

AGE, EUSTACHIAN TUBE FUNCTION AND INCIDENCE OF CONDUCTIVE HEARING LOSS

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The anatomy and physiology of the pharyngo-tympanic tube (Eustachian tube) was given out by Eustachius. In his literature on the pharyngo-tympanic tube, he emphasized the importance of this tube in the middle ear functioning. Today the importance of this tube in the middle ear ventilation and also in the process of hearing has been accepted. It is the general opinion of the present day clinicians that malfunctioning of the eustachian tube may result in:

1. Acute or Chronic Otitis Media
2. Secretory Otitis Media.

Holborow (1970) indicates important anatomical and functional differences of the eustachian tube in children and adults. He further reports that the anatomical differences in the shape and position of the tube lead to a less efficient mechanism in infancy and early childhood. Hence, he emphasizes the concept of a critical age for the incidence of aural disease which is chiefly caused by eustachian tubal malfunction. According to Holborow (1970) this critical period of tubal inefficiency is relatively short and extends from birth to about seven years of age. Therefore, the purpose of the present investigation is to test hypotheses: i.e.,

- (1) The incidence of Conductive hearing loss and Sensorineural hearing loss do not differ from each other in the 3-9 years age group.
- (2) The incidence of Conductive hearing loss and mixed hearing loss do not differ from each other in the 3-9 years age group.
- (3) The incidence of Sensorineural hearing loss and mixed hearing loss do not differ from each other in the 9-15 years age group.
- (4) The incidence of Conductive hearing loss and Sensorineural hearing loss do not differ from each other in the 9-15 years age group.
- (5) The incidence of Conductive hearing loss and mixed hearing loss do not differ from each other in the 9-15 years age group.

Methodology

Subjects: The sample of the present investigation consisted of two groups, A and B. The two groups were formed by taking age as the criterion. The group A consisted of thirty (30) subjects and the ages of the subjects were between three (3) to nine (9) years. The mean age of this group was five (5) years. Similarly, even the group B consisted of thirty (30) subjects but the subjects

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were aged between nine (9) and fifteen (15) years. The mean age of this group was fourteen (14) years. Both the groups had approximately equal number of males and females. All the subjects tested were patients who came to the Otorhinolaryngology department with the complaint of difficulty in hearing.

Procedure

A case history was taken prior to all the examinations. The case history consisted of information on the family history, developmental history and medical history. Later, all the subjects were examined for otorhinolaryngological problems. Findings were recorded on a sheet. In this examination the conventional tuning fork tests like Rinne's, Weber's tests were administered and the results were recorded.

Later, all the subjects were given a detailed audiological examination. Usually the audiological examination started with the administration of pure-tone air and bone conduction tests. Wide band masking noise was used appropriately (Studebaker, 1967) whenever indicated. Depending on the extent of the air-bone gap, the hearing loss was classified either as Conductive, Sensori-neural or Mixed. However, Speech audiometric data could not be obtained due to lack of necessary equipment during the time of the study. Under conditions where it was essential, Short Increment Sensitivity Index Test (SISI Test), Tone Decay Test (TDT) and Alternate Binaural Loudness Balance Test (ABLB) were administered. With the help of audiological examination and the ENT examination, diagnosis was made.

The audiologic evaluations were made by one of the authors, employing the same test methods with all the cases irrespective of age and sex.

Results and Discussion

The sample, tested in the present investigation consisted of two groups A and B and each group consisted of thirty (30) subjects. Majority of the subjects tested were school going children. However, no attempt was made in the present investigation to control the socio-economic status of the subjects. This may be a significant variable which has to be controlled.

Reliability of the scores was established through test-retest procedure. From the original sample of sixty (60) subjects, ten (10) subjects from each group were selected at random. However, only the audiological evaluation was repeated on these selected subjects. The Product Moment Correlations were determined to establish the reliability. The correlation coefficients obtained between the scores of the two testings were 0.71 and 0.63 for the groups A and B, respectively. The obtained correlation coefficients were significant at .05 level of confidence.

Table 1, gives the pure-tone audiometric average in both the groups. Table 2, gives the incidence of conductive hearing loss, Sensori-neural hearing loss and mixed hearing loss in both the groups. Table 3, gives the incidence of the three types of hearing losses of both the groups in percentage.

The chi Square test was used to test all the six (6) Null Hypotheses. The obtained table value and chi square values are given in the table 4.

TABLE 1
Pure-tone average scores in both the groups

Group	Age Group Year	Mean age Year	Mean PTA Rt	Mean PTA Lt
A	3- 9	5	54 dB	50 dB
B	9-15	14	63 dB	55 dB

TABLE 2
Incidence of Conductive hearing loss, Sensori-Neural hearing loss and Mixed hearing loss in both the groups

Group	No. of conductive loss	No. of Sensori-neural loss	No. of mixed loss
A	18	3	9
B	16	7	13

TABLE 3
Incidence of Conductive hearing loss, Sensori-Neural hearing lost and Mixed hearing loss expressed in percentage

Groups	Percentage of conductive loss	Percentage of sensori-Neural loss	Percentage of mixed loss
A	60	10	30
B	33.33	23.31	43.33

TABLE 4
X' Values and the respective table values

Hypothesis	X' Value	Table value at 0.01 level	Table value at 0.05 level	df
1	10.70	6.635	3.841	1
2	3.00	6.635	3.841	1
3	3.00	6.635	3.841	
4	0.54	6.635	3.841	
5	0.38	6.635	3.841	
6	1.80	6.635	3.841	

The first null hypothesis, i.e., the incidence of conductive hearing loss and sensori-neural hearing loss do not differ in the 3-9 years age group, was rejected in favour of the alternative hypothesis. The alternative hypothesis which was confirmed was that the incidence of conductive hearing loss is significantly greater than the incidence of sensori-neural hearing loss in the 3-9 years age group. However, there was not statistically significant difference in the incidence of sensori-neural and mixed hearing losses and also between the conductive hearing loss and the mixed hearing loss in the 3-9 years age group. From these results obtained in the present investigation it may be said that the incidence of middle ear involvement is significantly greater than the involvement of inner ear alone in children aged between three (3) to nine (9) years.

This finding of the present investigation is in accordance with the speculations of Holborow (1970), who emphasized that it is the conductive hearing loss which is predominant than the other types of hearing losses in the children aged between 0-7 years. This greater of conductive hearing loss at this age has been attributed to eustachian tube malfunctioning. It is cited that there will be clear differences between the adult and the child in the anatomy of eustachian tube. The ostium of the tube is more exposed as it lies lower in the shallower nasopharyngeal vault, but more important are differences in the cartilage and muscle. In adults the tubal cartilage lies at right angles to the plane of the base of the skull. But in children it lies more in the plane. Further there is a very considerable change in the amount of glandular tissue around the tube. This decreases with the age. Hence in infancy and in early childhood the mechanism of the tubal opening is less efficient. It may be because of this inefficiency there will be eustachian tube malfunctioning in infancy and in early childhood. And, this in turn may be the chief operating cause for the greater incidence of the conductive hearing loss than the other types of hearing losses in the 3-9 years age group.

The second consideration of the present investigation was to test the similar null hypotheses in the Group B. Here again the chi-square test was used to test the-statistical significance of the difference in the incidence of conductive hearing loss, sensori-neural hearing loss and mixed hearing loss in the 9-15 years age group. The obtained X^2 values are given in the Table 4.

In the Group B, all the three null hypotheses (4th, 5th and 6th) were confirmed at both the levels of confidence (0.01 and 0.05). This indicated that there is no difference in the incidence of conductive hearing loss, sensori-neural hearing loss and mixed hearing loss in the 9-15 years age group.

Similar to the first finding even this finding of the present investigation is in accordance with the speculations of Holborow (1970). Holborow (1970) said that the period of tubal inefficiency is relatively short and extends from birth to about 7 years of age. Then, probably almost equal incidence of all the three types of hearing losses in the Group B indicates that the incidence of tubal inefficiency decreases significantly after 9 years. On the other hand, greater incidence of conductive hearing loss in the Group A indicates that probably the incidence of tubal inefficiency is greater between the third and the ninth year.

With the findings of the present study in hand it may be tentatively concluded that as emphasized by Holborow (1970), there appears to be a definite relation between age, eustachian tube function and the incidence of conductive hearing loss. It is highly probable that in infancy and in early childhood period there is eustachian tube malfunctioning and consequent to this there is greater incidence of conductive hearing loss. Further, the incidence of conductive hearing loss decreases after 9 years because of decrease in the incidence of eustachian tube malfunctioning.

Summary

Thirty subjects in the age group 3-9 years and thirty subjects in the age group 9-15 years were put on an audiological examination. Results indicated that the incidence of conductive hearing loss was high in the former group and in the later group there was no difference in the incidences of conductive hearing loss sensori-neural hearing loss and mixed hearing loss. It is concluded that because of the malfunctioning of the eustachian tube during early childhood the incidence of conductive hearing loss is high.

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