificity and positive predictive value, it is useful for diagnosing middle ear cholesteatoma, including postoperative recurrent cholesteatoma of 5 mm diameter or larger.

METHODS AND MATERIALS

DWI examination was performed on 73 patients suspected of having middle ear cholesteatoma according to medical history, otoscopic examination, audiological examinations, and CT scan. Patients were examined using spin-echo-type echo planar imaging (SE-EPI) pulse sequences and imaging parameters of 1.5 T MR machine. A radiologist evaluated all MR images without knowledge of the above-mentioned signal characteristics. Each operation was carried out within three months after the DWI examination. We investigated the types and sizes of cholesteatoma using intraoperative findings, and clarified the sensitivity, specificity, and positive and negative predictive values of preoperative DWI examination regarding cholesteatoma.

RESULTS

1) Patient profiles and DWI findings

The clinical features of patients participating in the present study are summarized in Table 1. The correlation between DWI preoperative and operative findings is summarized in Table 2. A correct diagnosis using DWI was made in 54 (73.9%) of the 73 subjects examined, that is, 41 subjects were true-positive (TP) and 13 subjects were true-negative (TN). DWI, however, failed to detect the presence or absence of cholesteatoma in 19 (26.1%) of the 73 subjects, that is, 18 subjects showed false-negative results and one showed a false-positive result. Thus, the sensitivity, specificity, and positive and negative predictive values of DWI for cholesteatoma were 69.4%, 92.8%, 97.5%, and 41.9%, respectively.

2) Correlation between type and size of cholesteatoma and negative DWI findings

Patients were divided into two groups: a less than 5 mm group and an equal to or more than 5 mm group, based on the size from entry to the bottom of each cholesteatoma that was measured using an elevator during otologic surgery. In the case of a cholesteatoma mass equal to or larger than 5 mm, 37 (82.2%) of 45 subjects were found to be DWI positive.

DISCUSSION

Several studies have reported that MRI without DWI after primary surgery showed a specificity range of 63-71% and a positive predictive value within 50-78%. In this study, DWI was shown to have a relatively high specificity and positive predictive value in detecting cholesteatoma, and it can also provide more information to cholesteatoma to differential findings obtained by conventional MRI examination.

In this study, there were 18 false-negative subjects in 10 of these, the diameter of the cholesteatoma mass was less than 5 mm. The remaining eight subjects had an adhesion-type cholesteatoma or partially evacuated atic cholesteatoma with a small amount of keratin accumulation. In the case of a cholesteatoma mass with a diameter of at least 5 mm, the rate of correct diagnosis was 82.2% (n=45). The rate of correct diagnosis was only 28.5% in subjects with a cholesteatoma mass diameter less than this. However, even with larger diameters, the volume of accumulated keratin considerably affects the detection rate of adhesion-type or evacuated cholesteatoma masses.

REFERENCES