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Original article:

Study of correlation of pre-operative CT imaging of the temporal bone with the intra operative findings in cases undergoing mastoidectomy

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Abstract:

Introduction: The purpose of this study is to evaluate the past and recent literature in order to determine the role of pre-operative CT scans in chronic otitis media.

Material and methods: The present study carried out in the department of otorhinolaryngology, Kamineni academy of medical sciences and research centre Hyderabad during the period of january 2018 to december 2019. which correlates the preoperative HRCT imaging findings to those found intra-operatively in the patients who underwent mastoidectomy . Institutional ethics committee approval was taken for this study.

Results : In the present study, mastoid was found to be well pneumatised in 52.94%, sclerotic in 44.11% and diploic in 2.94% on pre-operative CT imaging as well as intra-operatively. Hence, pre-operative CT imaging of the mastoids is 100% sensitive and specific to know the type of mastoid pneumatisation pre-operatively.

Conclusion: The major role of CT scans in the context of COM is to provide more information regarding the condition of the middle ear and its structures as well as the extent of the disease. CT scans provide a reasonably good information to the otologists, that is valuable as it influences the surgical planning and improves the outlook of the treatment.

Keywords : Computed tomography , COM

Introduction:

The purpose of this study is to evaluate the past and recent literature in order to determine the role of pre-operative CT scans in chronic otitis media.[1]We aim to find consensus on the diagnostic ability of CT imaging in various

anatomical parts of the middle ear and mastoid, and how this knowledge can affect clinical and surgical management. In context of all literature, there has been mixed results when looking at the sensitivity and specificity of middle ear structures. [2]There was favourable consensus for the imaging technique's diagnosis of erosion of the malleus-incus complex, lateral semicircular canal, the facial nerve canal, and presence of soft tissue in the middle ear cavity. There were mixed results with respect to the erosion of tegmen tympani, and sigmoid sinus.[3] Lastly, there was an unfavorable consensus when looking at the erosion of the stapes, oval window, and round window. Various studies conclude that the information gained from CT regarding the condition of the mastoid and middle ear can influence both the type of surgical method used and the success rate by reducing the risk of complications and recurrence of disease. In many studies, the methodology and interpretation of the CT scans are not very well presented. This unfortunately makes meta-analysis between studies impracticable as the number of uncontrolled variables is too many. In the future, we hope that more information is provided as to the method of interpretation as well as the type of CTscanner and dosage.[4]This will allow for a more meaningful result when comparing sensitivities and specificities towards middle ear pathologies. Many otolaryngologists make a routine use of pre-operative CT imaging in cases of chronic otitis media while others are more selective. In order to reach a consensus, however, more research needs to be focused on the specific decision-making criteria of surgeons.

Material and methods:

The present study carried out in the department of otorhinolaryngology, Kamineni academy of medical sciences and research centre Hyderabad during the period of january 2018 to december 2019. which correlates the preoperative HRCT imaging findings to those found intra-operatively in the patients who underwent mastoidectomy . Institutional ethics committee approval was taken for this study.

In this study it was found that majority of the patients (41.17%) were aged between 21-30 years. 29.41% of the study population aged between 31-40 years. 14.70% were between 11-20 years. 8.82% were between41-50 years and 2.94% were between 0-10 years and 51-60 years. In this study the mean age was 30.02 years; the youngest patient being 10 years and the eldest being 60 years.

Results:

Table 1 : Pre-operative pneumatisation of the mastoids compared to intra-operative findings

PNEUMATIZATION	CT	IO	FALSE +VE	FALSE -VE	SENSITIVITY	SPECIFICITY
WELL PNEUMATIZED	18	18	0	0	100	100
SCLEROTIC	15	15	0	0	100	100
DIPLOEIC	1	1	0	0	100	100

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In the present study, mastoid was found to be well pneumatised in 52.94%, sclerotic in 44.11% and diploic in 2.94% on pre-operative CT imaging as well as intra-operatively. Hence, pre-operative CT imaging of the mastoids is 100% sensitive and specific to know the type of mastoid pneumatisation pre-operatively.

Table 2 : Scutum and ossicular erosion

STRUCTURE	CT	IO	FALSE +VE	FALSE -VE	SENSITIVITY	SPECIFICITY	PPV	NPV
SCUTUM	3	4	0	1	75	100	100	96.77
MALLEUS	7	10	1	4	60	100	100	85.19
INCUS	10	12	0	2	83.33	100	100	91.67
STAPES	1	4	0	3	25	100	100	90.91

In the present study, scutum erosion was detected pre-operatively in 8.82% of the cases on CT and in 11.76% intra-operatively, with 1 false negative. Hence, CT was 75% sensitive, 100% specific in diagnosing scutum erosion pre-operatively, with a positive predictive value of 100% and a negative predictive value of 96.77%.

In this study, malleus, incus and stapes were found to be eroded in 20.58%, 29.41% and 2.94% respectively on pre-operative CT and 29.41%, 35.29% and 11.76% respectively intra-operatively.

In case of malleus, there were 4 false negatives and 1 false positive with a sensitivity of 83.33% and specificity of 100% and a PPV and NPV of 100% and 85.19% respectively. In case of incus, there were 2 cases of false negatives with no false positives giving a sensitivity of 83.33%, specificity of 100% and a PPV and NPV of 100% and 91.67% respectively.

Whereas in stapes, there were 3 false negatives and 0 false positives, giving a sensitivity of 25%, specificity of 100%, a PPV of 100% and an NPV of 90.91%.

Discussion:

In this study, low lying dura was encountered in 8.82% cases intra-operatively, but none of them were detected on pre-operative CT. Hence, with 3 false positives, the sensitivity of CT for low lying dura was 0%, specificity was 100%, with no significant PPV and 91.14% NPV. None of the cases were detected with anterior lying sigmoid sinus on CT but 5.88% of the cases turned out to have the same.

In the present cross-sectional study involving 34 patients, mastoid was found well-pneumatised in 52.94%, sclerotic in 44.11% and diploic in 2.94%, on pre-operative CT imaging as well as intraoperatively. Hence the CT was 100% sensitive and 100% specific in assessing the mastoid pneumatisation pre-operatively. Similar results were reported by Jackler et al (1984)[5], Vlastarakos et al (2011)[6], who also found a strong radiosurgical correlation in case of mastoid air cell complex.

In the present study, one case previously underwent cortical mastoidectomy and the pre-operative CT correctly detected the operative defect in that particular case.In the present study, scutum erosion was observed in 11.76% of the cases, which is less than 86% as observed by Gaurano et al (2004)[43] and 62.9% as observed by Chintan Shah et al (2014)[44] in their respective studies. In this study HRCT detected scutum erosion with a sensitivity of 75% and a specificity of 100% suggesting moderate correlation of pre-operative CT imaging pertaining scutum erosion.

This observation is in accordance to the study done by Vlastarakos et al (2011)[6], but differs with that observed by Rocher P et al (1995)[7], who observed it to be 100% sensitive and 100% specific. Rogha M et al (2014)[8] observed 96.4% sensitive and 87.5% specific in their study. The PPV of 100% as observed in this study however correlates well with that of Rogha M et al (2014)[46], which is 96.42%. In this study, malleus erosion was reported on pre-operative CT in 20.5% of the cases. Its incidence is less than what was reported by Chintan Shah et al (2014)[9] as 45.7%. The sensitivity of CT for malleus erosion in this study was observed as 60% which is in close accordance to that observed by Vlastarakos et al (2010)[6] in their study and moderately differing to the observation made by Chintan Shah et al (2014)[44] and Rogha M et al (2014)[8].

A retrospective comparative study by Banerjee et al (2003)[11] focussed on whether pre-operative CT findings influence management. Banerjee et al (2003)[11] focused on dural height amongst other parameters like dural exposure, semicircular canal erosion, ossicle integrity and facial nerve canal dehiscence. Unfortunately, sensitivities and specificities cannot be determined in that study due to true positives and true negatives being grouped together. In the study done by Banerjee et al (2003)[11], they observed that 26 cases showed correlation and 13 cases did not correlate with the pre-operative CT with intra-operative findings. Anterior lying sigmoid sinus was not reported on pre-operative CT in any of the cases, but was observed intra-operatively in 5.88% of the cases, yielding 2 false negative interpretations. The specificity of 100% as observed in this study is in accordance to that observed by Chee NW et al (2001)[12]. The NPV in this study was observed as 94.12% in this study.

Conclusion:

The major role of CT scans in the context of COM is to provide more information regarding the condition of the middle ear and its structures as well as the extent of the disease. CT scans provide a reasonably good information to the otologists, that is valuable as it influences the surgical planning and improves the outlook of the treatment.

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