

DIAGNOSTIC ACCURACY OF CHOLESTEATOMA USING HIGH RESOLUTION COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING WITH ITS HISTO-PATHOLOGICAL CORRELATION

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ABSTRACT

INTRODUCTION- Cholesteatoma is a localized collection of keratinous debris and stratified squamous epithelium. It is located in the middle ear cavity and is very commonly associated with bony erosions of the ossicular chain, facial nerve canal, tegmen tympani, sigmoid plate and other structures of the ear.

AIM- To assess the role of HRCT and MRI in the accurate evaluation of cholesteatoma of middle ear with its histo-pathological correlation.

OBJECTIVES-

1. To study the HRCT findings in diagnosis of cholesteatoma.
2. To determine MRI diffusion restriction in differentiating middle ear focal lesions.
3. To determine the usefulness of these newer diffusion techniques to detect smaller lesions and in postoperative recurrent or residual lesions
4. To correlate the HRCT and MRI evaluation with its HPE findings.

MATERIALS AND METHODS- Our study was carried out in the Department Of Radio-diagnosis, Index medical College Hospital and Research Centre, Indore with 50 subjects.

SEQUENCES USED- Axial, sagittal and coronal views using 128 slice CT scan.

1.5 tesla MRI scanner

RESULTS - The most common clinical features in cholesteatoma is chronic ear discharge seen in 35 (70%), recurrent CSOM in 32 (64%). The least common was facial muscle weakness.

In our study, the Sensitivity to diagnose ossicular chain disruption on HRCT was 100%, specificity was 91.67%. PPV was 97.44% and NPV was 100%.

The Sensitivity of HRCT for diagnosing cholesteatoma was 79.55%, specificity was 66.66%, PPV 94.59% and NPV was 30.77%

Overall, Sensitivity for diagnosing cholesteatoma on MRI DWI, was 97.73%, specificity was 66.67%, PPV 95.56%. Diagnostic accuracy of DWI was 94%.

CONCLUSION- HRCT is convenient in recognizing erosions of ossicular chain and structures like facial recess, scutum, tegmen tympani etc. DWI MRI is a highly sensitive and efficient modality to precisely detect incidence of novel and recurrent/ residual cholesteatoma in pre and post operative patients respectively.

INTRODUCTION-

Cholesteatoma is a localized collection of keratinous debris and stratified squamous epithelium. [1] It is located in the middle ear cavity and is very commonly associated with bony erosions of the ossicular chain, facial nerve canal, tegmen tympani, sigmoid plate and other structures of the ear. [1,2]

HRCT Temporal is a very proficient modality to accurately diagnose the location and extent of cholesteatoma. It also quite helpful in recognizing potential complications, like peri-lymphatic or labyrinthine fistulas, observed with cholesteatoma. [1]

DWI is a MR Technique based on the principle of brownian movement of water molecules within the particular voxel for MRI. [1,3]

It can easily and precisely detect and diagnose the cases of not just primary and residual/recurrent cholesteatoma. But can also very keenly distinguish and differentiate other middle ear pathologies such as scar, cholesterol granuloma or granulation tissue from actual cholesteatoma, especially in cases where the HRCT temporal scan results are equivocal and inconclusive. [1,4,5]

It is also valuable tool in assessing the facial nerve and semicircular canal involvement.

Another major significance of DWI MR imaging is in diagnosing the recurrence in postoperative cases following cartilaginous reconstruction or after canal wall up mastoidectomy of cholesteatoma and to detect residual disease where middle ear cavity is filled with soft tissue and bone /ossicular erosions can't be detected on HRCT scan. [6]

The DWI technique has the potential of substituting the second look surgery, avoiding unnecessary morbidity due to extra surgery. It is nearly as proficient as post gadolinium enhanced scan and has the upper hand due to its non-invasiveness nature.[1,4]

Hence, the main goal of the proposed study is directed to evaluate the role of high resolution Computed tomography scan and Magnetic Resonance Imaging in the evaluation of middle ear cholesteatoma and compare it with its histo-pathological findings.

AIM- To assess the role of Computed tomography (CT) and Magnetic resonance imaging (MRI) in the accurate evaluation of cholesteatoma of middle ear with its histo-pathological correlation.

OBJECTIVES-

1.To study the High Resolution Computed tomography (HRCT) findings in the detection and diagnosis of cholesteatoma.

2. To determine the usefulness of MRI diffusion restriction in differentiating middle ear focal lesions.

3. To determine the usefulness of these newer diffusion techniques to detect smaller lesions and in postoperative recurrent or residual lesions

4. To correlate the MRI and HRCT findings with its Histo-pathological results.

MATERIALS AND METHODS

Our study was carried out in the Department Of Radio-diagnosis, Index medical College Hospital and Research Centre, Indore.

Instrumentation:-

Siemens Computed Tomography (CT) Scan 128 slice

GE Signa explorer Magnetic Resonance imaging (MRI) 1.5 Tesla

SEQUENCES USED-

Axial, sagittal and coronal views were obtained using 128 slice CT scan.

Using 1.5 tesla MRI scanner following sequences were used-

**TI AXIAL AND CORONAL
FST2 AXIAL AND CORONAL
DWI AXIAL & CORONAL**

Study Subjects - The computed sample size is 50 subjects with clinically suspected novel and recurrent/residual cholesteatoma pre or post operative patients.

Inclusion Criteria:

Patients of either sex with suspected novel and recurrent/residual cholesteatoma in both pre and postoperative cases referred from ENT department of the Institute for CT or MRI fulfilling the inclusion criteria will be subjected to imaging on Siemens 128 slice CT Scan Machine and 1.5 Tesla MRI machine after approval of local ethical committee and obtaining written informed consent.

Exclusion Criteria:

- Patient not willing to be part of the study
- Patients who haven't given their written consent.
- Pregnant patients
- Patients with cochlear implant
- Patient with MR incompatible pacemaker
- Other general contraindications for MR

DW images obtained and ADC maps were derived automatically from the software on voxel-by-voxel basis. The results were compared with the postoperative histo-pathological findings and analysed using SPSS Software.

RESULTS

This study is a prospective study carried out in the department of Radio diagnosis in Index Medical College, Indore, MP.

Our study included a subject population of 50 patients after taking proper informed, written consent.

In our study we found out that cholesteatoma incidence was most frequently noted in the middle age group patients between the age group of 40 to 50 years, constituting almost 70% of the study population.

The mean age of the study population was calculated to be 37.12+/- 4.21 years (table-1)

Table 1. Age group wise distribution of patients in the study

Age group (years)	N	Percentage
<20	6	12%
21-30	12	24%
31-40	10	20%

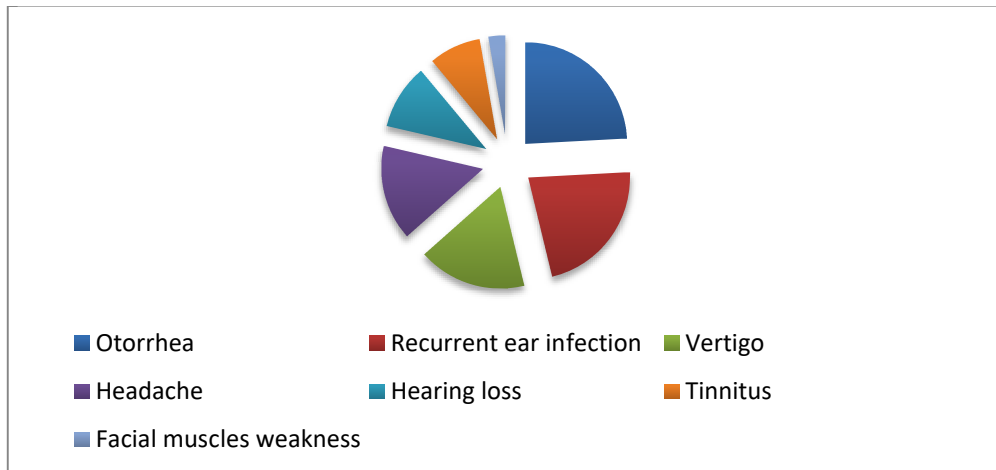
41-50	13	26%
51-60	9	18%
Total	50	100%

The most common clinical features associated with cholesteatoma is chronic ear discharge seen in 35 (70%) patients followed by recurrent episodes of Otitis media noted in 32 (64%) patients. The least common, however a dangerous clinical feature noted was facial muscle weakness associated with facial nerve dysfunction, noted as a complication of cholesteatoma. (table 2)(graph-1).

Table2- Representing the various different clinical features noted in cholesteatoma

CLINICAL FEATURES	Number of patients	Percentage
Otorrhea	35	70%
Recurrent ear infection	32	64%
Vertigo	25	50%
Headache	22	44%
Hearing loss	15	30%
Tinnitus	12	24%
Facial muscles weakness	4	8%

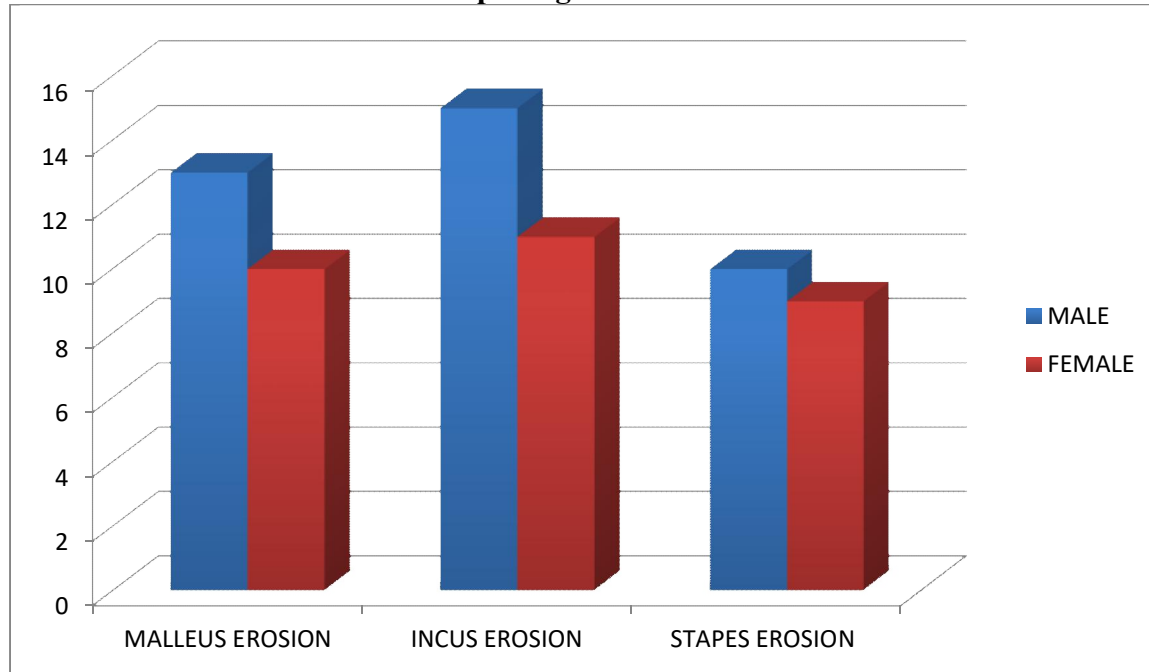
GRAPH 1- depicting the clinical features of cholesteatoma



In our study 33 preoperative and 17 postoperative cases are included to prove the accuracy and efficacy of DWI in diagnosing recurrent cholesteatoma. We found that out of 50 patients 39 (78%) of them had ossicular chain erosions whereas 11(22%) had intact ossicular chain. Lenticular process of the incus was found to be the most prone to erosion in our study. (Table-3) (graph-2)

Table 3- Proportion of involvement of individual ear ossicle in cholesteatoma

	MALLEUS EROSION	INCUS EROSION	STAPES EROSION
MALE	13	19	10
FEMALE	10	11	9
TOTAL	23	30	19

GRAPH 2- depicting ossicular chain erosion

38 cases (76%) were diagnosed with ossicular chain disruption on HRCT Temporal and then confirmed with surgery. (True positive) Whereas 1 case (2%) was falsely reported as positive for ossicular chain disruption on CT however had intact ossicular chain in surgery. (False positive) In 11 (22%) cases the ossicular chain was intact.

Hence, Sensitivity for detection of ossicular chain disruption by HRCT Temporal came out to be 100%, specificity of was 91.67% , Positive Predictive Value (PPV) showed an estimate 97.44% and negative predictive value was 100%. (table-4)

TABLE 4- Statistical evaluation of HRCT Temporal for ossicular chain disruption

Statistics	Value	95% CIs
HRCT Temporal for ossicular chain disruption		
Sensitivity	100.00%	90.75% to 100.00%
Specificity	91.67%	61.52% to 99.79%
Positive Predictive Value (*)	97.44%	85.33% to 99.60%

Negative Predictive Value (*)	100.00%	-
Accuracy	98%	89.3% to 99.95%

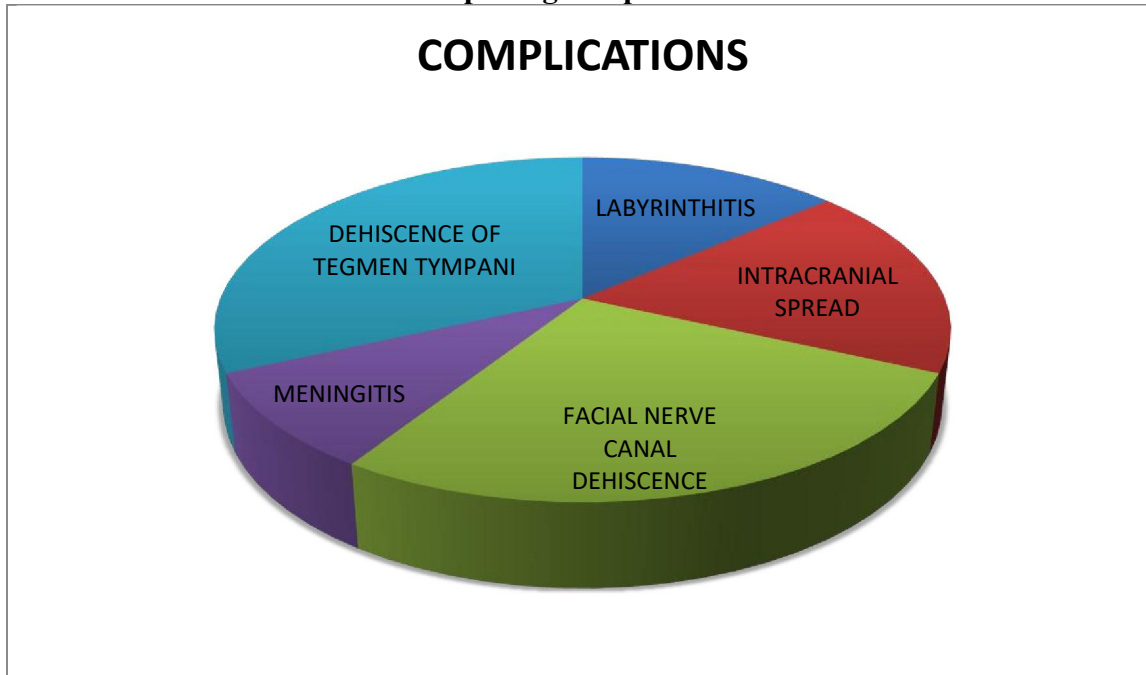
HRCT Temporal is a highly efficient and accurate imaging tool in correctly diagnosing ossicular chain integrity in middle ear cholesteatoma in correlation with surgical findings.

The most frequently encountered complication was dehiscence of tegmen tympani noted in 19 patients (38%), followed by dehiscence of facial canal resulting in facial nerve dysfunction noted in 14 patients (28%) and the least common complication was meningeal inflammation noted in 3 patients (table-5) (graph-3)

Table 5- Complications of cholesteatoma

COMPLICATIONS	NUMBER OF PATIENTS	PERCENTAGE
LABYRINTHITIS	5	10%
INTRACRANIAL SPREAD	4	8%
FACIAL NERVE CANAL DEHISCENCE	14	28%
MENINGITIS	3	6%
DEHISCENCE OF TEGMEN TYMPANI	19	38%

GRAPH 3- depicting complications of cholesteatoma



In our study 35 cases (70%) were diagnosed with cholesteatoma on HRCT Temporal and then confirmed with Histo-pathological analysis (True positive). Whereas 2 cases (4%) were falsely reported as positive for cholesteatoma on CT however were subsequently confirmed as granulation tissue/cholesterol granuloma on HPE. (False positive). In 9 (18%) cases the findings were inconclusive for cholesteatoma on HRCT as well as HPE. Whereas 4 cases (8%) were falsely reported as negative for cholesteatoma on CT however were subsequently confirmed for cholesteatoma on HPE (table 6).

Table 6- Diagnostic valuation of CT in pre and post operative cases with Histopathological report (HPE)

HRCT Temporal (Pre+post operative)	HPE Positive	HPE Negative	Total
CT confirming cholesteatoma	35	2	37

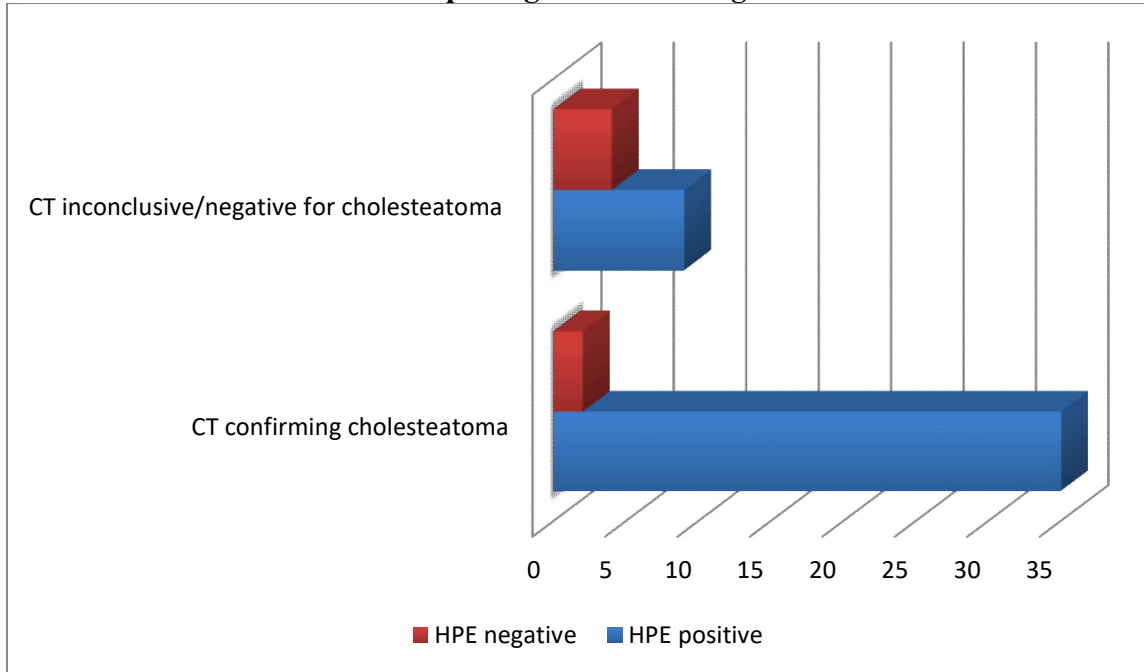
CT inconclusive/negative for cholesteatoma	9	4	13
Total	44	6	50

Hence, In our study, the Sensitivity came out to be 79.55%, specificity was 66.66%, Positive Predictive Value (PPV) showed an estimate 94.59% and negative predictive value was 30.77%. Here, Diagnostic accuracy of CT was 78%. (table-7) (graph-4)

Table 7- Statistical analysis of diagnostic efficacy of HRCT temporal in cholesteatoma

Statistics	Value	95% CIs
HRCT Temporal for cholesteatoma		
Sensitivity	79.55%	64.7% to 90.20%
Specificity	66.66%	22.28 to 95.67%
Positive Predictive Value	94.59%	84.82% to 98.21%
Negative Predictive Value	30.77%	16.48% to 50.03%
Diagnostic Accuracy	78%	64.04% to 88.47%

GRAPH 4- depicting HRCT findings for cholesteatoma



There are 43 cases that are true positive, showing diffusion restriction on DWI and later confirmed with HPE analysis as cholesteatoma. There are 2 cases that are false positive in our study, showing diffusion restriction on DWI, however were confirmed as non-cholesteatomatous lesions on HPE analysis. There are 4 cases that are true negative and one false negative case.

Therefore, Sensitivity for diagnosing cholesteatoma on DWI was 97.73% with 95% confidence interval 87.98% to 99.94%, specificity was 66.67%, Positive Predictive Value (PPV) showed an estimate 95.56%. Diagnostic accuracy of DWI was 94%. (table 8,9) (graph 5)

Table 8. Diagnostic efficacy of DWI in correlation with Histo-pathological report (HPE)

DWI	HPE Positive	HPE Negative	Total
Restricted	43	2	45
Not restricted	1	4	5
Total	44	6	50

DWI: Diffusion weighted image,

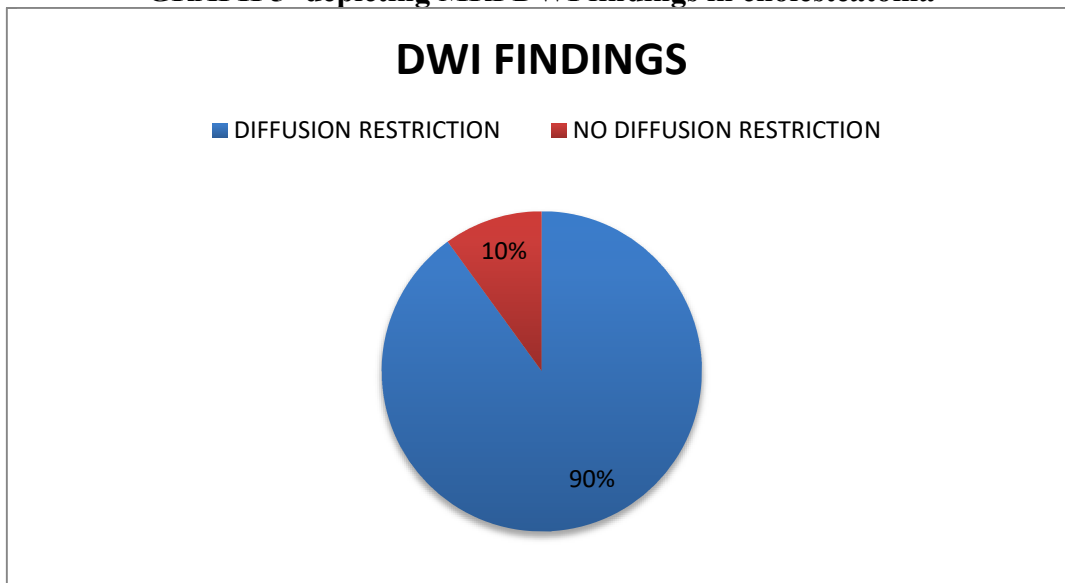
HPE +ve: Confirmed same as cholesteatoma

HPE -ve: Confirmed same as granulation tissue or cholesterol granuloma

Table 9.-Statistical analysis of diagnostic efficacy of DWI in cholesteatoma

Parameter	Estimate	Lower - Upper95% CIs
DWI		
Sensitivity	97.73%	87.98% to 99.94%
Specificity	66.67%	22.28% to 95.67%
Positive Predictive Value	95.56%	87.39% to 98.52%
Negative Predictive Value	80.00%	34.70% to 96.79%
Diagnostic Accuracy	94.00%	83.45% to 98.75%

GRAPH 5- depicting MRI DWI findings in cholesteatoma



For post-operative cases of recurrent cholesteatoma, sensitivity was 100%, specificity was 75%. PPV was 92.86%, Negative predictive value was 100%. Here, Diagnostic accuracy of DWI was higher 94.12% (table-10).

Table-10. Diagnostic evaluation of DWI (postoperative cases) with Histopathological report(HPE)

DWI (postoperative cases)	HPE		Total
	HPE Positive	HPE Negative	
Restricted	13	1	10
Not restricted	0	3	3
Total	13	4	17

DWI: Diffusion weighted image,

HPE +ve: Confirmed same as cholesteatoma

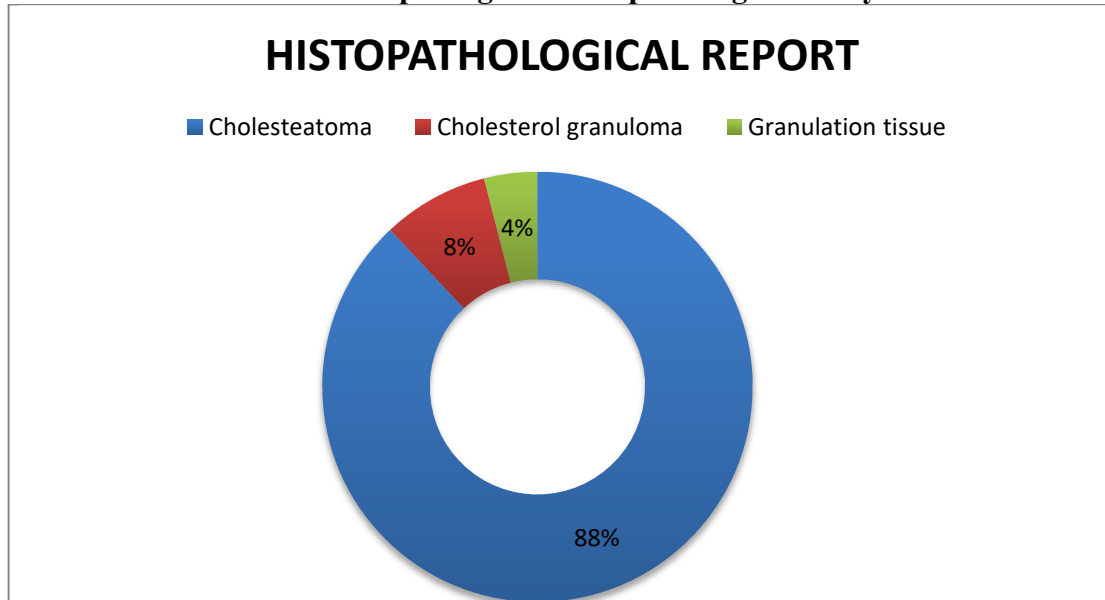
HPE -ve: Confirmed same as granulation tissue or cholesterol granuloma

Table 11- Statistical analysis of DWI MRI in post operative cases with recurrent/residual cholesteatoma

Parameter (postoperative cases)	Estimate	Lower - Upper 95% CIs
Sensitivity	100%	75.29% to 100.00%
Specificity	75.00%	19.41% to 99.37%
Positive Predictive Value	92.86%	70.42% to 98.61%
Negative Predictive Value	100.00%	-
Diagnostic Accuracy	94.12%	71.31% to 99.85%

In our study the Histo-pathologically proven cases of cholesteatoma were 44 out of 50 (88%). There were 4 cases of cholesterol granuloma and 2 of granulation tissue. (graph-6)

GRAPH 6- depicting the histo-pathological analysis



A 24 year old man presented to the ENT Department with complains of chronic ear discharge, ear fullness and ear ache in the right ear. This was associated with hearing loss of the ipsilateral ear. Patient was subjected to MRI 1.5 T scan in our department.

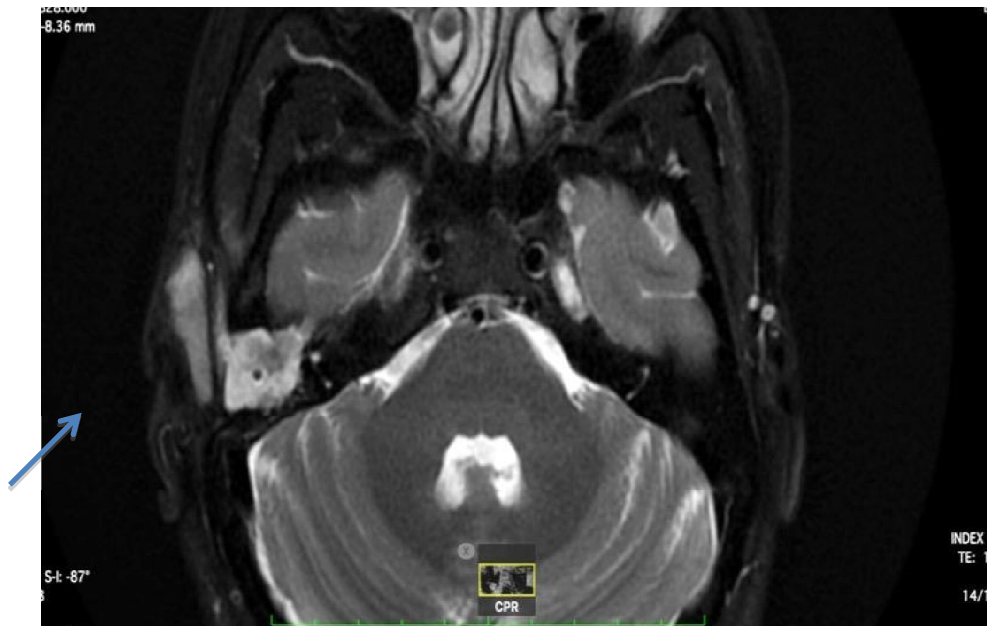


FIG 1

FIG 1– Axial and coronal T2 weighted imaging respectively, showing a hyperintense mass lesion noted in right middle ear cavity suggesting cholesteatoma

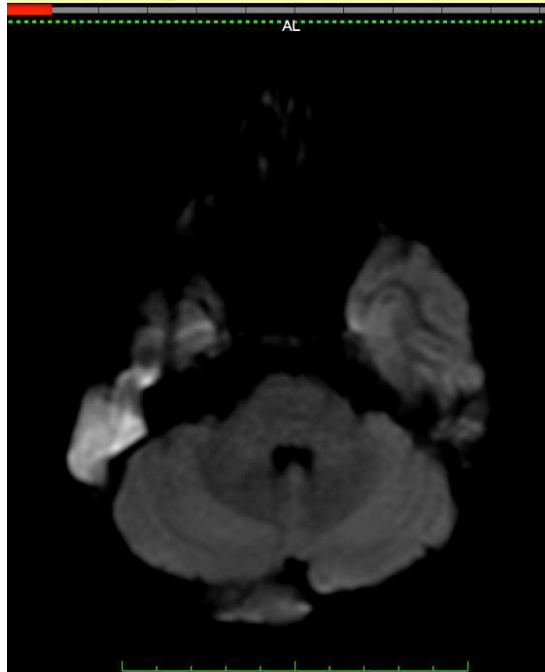


FIG 2

FIG 2- Diffuse weighted MRI imaging demonstrating Restricted diffusion due to cholesteatoma in right ear



FIG 3

FIG 3-3D- Cochlear reconstruction image demonstrating a normal inner ear

DISCUSSION

This study is a prospective study carried out in the department of Radio diagnosis in Index Medical College, Indore, MP. Our study included a subject population of 50 patients after taking proper informed, written consent.

In our study incidence of cholesteatoma was most frequently noted in the middle age group patients between the age group of 25 to 50 years, constituting almost 70% of the study population. The maximum patients were in the age group of 40-50 years. The mean age of the study population was calculated to be 37.12+/- 4.21 years.

In a study done by **Dalia MonirFahmy et al** ⁷ in 2012 which encompassed 20 patients (7 female and 13 male patients) with mean age 42 years, also observed that cholesteatoma was a common occurrence in males and middle age group patients, similar to what we have evaluated in our study.

In our study the number of male patients were 29 (58%) and female patients were 21 (42%). The ratio of males to females came out to be 1.38:1, with a higher predominance of the disease noted in males than in females.

A study by **Milan Profantet al** ⁸ in 2012 included 33 patients with 20 males and 13 female patients also had a higher preponderance of the disease noted in males than in females.

In our study, there were 33 preoperative patients without any prior history of cholesteatoma whereas there were 17 postoperative cases with recurrent or residual disease have been included to prove the accuracy and efficacy of HRCT and DWI in diagnosing recurrent cholesteatoma

A study by **Milan Profantet al** ⁸ in 2012 included 33 patients with 20 males and 13 female patients. 16 (48.5%) of which were diagnosed with a primary cholesteatoma, and remaining 17 (51%) patients were postoperative having recurrent/residual cholesteatoma after canal wall down tympanoplasty

In our study, we found out that out of 50 patients 39 (78%) of them had ossicular chain erosions whereas 11(22%) had intact ossicular chain.

Out of which Lenticular process of the incus was found to be the most prone to erosion noted in 30 patients (60%) followed by erosion of malleus

Therefore, the Sensitivity for accurately detecting ossicular chain erosion on CT as compared to operative findings, came out to be 100%, specificity was 91.67%, Positive Predictive Value (PPV) showed an estimate 97.44% and negative predictive value was 100%.

According to **Payalchawda et al**[9], Ossicular chain erosion was noted in 89 out of 100 patients on HRCT as well as confirmed via surgery in their study. 11 patients had intact ossicular chain in both CT as well as surgery. The sensitivity of detecting ossicular chain erosion was 100%, specificity is 100%, positive predictive value is 100% and negative predictive value is 100%. These values were comparable to the ones by our study.

The most frequently encountered complication was dehiscence of tegmen tympani noted in 19 patients (38%), followed by dehiscence of facial canal resulting in facial nerve dysfunction noted in 14 patients (28%) and the least common complication was meningeal inflammation noted in 3 patients .

In a study by **Joselito L. Gaurano et al** [10] in 2004, done on evaluating the role of HRCT in detection of the extent of middle ear involvement, and early bony erosions involving the ear ossicles and adjacent structures noted in cholesteatoma Of which 59 (92%) had expansion of mastoid antrum and aditus, 59 (92%) had ossicular chain erosion, with the most common being erosion of the long process of incus noted in 48 (75%).

In this study by Joselito et al, 55 patients (86%) had an erosion of scutum, 55 (86%) an eroded facial nerve canal, 48 (75%) had erosion of tegmen tympani.

They discovered that the correlation between pre-operative CT for detecting bony ossicular chain, with surgical and histopathological findings came out to be 97%. In our study too, the diagnostic accuracy for this was 94%.

In another study done in **2001 by Chee N W** et al [11], with 36 patients which showed that HRCT findings included- a non-dependent soft tissue mass, specific site for cholesteatoma and bony and ossicular chain erosion. They evaluated the radio-surgical correlation and found out that the agreement was highly accurate for detection of malleus, stapes and semicircular canals, followed by erosions of incus and tegmentympani.

The least accurate detection was for diagnosing facial nerve canal dehiscence. Similar such results were evaluated in our study with the highest rate of diagnostic accuracy found in diagnosing erosion of malleus followed by incus and stapes.

High-resolution CT scan is an important investigative tool particularly for detecting bone erosions prior to cholesteatoma surgery. Early diagnosis of which can alert the surgeon for the potential dangers and complications of surgery well before hand, thus aiding in better surgical outcome.

In our study 35 cases (70%) were diagnosed with cholesteatoma on HRCT Temporal and then confirmed with Histo-pathological analysis. (True positive). Whereas 2 cases (4%) were falsely reported as positive for cholesteatoma on CT however were subsequently confirmed as granulation tissue/cholesterol granuloma on HPE. (False positive). In 9 (18%) cases the findings were inconclusive for cholesteatoma on HRCT as well as HPE. (True negative). Whereas 4 cases (8%) were falsely reported as negative for cholesteatoma on CT.

The Sensitivity came out to be 79.55%, specificity was 66.66% , Positive Predictive Value (PPV) showed an estimate 94.59% and negative predictive value was 30.77%.

As per a study done by **Payalchawda et al [9]**, cholesteatoma was detected in 82 out of 100 patients in surgery (82%). There were 76 patients (73.91%) where cholesteatoma was accurately detected by CT scan prior to the surgery and 17 patients (98.70%) where the diagnosis was correctly excluded. There was one false positive case. Hence, the sensitivity was 98.70%, specificity 73.91%, positive predictive value 92.68% and negative predictive value 94.44% by diagnosis on cholesteatoma on HRCT.

The main purpose and primary utility of HRCT Temporal scan is to evaluate the bony involvement of cholesteatoma. However it is not very useful when it comes to differentiating and distinguishing cholesteatoma from other soft tissue lesions. Hence many times HRCT temporal fails to recognize this and can pose to be a problem for accurate detection of cholesteatoma.

CASE – 20 year old male post operative patient presented with the complaints of recurrent episodes of chronic suppurative otitis media in both ears associated with ear discharge, earache and fullness. He had conductive hearing loss and tinnitus in both ear. This patient had a prior history of cholesteatoma with mastoidectomy done 8- 12 months before. He was then subjected to HRCT TEMPORAL and MRI Imaging on 1.5 T.

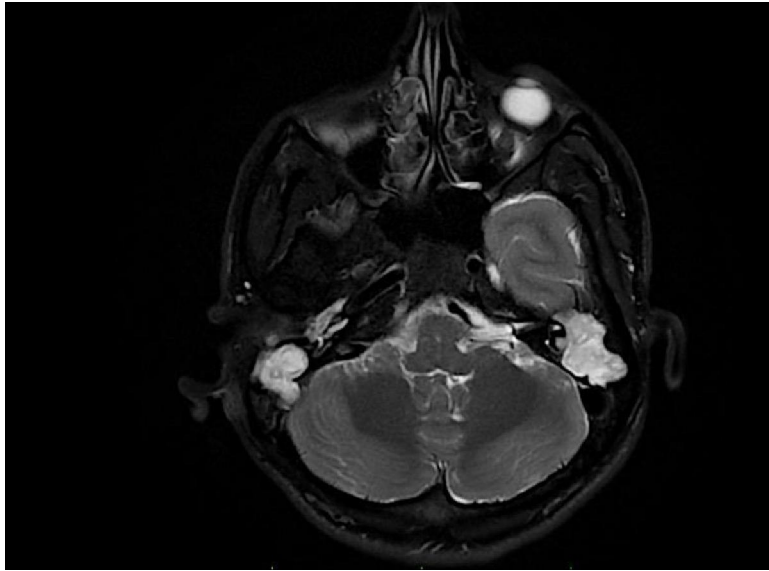


FIG 4

FIG 4- Axial, Coronal and Sagittal T2 Weighted MRI Imaging which illustrate extensive hyperintense soft tissue density lesions noted in bilateral middle ear cavities. These are suggestive of recurrence of cholesteatoma in this post operative patient.

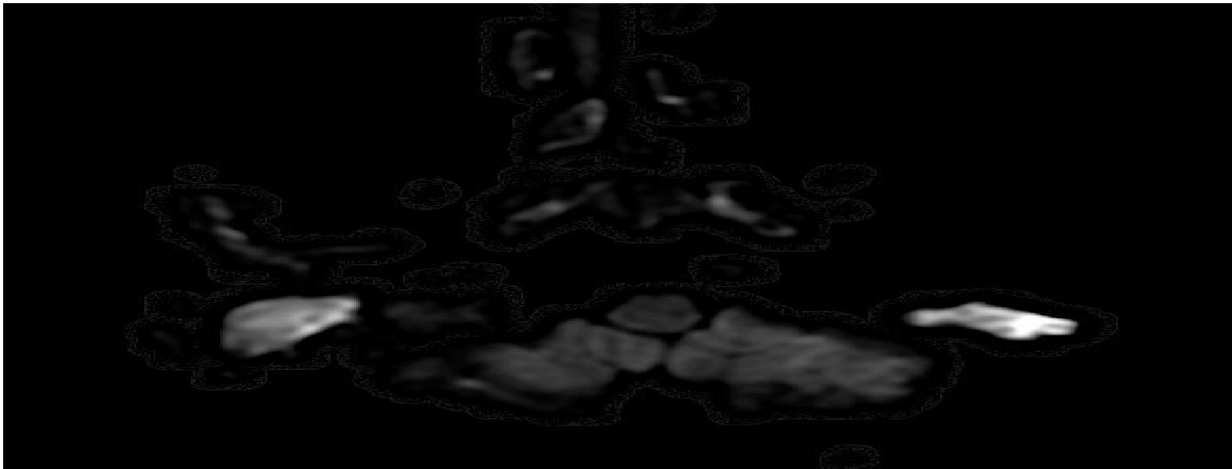


FIG 5- DWI showing diffusion restriction seen bilaterally

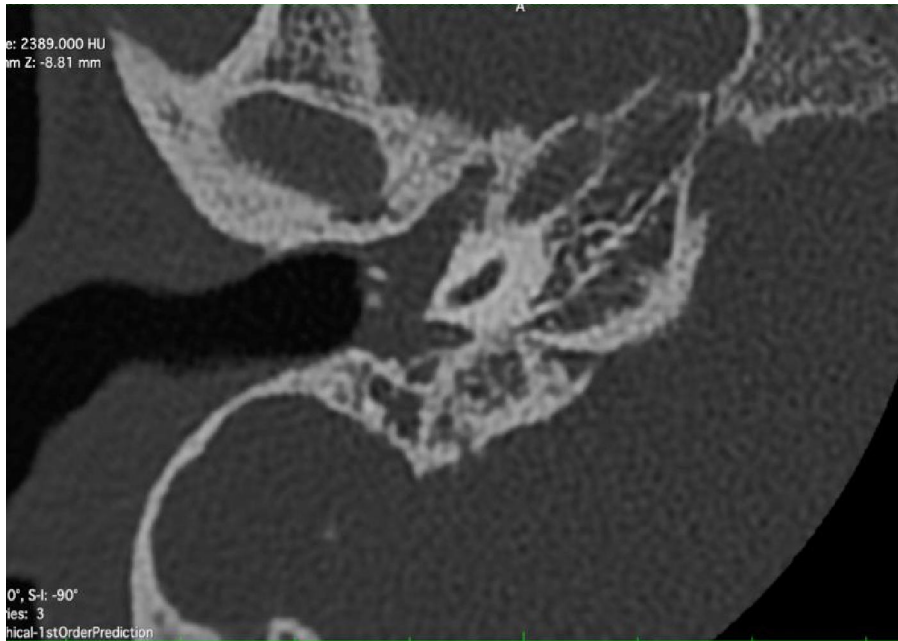


FIG-6



FIG 7

FIG 6, 7 - Axial HRCT Temporal scan of right ear, respectively, demonstrating extensive soft tissue density mass lesion noted in right prussack space, attic and antrum.

H/O post operative mastoidectomy on right side

There is associated disruption of the head and body of malleus, lenticular process of incus and stapes.

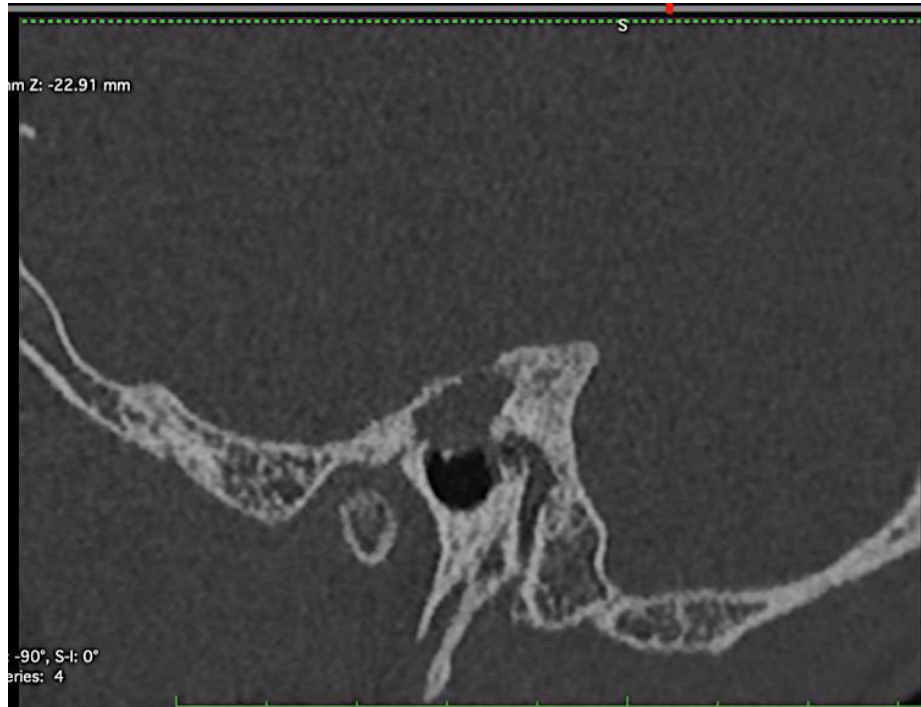


FIG 8- Dehiscence of tegmen tympani and Facial canal along with erosion of sigmoid plate and scutum noted.

In our study, there are 43 cases which are true positive, showing diffusion restriction on DWI and later confirmed with HPE analysis as cholesteatoma. There are 2 cases that are false positive showing diffusion restriction on DWI, however were confirmed as granulation tissue on HPE analysis. There is one false negative case that showed no diffusion restriction on DWI, however was later confirmed as cholesteatoma on HPE analysis

Similarly in a study by **Sharon e Clarke et al [13]**, surgery confirmed cholesteatoma in 15 patients, out of which 13 were previously confirmed on DWI, however in 2 cases the DWI MRI did not correspond to the specific location of the cholesteatoma observed at surgery.

In another study by **Dalia MonirFahmy et al [7] done in 2012**, out of the 20 cases, 8 were diagnosed as cholesteatomas on imaging, 9 were granulation tissues. In Two cases the size of the lesions was smaller than 5 mm and could not be correctly evaluated on MR diffusion. One case was misdiagnosed as cholesteatoma but was pathological confirmed as acute inflammatory process.

Overall, In our study, the Sensitivity for diagnosing cholesteatoma on DWI was 97.73%, specificity was 66.67%, Positive Predictive Value (PPV) showed an estimate 95.56%. Diagnostic accuracy of DWI was 94%.

In a study by **Geoffray et al [12] done in 2013**, 18 patients of pediatric age group were taken and subjected to MR imaging. The sensitivity came out to be 87% and specificity was 71% to diagnose cholesteatoma. Collectively, the sensitivity was 87%, the specificity 100%.

In **Dalia MonirFahmy et al [7] case study done in 2012**, The overall Sensitivity of the study was 80%, specificity- 90%, Positive Predictive Value was 89% and Negative Predictive Value was 82%.

We included 17 postoperative patients with residual or recurrence of cholesteatoma, the Sensitivity for accurately diagnosing cholesteatoma on MRI was 100%, specificity was 75%, PPV was 92.86% with 95 % confidence intervals- 70.42% to 98.61%, Negative predictive value was 100%. Here, Diagnostic accuracy of DWI was higher 94.12%

In a study conducted by **Foer et al [15], done in 2008**, they included a study population of 32 patients with residual/recurrent cholesteatoma 12-18 months post surgery. 9 out of 10 patients developed residual cholesteatoma which was detected using non EPI DWI MR. They reported one false negative case as the size of the lesion was very small <2mm and showed motion artifacts.

The Sensitivity, specificity, positive predictive value, and negative predictive value were 90, 100, 100, and 96%, respectively for diagnosing cholesteatoma.

In a study conducted in 2004 by **Stasolla, Alessandro et al [14]** which comprised of 18 postoperative cases with suspected relapsing/residual cholesteatoma 7 to 19 months after a canal wall-up mastoidectomy were subjected to DWI MRI.

5 out of 6 patients with cholesteatoma showed restricted diffusion in EPI DWI. There was only one misdiagnosed case of cholesteatoma as the size was really small < 2 mm in diameter. This study had a sensitivity of 86%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 92% in accurately diagnosing the incidence of relapsing/residual cholesteatomas in patients.

Hence, it is confirmed that MRI DWI is a very efficient tool for diagnosing cholesteatoma. It can not only accurately diagnose cholesteatoma but also can reliably differentiate it from other middle ear soft tissue pathologies and can save the effort and time for a second look surgery.

CONCLUSION

I observed that DWI MRI imaging is a highly sensitive and efficient imaging modality to precisely detect and diagnose the incidence of novel and recurrent or residual cholesteatoma in pre and post operative patients respectively.

HRCT is highly convenient in recognizing and analyzing the middle ear structures, especially to detect the erosions of the ossicular chain and other structures such as the facial recess, scutum and tegmentympani.

DWI can very aptly differentiate other middle ear pathologies such as scar, cholesterol granuloma or granulation tissue from cholesteatoma. It is particularly helpful when the otoscopic examination and HRCT temporal bone findings are unable to reach to a particular diagnosis.

We highly recommend the DW MRI as a valid method for diagnosing cholesteatoma and follow-up after cholesteatoma surgery

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