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# EVALUATION OF MUCOCILLIARY FUNCTION OF EUSTACHIAN TUBE IN CHILDREN WITH CHRONIC OTITIS MEDIA MUCOSAL TYPE

#### Objective:

To assess eustachian tube mucocilliary function in children with chronic otitis media mucosal type.

#### Material and methods:

It is a prospective comparative analytical study carried out in Ganesh Man Singh Memorial (GMSM) Academy of ENT and Head and Neck Studies, Kathmandu over duration of 19 months. Patients of COM mucosal with 3 to 12 years of age and both gender were taken. Revision cases, conditions with obvious eustachian tube dysfunction and caretaker of children not giving consent for eustachian tube evaluation were excluded. Dye used was 0.25% Gentian Violet and flexible nasopharyngoscopy was done to see if eustachian tube opening was stained with dye. Eustachian tube was labelled as patent if staining was there otherwise labelled as obstructed.

#### Results:

Thirty eight patients were included in study, out of which 19 (50%) had patent tube. Out of 8 cases in  $\leq 7$  years age group, 6 (75%) had obstructed eustachian tube. In  $\geq 8$  years age group, 13 (43.33%) had obstructed eustachian tube.

#### Conclusion:

Mucociliary function of eustachian tube evaluation by dye method in COM mucosal type in children shows equal proportion of patency and obstruction.

**Keywords:** eustachian tube, dye test, mucocilliary function

## INTRODUCTION:

Chronic otitis media –mucosal, inactive has been defined by Browning<sup>1</sup> in 1997 as a clinical condition where there is permanent defect of pars tensa with no current evidence of inflammation either of the middle ear mucosa or tympanic membrane. Prevalence of chronic otitis media mucosal type in Nepal and neighbouring countries has been found to be high. It is 7.6%<sup>2</sup> to 13.2%<sup>3</sup> in Nepal which is comparable to results of study done in neighbouring countries like Bangladesh and India.<sup>4, 5</sup>

According to WHO/CIBA workshop<sup>6</sup> of otitis media experts in 1996 COM is a public health problem in Nepal. Many authors have proposed eustachian tube as a factor playing important role in pathogenesis of COM-mucosal and hence in outcome of myringoplasty. Eustachian tube is developmentally an outgrowth of the pharynx. This dynamic conduit between nasopharynx and middle ear normally reaches its adult size by age of seven years.<sup>7,8</sup> The eustachian tube being short and horizontal in children may be causing easier access of bacteria from nasopharynx leading to higher incidence of COM in children.<sup>9</sup> There is higher incidence of COM in children with Cleft palate and Down's syndrome<sup>10</sup> which are known to have eustachian tube dysfunction as well.

Though eustachian tube has always been a centre of interest in COM, there is no universal and comprehensive methodology to evaluate it preoperatively and postoperatively. Various methods have been described in different times. Some methods test anatomical aspects like patency while others evaluate functional aspect. In earlier days testing was done by non physiological methods like Valsalva and Toynbee. Ventilation function assessment by pressure equalization using impedance audiometry has been widely used. For last two decades it is thought that only mucociliary clearance function assessment has prognostic significance in myringoplasty.<sup>11,12</sup> Evaluation of mucociliary function is more frequently done nowadays. e.g.: dye clearance, saccharine test, contrast radiography, radioisotope scanning.<sup>13-18</sup> Foreign material introduced into the normal middle ear is promptly evacuated through the eustachian tube into the nasopharynx.<sup>19,20</sup> Tubal mucociliary transports is important for elimination of the inflammation products from the middle ear enabling recovery of the affected mucosa of the middle ear, local circulation and restoration of normal air pressure in the middle ear.<sup>21</sup> Adequate clearance of middle ear hastens healing of the mucosal epithelium;

poor drainage yields poor results.<sup>22,23</sup> Assessment of eustachian tube in children is more relevant as the obstruction of the tube is more common in this age group. Though eustachian tube function is taken as important aspect it is neglected due to difficulty in evaluation. Assessment by instilling of otic drops and asking the child to taste was also used. Though it seems quick and simple; but the child must be mature enough to reliably report the taste of an eardrop.<sup>24</sup> Reliably assessing eustachian tube function requires a method that doesn't depend on child's ability to perform a task.<sup>25</sup> So far there has been no study where mucociliary function is exclusively tested in children. The objective of this study is to assess eustachian tube patency preoperatively in children undergoing myringoplasty under general anaesthesia.

## MATERIALS AND METHODS:

It is a prospective comparative analytical study done in Ganesh Man Singh Memorial Academy (GMSMA) of ENT and Head and Neck Studies, Kathmandu, Nepal. Study was started after obtaining ethical clearance from Institutional Review Board. The study was conducted for a period of nineteen months starting from 15th Nov 2007 to 15th June 2009. Children below or equal to 12 years of both genders having COM mucosal inactive disease were taken. Exclusion criteria were condition with obvious eustachian tube dysfunction e.g.-cleft palate, nasopharyngeal mass, chronic or acute rhinosinusitis and patient or caretaker not willing to undergo eustachian tube test.

Child and caretaker were explained about the procedure to be done. After counselling, verbal consent was taken. Nasal pack made by soaking cotton in 4 % lignocaine and 0.025% oxymetazoline hydrochloride nasal solution was inserted into ipsilateral nasal cavity. Child was then asked to lie in bed of treatment room in supine position. Half millilitres of 0.25% sterile Gentian Violet (GV) was drawn in a 3 or 5ml disposable syringe. Intravenous cannula 18 G was applied over the syringe. Under microscope the tip of cannula was inserted into middle ear cavity via the perforation and the dye (Gentian Violet) was instilled. Time of instillation was recorded. Then child was made to lie in lateral position with testing ear uppermost for 16 minutes.

After 16 minutes child was made to sit and nasal pack was removed with nasal forceps. Staining of pack with GV was noted. If there was no staining then using tongue depressor oropharynx of child was examined for dye staining. If still no staining noted then flexible

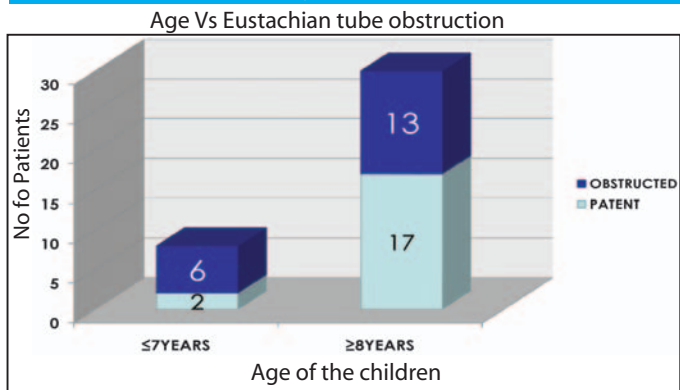
nasopharyngoscopy was done in ipsilateral side for GV staining at or near eustachian tube opening. If still there was no staining it was labelled as obstructed.

**RESULTS:**

There were altogether 43 patients who fulfilled the enrolment criteria. But 5 cases had upper respiratory tract infection and were excluded; hence 38 cases were included in the study. Out of 38 cases there were 20 females and 18 males. The age of patients ranged from 4 years to 12 years. Most common age in this study was 12 years (26.3%). Out of 10 patients of 12 years age 6 were females and 4 were males. Out of total ear that underwent eustachian tube test, 21 were of right side and 17 were of left side. There were equal number of patients with obstructed eustachian tube and patent tube i.e. 19 in each. Out of 19 patent cases, fourteen cases had dye seen only after nasopharyngoscopy, five had pharynx stained with GV and none had stain in nasal pack. There were 8 cases with age 7 years and below and 30 were more than 7 years as shown in Fig-1. Out of 8 cases in  $\leq 7$  years age group, 6 (75%) had obstructed eustachian tube. In  $\geq 8$  years age group only 13(43.33%) had obstructed eustachian tube.

From table 1, we can correlate age groups and eustachian tube patency which after application of Z test for mean, p value was computed to be more than 0.05. Hence though patent tube was found in higher age group this is not statistically significant. Contralateral ear was taken as diseased if there was history of middle ear surgery in other ear, or during evaluation there were signs of COM. As shown in Fig-2 in diseased contralateral ear there was 16/29 (55.1%) obstructed

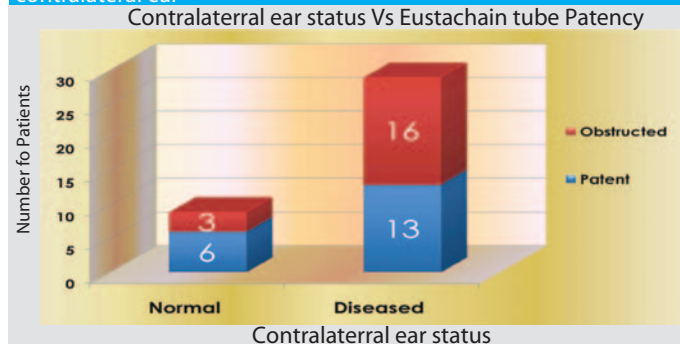
**Fig. 1. Eustachian tube patency in different age groups.**



**Table :1. Correlation of eustachian tube status and age**

ET status	Total Number (n=38)	Age in years		Z test of Mean	Tabulated value for p <0.05	Significance
		Mean	S.D			
Obstructed	19	9.36	2.69	0.67	1.96	Not significant (p>0.05)
Patent	19	9.84	1.57			

**Fig. 2. Eustachian tube patency in relation to normal or diseased contralateral ear**



eustachian tube while this value in normal contralateral ear was 3/9(33.3%).

**DISCUSSION:**

Several methods have been described to assess tubal function, but most of the methods used are complicated, time consuming and need elaborate instrumentation. The simpler methods, which are available, are non-physiological and more or less quantitative, indicating anatomical patency of the tube, which does not necessarily mean normal function.<sup>26</sup>

We used 4% lidocaine in nasal pack so that if nasopharyngoscopy need to be done there won't be much discomfort to the child. Both lidocaine and preservative methylparaben cause ciliostasis,<sup>27</sup> but the effect should not be significant as we made the child to lie down in lateral position with testing ear uppermost. Hence any amount of drug reaching the nasopharynx would find its way to opposite eustachian tube end which was not tested. As we are not testing both ears of the child in same setting, this effect should not be of paramount importance. Besides 0.025% oxymetazoline has no effect in human nasal ciliary beating frequency (CBF).<sup>27,28</sup>

Method of testing eustachian tube used in this study has been taken from Sen et al study (1999)<sup>23</sup> and Raychowdhury study<sup>29</sup> (2000) with some modifications. In our study use of tragal pressure if dye was not seen at nasopharyngeal end has not been done because use of such pressure is not physiological and doesn't occur in natural circumstances. In their study it has been done in both active and inactive COM mucosal but we have taken only inactive cases. This eliminates any obstruction secondary to mucosal edema, granulations or inspissated mucus.

Other dyes used in eustachian tube evaluation are Methylene blue<sup>15</sup>, Indigo<sup>13</sup>, 4% Fluorescein sodium.<sup>16</sup> Gentian Violet has been used in this study because it has been used in other previous studies.<sup>23, 29</sup> It is generally considered safe for use on children and breastfeeding mothers and its property of staining the tissue makes easy detection of presence of dye in nasopharynx. It is used as a medication in middle ear as antifungal and also in granulation tissue. The dose used here(0.25%) is less than reported therapeutically(1-2%) hence side effect of the dye is minimal.

Time allowed for dye to reach nasopharynx before labelling "obstructed" in different studies ranges from 10-30 mins<sup>13,15,16,23</sup>. Allowance of longer time however has possibility of getting more false positive result where rather than mucociliary function, the gravity plays role. This is evident if we compared those studies. Obstruction rate is only 5.12% in Takahashi et al<sup>13</sup> study where 30 minutes have been used as compared to 32% in Sethi et al<sup>16</sup> study where 10 minutes have been used. Before inserting endoscope we looked for dye stain in pharynx and nasal pack so that unnecessary insertion of endoscope in child could be avoided. In our study to our surprise exact number of children had obstructed eustachian tube (50%) and patent tube. This could be due to small sample size. It is in contrast to Sen et al study<sup>23</sup> where 9 out of 50 (18%) patients had obstructed tube. Roychowdhury et al<sup>29</sup> study also had similar result i.e 7/30 (23.3%). Though methodology was similar with same dye used in all these cases, our study was only done in <12years children in which eustachian tube dysfunction is expected more than in adults. Obstructed tube was found in 22.1% in Prasad et al<sup>15</sup> study and 32% in Sethi et al<sup>16</sup> study both of which were performed in adults. Their result is also less than that of ours probably due to same cause.

Evaluation done by test other than dye test however shows high proportion of obstructed eustachian tube.. Yuceturk et al<sup>22</sup> in 1997 observed eustachian dysfunction in 71.7% of the CSOM group and it was only seen in 34.9% of the control group using pressure equalization test and toynbee test.

In our study in less than or equal to 7 years child ,75% had obstructed eustachian tube which is much higher than that of  $\geq 8$  years child. But this difference is not statistically significant(p>0.05). This discrepancy can be due to smaller sample size in  $\leq 7$  years group(n=8). Similarly, mean age in patent eustachian group is marginally more than that in obstructed group but the result is not significant.

**CONCLUSION:**

Mucociliary function of eustachian tube evaluation by dye method in COM mucosal type in children shows equal proportion of patency and obstruction. When compared to other studies with similar methodology this proportion of obstruction is more in children than adult. But to establish its predictive value and develop as a routine preoperative eustachian tube evaluation method, further prospective studies preferably with control should be carried out.

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