THE USEFULNESS OF DIFFUSION-WEIGHTED IMAGING IN CHOLESTEATOMA DIAGNOSIS AND POSTOPERATIVE PATHOLOGIC CORRELATION

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Abstract-Cholesteatomas are cystic collection of keratinised squamous epithelium laid on a fibrous matrix predominantly involving middle ear cavity, that can erode bones and can lead to intracranial complications. The goal of this study was to evaluate the usefulness of DWI in diagnosing primary middle ear cholesteatomas and to differentiate post operative inflammatory changes from recurrent cholesteatoma with the aid of postoperative pathological correlation.

Keywords –:cholesteatoma, diffusion, second look surgery.

I. INTRODUCTION

A sac of keratin collection lined by squamous epithelium that enlarges progressively is called as cholesteatoma. Also called as “pearl tumor,” “margaritoma,” or “keratoma”. DWI is the MRI technique which is based on the brownian movement of particles within the particular voxel and cholesteatoma shows diffusion restriction due to its keratin content. By using non echoplanar imaging, tiny lesions can be accurately diagnosed.

II. MATERIALS AND METHODS:

Forty patients between 10-60 years of either sex with suspected cholesteatoma both new and postoperative cases were subjected to HRCT temporal bone and MRI in a 3 tesla MRunit (Siemens, SKYRA).

Three groups of patients included in our study are
1)Patients in whom middle ear focal lesion suspected on otoscopic examination,
2)Patients in whom HRCT temporal bone found to be inconclusive and
3)Postoperative patients before second looking surgery

Sequences used:
Using 3 tesla MRI scanner following sequences are used
TI AXIAL AND CORONAL
T2 AXIAL AND CORONAL
DWI AXIAL & CORONAL

III. RESULTS AND DISCUSSION:

Patients suspected of having middle ear focal lesions by otoscopic examination, postoperative patients, HRCT temporal bone inconclusive patients are subjected to different MRI sequences including DWI especially HASTE axial images with b-values of 0 and 1000 s/mm². DW images obtained and ADC maps were derived automatically from the software on voxel-by-voxel basis. The results are compared with the postoperative pathological findings and analysed using statistical package and sensitivity, specificity positive and predictive values are calculated using Wilson score.

In our study out of 40 patients 28 cases are newly diagnosed cases of which MRI detects 27 cholesteatoma cases accurately which confirmed post operatively. In one case it was found to be cholesterol granuloma which MRI detects accurately. Out of 12 post operative cases 9 cases are diagnosed as cholesteatoma accurately and confirmed by postsurgical HPE analysis, three cases were diagnosed as granulation tissue. Out of three granulation tissue two are picked up in the MRI accurately and one lesion is misdiagnosed as cholesteatoma which shows diffusion restriction but with low ADC values compared to other cholesteatomas. Granulation tissue shows significantly lower ADC values than cholesteatomas. Most of cholesteatomas shows ADC values higher than 0.55 however infected cholesteatoma can show low ADC value. Our study confirms DWI has high sensitivity and specificity in diagnosing cholesteatoma and is confirmed with postoperative histopathological reports. Smallest lesion detected in our study is 4 mm. DW MRI has 100% sensitivity, 75% specificity, 97.3% PPV and 100% NPV in detecting cholesteatoma. Hence the MRI is more accurate than HRCT temporal bone in diagnosing cholesteatomas.
CASE 1: T1 AXIAL                  T2 AXIAL                  DWI                  ADC
Lesion noted in the left middle ear has low signal on T1 images, high signal on T2 images and showing diffusion restriction with corresponding low ADC values - 0.59 x 10^{-3} \text{mm}^2/\text{s}  and the provisional diagnosis of cholesteatoma was made. Patient was taken for surgery and removal of middle ear mass done and specimen sent for histopathological analysis. HPE reveals and confirms the diagnosis of cholesteatoma.

CASE 2: T1 AXIAL                  T2 AXIAL                  DWI                  ADC
Lesion appears hyperintense both in T1 and T2 sequences and doesnot shows diffusion restriction with ADC value - 0.45 x 10^{-3} \text{mm}^2/\text{s}  and diagnosis of granulation tissue was made which was subsequently confirmed by postoperative histopathological analysis.

CASE 3: T1 AXIAL                  T2 AXIAL                  DWI                  ADC
Lesion appears hyperintense on T1, T2 and FLAIR sequences and hypointense in DWI and hyperintense in ADC sequences. ADC value is 1.9 x 10^{-3} \text{mm}^2/\text{s}  . Since no history of previous surgeries diagnosis of cholesterol granuloma made out. Postsurgical HPE analysis confirms the diagnosis.
FLOWCHART ANALYSIS:
IV. CONCLUSION

DWI can accurately detect primary cholesteatomas especially in absence of bony erosion in HRCT temporal bone. It can distinguish scar, granulation tissue, and inflammatory changes from cholesteatoma in patients with prior cholesteatoma resection and alleviate the need of second-look surgery in noncholesteatoma patients. DWI is superior to conventional T2 sequence in detecting the cholesteatomas. HRCT and MRI are complementary to each other in diagnosing cholesteatomas. In preoperative cases HRCT has high diagnostic accuracy and MRI is usually used to confirm the diagnosis whereas in postoperative cases HRCT is highly non specific and MRI plays significant role in diagnosing cholesteatomas. DWI can replace the second look surgery, avoiding another surgical morbidity.

REFERENCES


2. Contemporary Non–Echo-planar Diffusion-weighted Imaging of Middle Ear Cholesteatomas Fernando Más-Estellés RG 2012 Volume 32 Number 4


### Table 1: Diagnostic Accuracy of CT (Pre/post operative)

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<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>Sensitivity</td>
<td>75%</td>
<td>(58.93, 86.25)</td>
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<tr>
<td>Specificity</td>
<td>75%</td>
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<tr>
<td>Positive Predictive Value</td>
<td>96.43%</td>
<td>(82.29, 99.37)</td>
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<tr>
<td>Negative Predictive Value</td>
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<td>(8.894, 53.23)</td>
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<tr>
<td>Diagnostic Accuracy</td>
<td>75%</td>
<td>(59.81, 85.81)</td>
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<tr>
<td><strong>Method:</strong> Wilson Score</td>
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### Table 2: Diagnostic Accuracy of DWI

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<th>Parameter</th>
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<td>Sensitivity</td>
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<tr>
<td>Specificity</td>
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<tr>
<td>Positive Predictive Value</td>
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<td>(86.18, 99.52)</td>
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<tr>
<td>Negative Predictive Value</td>
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<tr>
<td>Diagnostic Accuracy</td>
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<td>(87.12, 99.56)</td>
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<td><strong>Method:</strong> Wilson Score</td>
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