Original Research Article

Radiographic imaging of mastoid in chronic otitis media: need or tradition?

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ABSTRACT

Background: Computed tomography is the imaging of choice in chronic otitis media (COM) but it is neither available at every centre nor is affordable to masses of economically weaker countries. In this situation where only X-ray facility is available should plain radiographs of mastoid be done? If yes then what is the analytical evidence? This study, was conducted to find the utility of plain radiographs of mastoid by comparing radiological findings vis-a-vis operative findings.

Methods: Pre-operative radiographs of mastoids (Schuller’s view (s/v)) were taken and the radiological findings were statistically analysed with the operative findings.

Results: Plain radiograph of mastoid (s/v) predicted some of the surgical landmarks of mastoid surgery viz tegmen and sinus plates with a fair degree of accuracy. The positive predictive value (PPV) for radiolucent shadow (assumed to indicate bone destruction and thus cholesteatoma) was also high but at the same time, a low negative predictive value and a Cohen’s kappa test showing only a fair agreement underscores the point that absence of a radiolucent shadow does not rule out the presence of cholesteatoma.

Conclusions: Radiographs of mastoid are helpful in providing a prior knowledge of the surgical landmarks in mastoid surgery. Hence with this information, if a surgeon finds himself more at ease in operating a patient then this imaging should be done when CT scan facility is unavailable. However, citing the limited information on other aspects of the disease, its use as a ‘routine’ investigation in chronic otitis media is discouraged.

Keywords: Plain radiograph mastoids, Schuller’s view, Chronic otitis media, Attico antral, Cholesteatoma

INTRODUCTION

Major proportions of chronic otitis media (COM) patients are concentrated in the developing countries and India belongs to the highest prevalence group.¹

Imaging is universal investigation in cases of COM. Indeed, studies have shown usefulness of high-resolution computed tomography (HRCT) of the temporal bone in these cases.² However, facilities of CT and MRI are neither available everywhere nor affordable for every patient, more so in countries like India where a substantial population lives below poverty line and in low facility areas. In this situation where only X-ray facility is available should plain radiographs of mastoid be done? If yes then what is the analytical evidence?

The present study was done to find the utility of plain radiographs of mastoid by comparing radiological findings vis-a-vis operative findings.
METHODS

This was a cross-sectional analytical study done at tertiary level teaching hospital J. N. Medical College and Hospital, A. M. U, Aligarh. Study period was from October 2015 to April 2018.

Study population

32 patients of COM (atticoantral disease) who presented to ENT outpatient facility of the hospital were included. Patients with a previous history of ear surgery, history of temporal bone fracture, those having a neoplastic or granulomatous disease of temporal bone and those considered unfit for surgery (e.g. pregnancy/ischemic heart disease) were excluded. Diagnosis of COM (atticoantral disease) was made on clinical grounds.

Study instruments

Performa for history and examination, for radiologist to report findings, for surgeon to report intra operative findings.

After a detailed history and examination and obtaining an informed consent these patients underwent bilateral plain radiograph of mastoid Schuller’s view (s/v) and findings were reported by a single experienced radiologist. The radiologist was asked to comment on the following points: dural plate position, sinus plate position, dural plate integrity, sinus plate integrity, radiolucent shadow in the mastoid. This radiological reporting was then compared with the intra-operative findings.

Ethical approval

All procedures performed were in accordance with the ethical standards of the institutional ethics committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

RESULTS

A total of 32 patients were enrolled in the study. Majority of the patients were in the second decade of life (Figure 3). Out of the total number of subjects 19 were males and 13 were females with a male to female ratio of 1.5:1 (Figure 4). Dural plate position was found normal in all the 32 cases intraoperatively and plain radiograph (s/v) predicted the same with 100% negative predictive value (NPV) (Table 1).

One case of an anteposed sigmoid sinus was detected intraoperatively. The NPV based on radiograph was 96.88% (Table 2).

Intra-operative finding of breach in dural plate was seen in 5 patients. It was radiologically detected in all the cases but 5 false positive results were also given. Hence, the NPV was 100% in this case but the PPV dropped to just 50% (Table 3).

Out of the 7 cases of sinus plate erosion only 2 could be detected on plain radiograph (s/v) giving an NPV of 82.14% (Table 4).

In 10 cases where a radiolucent shadow was reported, cholesteatoma was found in all the cases giving a 100% positive predictive value but at the same time an NPV of just 36.36% and a Cohens kappa value of 0.263.

This implies that radiographic finding of a radiolucent shadow in these patients was strongly suggestive of cholesteatoma but at the same time its absence did not rule out the same (Table 5 and 6).
Table 1: Correlating dural plate position.

<table>
<thead>
<tr>
<th>Dural plate position</th>
<th>TP</th>
<th>TN</th>
<th>FP</th>
<th>FN</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>Predictive values (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (S/V) Operative N</td>
<td>32</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>*</td>
<td>100</td>
</tr>
<tr>
<td>Low</td>
<td>32</td>
<td>0</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>*</td>
<td>100</td>
</tr>
</tbody>
</table>

R (S/V) = radiograph (Schuller’s view), N = normal, TP = true positive, TN = true negative, FP = false positive, Sn = sensitivity, Sp = specificity, CI = confidence interval, PPV = positive predictive value, and NPV = negative predictive value.

Table 2: Correlating sinus plate position.

<table>
<thead>
<tr>
<th>Sinus plate position</th>
<th>TP</th>
<th>TN</th>
<th>FP</th>
<th>FN</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>Predictive values (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (S/V) Operative N</td>
<td>32</td>
<td>31</td>
<td>0</td>
<td>1</td>
<td>100</td>
<td>*</td>
<td>96.88</td>
</tr>
<tr>
<td>An.</td>
<td>32</td>
<td>0</td>
<td>31</td>
<td>0</td>
<td>0</td>
<td>*</td>
<td>100</td>
</tr>
</tbody>
</table>

R (S/V) = radiograph (Schuller’s view), N = normal, An. = anteposed, TP = true positive, TN = true negative, FP = false positive, Sn = sensitivity, Sp = specificity, CI = confidence interval, PPV = positive predictive value, and NPV = negative predictive value.

Table 3: Correlating dural plate integrity.

<table>
<thead>
<tr>
<th>Dural plate integrity</th>
<th>TP</th>
<th>TN</th>
<th>FP</th>
<th>FN</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>Predictive values (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (S/V) Operative N</td>
<td>22</td>
<td>10</td>
<td>27</td>
<td>5</td>
<td>5</td>
<td>100</td>
<td>81.48</td>
</tr>
<tr>
<td>Br.</td>
<td>22</td>
<td>5</td>
<td>27</td>
<td>10</td>
<td>5</td>
<td>100</td>
<td>81.48</td>
</tr>
</tbody>
</table>

R (S/V) = radiograph (Schuller’s view), N = normal, Br. = breach, TP = true positive, TN = true negative, FP = false positive, Sn = sensitivity, Sp = specificity, CI = confidence interval, PPV = positive predictive value, and NPV = negative predictive value.

Table 4: Correlating sinus plate integrity.

<table>
<thead>
<tr>
<th>Sinus plate integrity</th>
<th>TP</th>
<th>TN</th>
<th>FP</th>
<th>FN</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>Predictive values (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (S/V) Operative N</td>
<td>28</td>
<td>4</td>
<td>25</td>
<td>7</td>
<td>2</td>
<td>23</td>
<td>28.57</td>
</tr>
<tr>
<td>Br.</td>
<td>28</td>
<td>4</td>
<td>25</td>
<td>7</td>
<td>2</td>
<td>23</td>
<td>28.57</td>
</tr>
</tbody>
</table>

R (S/V) = radiograph (Schuller’s view), N = normal, Br. = breach, TP = true positive, TN = true negative, FP = false positive, Sn = sensitivity, Sp = specificity, CI = confidence interval, PPV = positive predictive value, and NPV = negative predictive value.

Table 5: Correlating radiolucent shadow with cholesteatoma.

<table>
<thead>
<tr>
<th>Radiolucent shadow</th>
<th>Cholesteatoma</th>
<th>TP</th>
<th>TN</th>
<th>FP</th>
<th>FN</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
<th>Predictive values (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R(S/V) Operative P</td>
<td>10</td>
<td>22</td>
<td>24</td>
<td>8</td>
<td>10</td>
<td>14</td>
<td>41.67</td>
<td>100</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>22</td>
<td>24</td>
<td>8</td>
<td>10</td>
<td>14</td>
<td>41.67</td>
<td>100</td>
</tr>
</tbody>
</table>

R (S/V) = radiograph (Schuller’s view), P = present, A = absent, TP = true positive, TN = true negative, FP = false positive, Sn = sensitivity, Sp = specificity, CI = confidence interval, PPV = positive predictive value, and NPV = negative predictive value.
Intra-operatively dural plate breach was found in 5 cases (15.6%). This finding is similar to Rai who reported an incidence of 12% but is in conflict with Suatkeskin et al who reports an incidence of 5%.7,11

The coherence with findings of Rai which is an India based study and the conflict with findings of Suatkeskin et al which is a Turkey based study is probably for the reason that in the Indian scenario, patients come to medical attention very late in the course of disease progression especially at the tertiary health care facility like the one in which the present study was conducted.7,11

Plain radiograph mastoid (s/v) detected all the 5 cases of dural plate erosion with an additional 5 false positive results thereby accounting for 100% negative predictive value but only 50% positive predictive value. Hence if intact dural plate is reported, it is quite likely that the dural plate will be found intact intraoperatively but at the same time a positive result has only a 50% chance of being true. Intra-operatively sinus plate erosion was found in 21.8% of cases. This is similar to the findings of Rai (18%).7 Plain radiograph mastoid (s/v) detected sinus plate erosion with a negative predictive value of 82.14%. Presence of bone destruction with cholesteatoma was found intraoperatively in 75% of the cases. This is in line with the findings of O’Reilly et al (79%) and also Jackler, O’Donoghue, and Alzhoubi with all 3 of them reporting an incidence of 80%.12-15

Radiolucent shadow in mastoid (s/v) in these study subjects of COM was considered to represent bone destruction and indicative of presence of cholesteatoma (Figures 1 and 2). Indeed, all 10 cases with a radiolucent shadow on plain radiograph mastoid (s/v) did have cholesteatoma intra-operatively giving a 100% positive predictive value. However, a negative predictive value of 36.36% together with a Cohen’s kappa value of 0.263 which is interpreted as only a ‘fair’ degree of agreement was also found. This underscores the point that absence of a radiolucent shadow does not rule out the presence of cholesteatoma.

**Limitations**

This study was undertaken with a sample size of 32 subjects. Although statistically adequate, a larger sample size may lead to further insights and more authenticated findings applicable to a larger cohort.

**Clinical significance**

This study provides a statistical basis, discouraging routine use of plain radiographs in chronic otitis media, a practice that is prevalent in the Indian scenario.

**CONCLUSION**

We thus conclude that plain radiographs of mastoid are to some extent helpful in providing a prior knowledge of the
surgical landmarks in mastoid surgery. Hence with this information, if a surgeon finds himself more at ease in operating a patient then a plain radiograph of mastoid may be done when CT scan facility is unavailable. However, citing the limited information that a plain radiograph of mastoid has to offer on other aspects of the disease, its use as a routine investigation in chronic otitis media should be discouraged.

**Funding:** No funding sources  
**Conflict of interest:** None declared  
**Ethical approval:** The study was approved by the Institutional Ethics Committee

**REFERENCES**


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