The role of DW-MRI in the management of paediatric cholesteatoma

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Introduction

A cholesteatoma is the accumulation of keratinous debris and stratified squamous epithelium in the middle ear. Due to the aggressive and destructive nature of this disease in the young population, rapid recognition and thorough management via surgical resection are essential.

This study, from a tertiary referral center, explores the use of diffusion-weighted magnetic resonance imaging (DW-MRI) in predicting the presence of disease compared to surgical findings and its role in identifying residual or recurrent disease after surgery.

Methods

Design: Retrospective case series
Population: Children with cholesteatoma undergoing surgery
Intervention: DW-MRI scans prior to primary and revision surgeries. Non-EPI HASTE DWI is the imaging sequence of choice at our center.

Results

52 cases in 48 patients (30 males, 18 females).

Surgical intervention in the management of cholesteatoma has two aims: i) disease eradication; ii) hearing rehabilitation. We looked at the findings from surgeries and compared these to DW-MRI scan results to look at their correlation. For hearing rehabilitation, we looked at the most recent pure tone audiometry (PTA) results pre- and post-operatively for each case. The average air conduction (AC) levels across 2-4 different frequencies was used to compare overall outcomes. There were no ‘dead’ ears.

Radiological versus surgical findings

<table>
<thead>
<tr>
<th>On imaging</th>
<th>No. of scans</th>
<th>Disease present at surgery</th>
<th>Disease absent at surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>38</td>
<td>37</td>
<td>1</td>
</tr>
<tr>
<td>Negative</td>
<td>7</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Equivocal</td>
<td>7</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1. Imaging findings versus disease status are surgery

<table>
<thead>
<tr>
<th>Sample size (n)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-look surgery</td>
<td>12</td>
<td>91.67%</td>
<td>---</td>
<td>100%</td>
</tr>
<tr>
<td>Second-look surgery</td>
<td>33</td>
<td>83.87%</td>
<td>50.00%</td>
<td>96.37%</td>
</tr>
<tr>
<td>Combined</td>
<td>45</td>
<td>86.05%</td>
<td>50.00%</td>
<td>97.37%</td>
</tr>
</tbody>
</table>

Table 2. Pre-op DWMRI prediction of disease as compared to surgical findings

- **Sensitivity** = true positive rate; whether scan correctly predicted disease presence
- **Specificity** = true negative rate; whether scan correctly predict disease absence
- **PPV** = positive predictive value; probability of having disease when test positive
- **NPV** = negative predictive value; probability of not having disease when test negative

Conclusion

- Mean time interval between scans and surgeries 6 – 18 months
- DWMRI correctly predicted the presence or absence of disease in 84% (38/45)
- Very small lesions or attic disease likely to be missed
- High specificity and PPV, consistent with current evidence
- Small sample sizes for negative findings
- Plan: Prospective database for all patients presenting with cholesteatoma

Pre-op DWMRI 1st-look surgery (remove disease) Review at 1 year

Clinical evidence of cholesteatoma No clinical evidence of cholesteatoma

2nd-look surgery (residual/recurrent disease) DWMRI surveillance Positive Negative

2nd-look surgery Continue surveillance

Table 3. Latest approach for management of cholesteatoma