



COMPARATIVE EVALUATION OF EUSTACHIAN TUBE ANGLE ON HRCT TEMPORAL BONE IN PATIENTS OF CHRONIC OTITIS MEDIA AND IN SUBJECTS WITH NO MIDDLE EAR PATHOLOGY

Radiodiagnosis

Dr. Manasvini Pandey*

3rd year Post Graduate student, Department of Radiodiagnosis, Government Medical College & Dr. Susheela Tiwari Memorial Hospital, Haldwani, Uttarakhand.
*Corresponding Author

Dr. Pankaj Mahesh

Professor and Head of Department, Department of Radiodiagnosis, Government Medical College & Dr. Susheela Tiwari Memorial Hospital, Haldwani, Uttarakhand

Dr. Bhawana Pant

Associate Professor, Department of ENT, Government Doon Medical College, Dehradun, Uttarakhand

ABSTRACT

AIM: To compare the angle of Eustachian tube in patients of chronic otitis media and in subjects with no middle ear disease using HRCT temporal bone

MATERIALS AND METHODS: This is a descriptive, analytical cross-sectional study which was conducted on adult patients between 18-50 years of age attending the ENT OPD and diagnosed with COM subjected to HRCT Temporal bone. Study participants were recruited based on already set inclusion and exclusion criteria. All patients were divided into two groups i.e. 40 patients of COM and 40 patients with healthy middle ear. The horizontal plane, crossing bilateral inferior orbital wall and the bilateral upper wall of the external ear canal known as "Reid plane" was selected. The Reid plane-ET angle was measured in both groups of patients on HRCT of the Temporal bone using multiplanar reconstruction with a slice thickness of 1 mm.

RESULT: Out of the total 80 subjects, 40 subjects had chronic otitis media and 40 subjects had normal ears that underwent examination of temporal bone for another reason. The angle of Eustachian tube in COM patients showed a mean value of 25.59° (SD=2.33) and in subjects with normal ears showed a mean of 27.98° (SD=2.80).

CONCLUSION: High Resolution Computed Tomography of Temporal bone with multiplanar reconstruction is a non invasive, reliable and easy investigation to assess the Eustachian tube-Reid plane angle. Although chronic otitis media is a multifactorial disorder, the decrease in Reid plane-ET angle in adults may play a significant role in its etiology.

KEYWORDS

High resolution computed tomography, Reid plane, Eustachian tube

INTRODUCTION:

Chronic otitis media (COM) is characterized by hearing loss, chronic inflammation of the middle ear and mastoid air cells. Although it is a common problem throughout the world, the etiology of COM is still not clear. According to the genetic theory of the temporal bone pneumatization, it is the genetically determined and bad pneumatized ears that are candidates for COM.^[1] The environmental theory supporters claim that environmental factors such as frequent upper respiratory tract infections, poor living conditions and smoking causes chronic otitis and reduce temporal air pneumatization.^[2,3] Another theory says that there may be associated variations in the craniofacial anatomy of middle ear disease.^[4,5] These middle ear atelectasis, lower mastoid pneumatization studies, cholesteatoma and effusion has been shown to be associated with COM.^[6-8]

Earlier studies showed that the Eustachian tubes were shorter and more horizontally located in children than in adults.^[10] The more horizontal angle of the Eustachian tube, the more it may cause otitis media in children.^[11] ET angle give the idea about the direction and placement of the tube. Reid horizontal plane was found in 1962 by the world federation of radiology, bilateral inferior orbital wall and superior walls of the bilateral external ear canal.^[12,13] This study aims to summarize the use of imaging in the anatomical assessment of ET angle.

AIM:

To compare the angle of Eustachian tube in patients of chronic otitis media and in subjects with no middle ear disease using HRCT temporal bone.

OBJECTIVES:

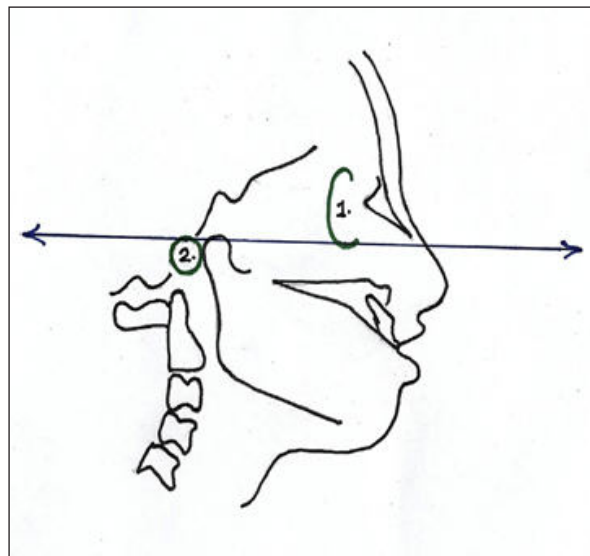
To measure the Eustachian tube angle in patients of chronic otitis media and in normal subjects.

To compare the difference in the angle of Eustachian tube between the two above mentioned groups.

Material And Methods:

This is a descriptive, analytical cross-sectional study which was conducted on adult patients between 18-50 years of age attending the ENT OPD and diagnosed with COM subjected to HRCT Temporal

bone. All patients were divided into two groups i.e. 40 patients of COM and 40 patients with healthy middle ear. The CT system used in the study was Siemens Somatom 16 Slice MDCT Scanner. The position of the patient was supine with head in the midline i.e. neutral position. The horizontal plane, crossing bilateral inferior orbital wall and the bilateral upper wall of the external ear canal known as "Reid plane" was selected.



Labels: 1- Orbit, 2- External auditory canal.

Figure 1: Pictorial Representation Of Reid's Plane

The orifices of Eustachian tube i.e. pharyngeal and tympanic orifices were seen in the same section by using multiplanar reconstruction technique in the coronal images. The line joining the two orifices determines the direction of the Eustachian tube. The angle was measured between the Reid plane and this line. The collected data was analyzed statistically using two tailed paired t-test and p value was studied accordingly.

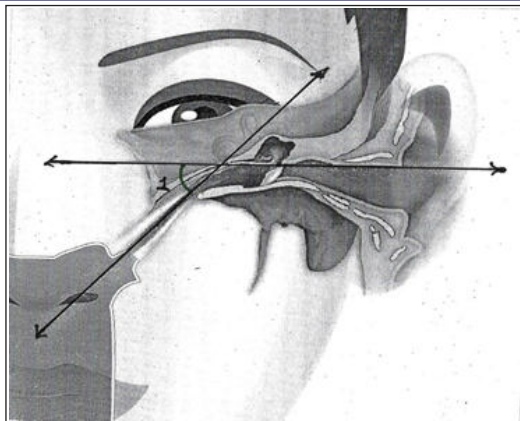


Figure 2: Pictorial Representation Of Reid's Plane-et Angle

Inclusion Criteria

All adult patients within 18-50 years of age group attending ENT OPD, diagnosed with Chronic Otitis Media and visiting the Department Of Radiodiagnosis for HRCT temporal bone

Exclusion Criteria

- Paediatric patients.
- Patients with past history of ear surgery.
- Patients with malignancy of external auditory canal or middle ear.

Results:

In this study, 40 patients with COM and 40 subjects without any middle ear pathology were recruited according to the set inclusion and exclusion criteria. The age range of patients was from 18 to 50 years. The mean age of patients was 35.4 years (range from 18 to 50 years). The maximum number of patients was noted in the age group of 36-45 years i.e. (16 cases; 40%).

The study included 21 adult male patients and 19 adult female patients of COM.

Measurement Of Eustachian Tube-reid's Plane Angle

The angle of Eustachian tube with Reid's horizontal plane was measured in HRCT temporal bone using multiplanar reconstruction. All the patients were divided into two groups i.e. Group A (diseased ears) and Group B (healthy ears).

Table 1: Showing Mean Value And Standard Deviation Of Et-reid's Plane Angle In The Groups A And B.

	GROUP A (COM)	GROUP B (HEALTHY EAR)
MEAN	25.59	27.98
STANDARD DEVIATION	2.33	2.80

Statistical Analysis

Comparison Of Et-reid's Plane Angle Between The Groups A And B.

The statistical analysis using two tailed paired t-test showed that there was a significant mean difference in the angle of Eustachian tube among the two groups (p value = 0.00023)[Table II]. P value < 0.05 was considered to be statistically significant.

Table 2: Statistical Comparison Of Et-reid's Plane Angle In The Groups A And B.

Group	Case no.	Reid plane-ET angle
Group A(COM)	40	25.59±2.33
Group B(Healthy ear)	40	27.98±2.80
Two tailed P value	0.00023 (<0.05)	
t value with 95° CI	4.05	
Degree of Freedom/Standard error of difference	39	

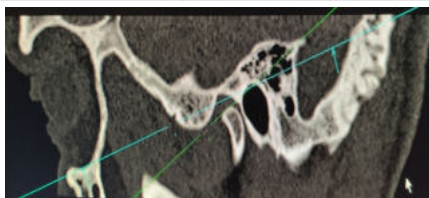


Figure 3: Sagittal Section In Hrct Temporal Bone Obtained By

Mpr Reconstruction Showing Reid's Horizontal Plane

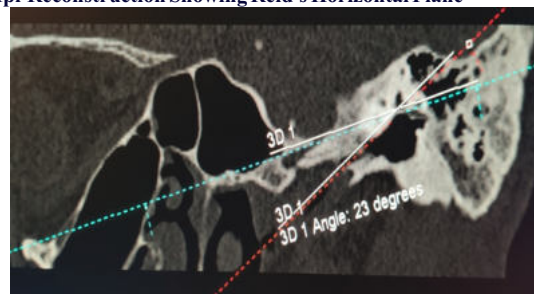


Figure 4: Coronal Section In Hrct Temporal Bone Obtained By Mpr Reconstruction Showing Reid Plane-et Angle

DISCUSSION:

The anatomical position of Eustachian tube (ET) has role in development of COM and cholesteatoma. The more horizontal and short Eustachian tube causes an increased risk of reflux of pathogenic organisms from the nasopharynx to the middle ear which is thought to facilitate the occurrence of acute and chronic otitis media.^[15-18]

Eustachian tube is a structure which is complex and inaccessible to study. Presently, with advances in imaging methods like HRCT temporal bone with high resolution capabilities, it can be accessed.^[21,23]

In our study the standard horizontal plane i.e. Reid's plane and Eustachian tube angle measurement was done using multiplanar reconstruction (MPR) techniques. **Takasaki et al., Aksoy et al., Babu et al., S Masita et al., S.V. Nemade et al. and Nasution et al.** also used Reid's plane in HRCT temporal bone with MPR for measurement of Eustachian tube angle.^[14,19,20,23]

In our study, the mean Reid plane-ET angle came as **27.98 ± 2.80 in healthy ears** and **25.59 ± 2.33 in diseased ears**. Here, the angle in normal individuals was seen to be close to the angle measured by **Takasaki et al.** They detected the ET angles in Reid plane 27.3 ± 2.0 for the right ear, 27.3 ± 2.8 for the left ear in the normal adult population.

CONCLUSION:

COM is still a common problem throughout the world. We came to the conclusion that there was a correlation between COM and the angle between eustachian tube and Reid's horizontal plane ($P = 0.00023$). The above mentioned angle was found to be lower in patients of COM as compared to ears with healthy middle ear compartments.

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