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Fully Endoscopic Tympanomastoidectomy in Cholesteatoma – Role of Diffusion Weighted MRI

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Abstract
Fully endoscopic ear surgeries are done in several centres for mucosal (non cholesteatomatous) otitis media. It is also being incorporated in cholesteatoma surgeries where the disease is presumed to be limited. Often the true extent of cholesteatoma is revealed only intraoperatively, necessitating microscope assistance and an on table conversion to a microscope assisted endoscopic ear surgery. This paper analyses the role of preoperative diffusion weighted MRI in cholesteatoma and whether preoperatively patients with cholesteatoma can be offered totally endoscopic transcanal ear surgery.

Keywords-*Chronic otitis media, cholesteatoma, fully endoscopictympanomastoidectomy, Microscope assisted endoscopictympanomastoidectomy,diffusion restricted MRI*

Introduction

Acquired cholesteatoma can be divided into a primary attic retraction and a secondary acquired cholesteatoma. When surgeries for cholesteatoma were being done using a microscope, it was noted that certain areas like the sinus tympani and anterior epitympanic recess where difficult to visualize and hence were the main sites for recidivism [4][6]. But with the advent of endoscope and its utilization in middle ear surgeries,[3][4] the incidence of residual disease in these areas have significantly reduced. These surgeries are called Endoscope Assisted Micro ear surgeries. As the skill and expertise in the use of endoscope for middle ear surgeries advanced, some cases of cholesteatoma were done only with endoscopes and these are called Fully endoscopic ear surgeries. When the disease extended beyond the limit of aditusadantrum, disease clearance using only the endoscope became technically challenging and warranted the need of microscope. These surgeries are called Microscope assisted Endoscopic ear surgery [2]. Therefore, it has become apparent that preoperative imaging with High Resolution Computed tomography of temporal bones does not adequately assess the true extent of the disease into the antrum and beyond.

Magnetic Resonance Imaging T1 and T2 also does not help in identification of cholesteatoma. Diffusion restricted MRI has been used in detecting epidermoid cyst in cerebellopontine angle. Diffusion restriction can also be used for diagnosing cholesteatoma. It is an important tool for diagnosing recurrence of cholesteatoma in canal wall up surgeries.

Here we are assessing the role of preoperative dwMRI to determine the extent of cholesteatoma and its corroboration with intraoperative findings. We were able to predict with high degree of certainty the extent of cholesteatoma using dwMRI, thereby facilitating us in the planning of a fully endoscopic minimal access transcanal cholesteatoma excision in selected cases.

Materials and Methods

50 patients with clinical suspicion of cholesteatoma were subjected to diffusion restricted MRI pre operatively. Patients with recurrence and complications (both intratemporal and intracranial) were excluded from the study. Based on findings patients were taken up for surgery. Out of the 50, 21 cases were planned for fully endoscopic approach and 29 cases with microscope assistance. Karl Storz endoscope with Spies camera was used for the surgery. Using siemen's 3T MRI taken

Results

16 out of this were attic cholesteatomas and 5 were posterosuperior retraction pockets. In all the 21 cases intra operative findings coincided with those of MRI and a full disease clearance was obtained with fully endoscopic approach. The remaining 29 cases had extension beyond the aditus/antrum into the mastoid on MRI and were subjected to a microscope assisted endoscopic approach. The radiological findings were confirmed on table for 28 cases.

One case which was radiologically proven to be cholesteatoma extending up to the mastoid tip was planned for a microscopic assisted endoscopic surgery. We used endoscope for the atticotomy and aditotomy. Cholesteatoma was found to be limited uptoaditus. However, taking into account the findings of dwMRI the procedure was converted to postaural approach and mastoid was opened which revealed a cholesterol granuloma.

Table 1:

		Male	Female	%
TOTAL		27	23	100
HRCT TEMPORAL BONE -SOFT TISSUE DENSITY		27	23	100
DWMRI	DIFFUSION RESTRICTION	27	22	98
	HYPODENSE	0	1	2

Table 2:

Extension	DWMRI	INTRAOPERATIVE	%
Posterosuperior	5	5	100
Attic	16	16	100
Mastoid tip	29	28	96.5

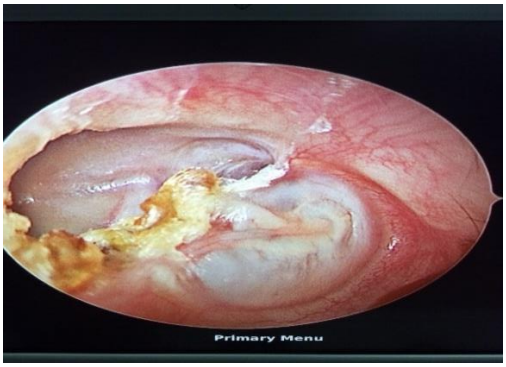

Fig 1: Attic retraction with cholesteatoma

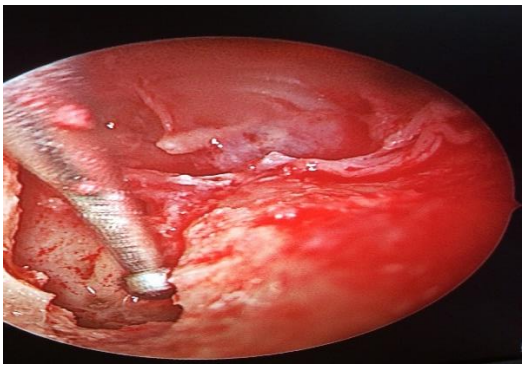

Fig 3: Intraoperative picture

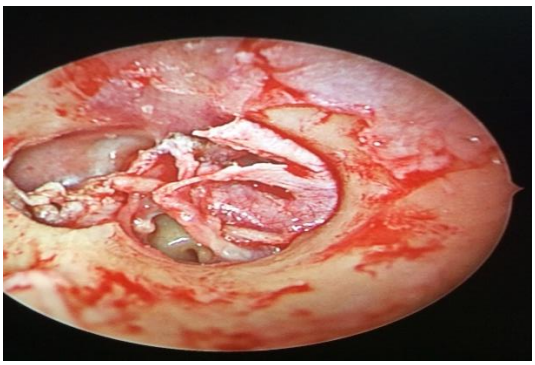

Fig 2: Attic cholesteatoma

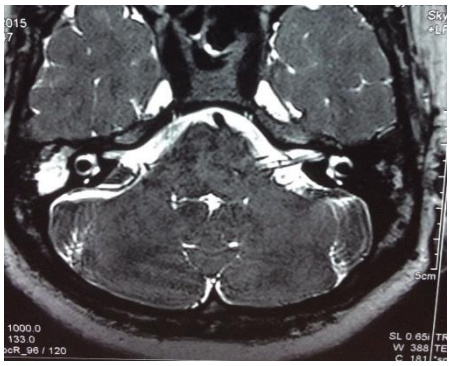

Fig 4: Dwi MRI showing cholesteatoma

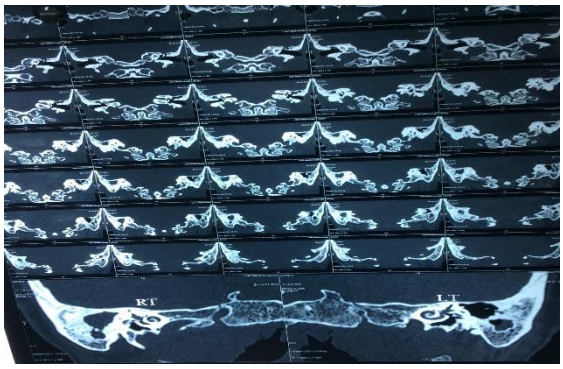

Fig 5: HRCT showing cholesteatoma

Discussion

The role of CT scan with its limitation in a middle ear disease has been well established. CT determine site, size and extent of the disease and also the presence of complications. However, it cannot distinguish cholesteatoma from retained secretions and inflammatory changes.

MRI was traditionally used for cholesteatoma with intracranial complication, dwMRI can differentiate cholesteatoma from other pathology. It shows diffusion restriction due to its keratin content.

Endoscopes for cholesteatoma surgeries [4] were initially used in limited diseases for example in a wide neck sac, a shallow fundus where the whole sac can be visualized with a single 0degree endoscope. With experience, cholesteatoma with narrow neck where the fundus was not completely visualized was also tackled with help of endoscope[5]. These cases started as Transcanal Atticotomy/ Marginectomy, bone removal was done until the posterior limit of the cholesteatoma sac was visualized. If the disease extended beyond the aditus, the procedure was converted to a postaural approach and disease clearance upto the mastoid tip was given with help of microscope [8].

In our study pre-operative assessment with HRCT and dwMRI enable us to know the exact extent of the disease. We found high sensitivity and specificity for dwMRI. This helped us to plan our route of approach and advise our patients for a fully endoscopic transcanal approach in cases of minimal disease.

A fully endoscopic transcanalapproachs when amenable offers distinct advantages to the patient [20]. It alleviates the need of post aural scar and mastoid dressings. It also reduces the duration of hospitalization and need for parenteral medication which translates to a reduction in the economic burden for the patient. The cost of the radiological imaging was covered in our government insurance scheme.

Conclusion

Diffusion weighted MRI has a high degree of accuracy in determining the extent of cholesteatoma in middle ear and mastoid. We suggest the use of dwMRI as a part of preoperative planning in all cases of primary and secondary acquired cholesteatoma when a fully endoscopic transcanal minimal access cholesteatoma excision is being planned.

Conflict of interest: NONE

Acknowledgement: Nil

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