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Original Article

Ear, Nose & Throat Section

The Incidence of Secretory Otitis Media in Cases of Cleft Palate

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ABSTRACT

Objective: Children with a Cleft Palate (CLP) and with or without cleft lips (non-syndromic) universally present with Secretory Otitis Media (SOM). The purpose of this study was to determine the incidence of secretory otitis media that occurs in patients with cleft palates and to confirm the existence of these manifestations by doing a Basic Audiologic Evaluation (BAE).

Material and Methods: A retrospective study was done on forty four male and female children who were within the 2 to 14 years age range, with non-syndromic cleft palates with or without cleft lips, with the symptoms of SOM. Otoscopy examinations were done in all the cases. X-rays of the mastoids (both sides) were done in all the cases to detect the pneumatization of the mastoid air cell system. The Basic Audiologic Evaluation (BAE) includes an evaluation by tympanometry of the middle ear function and an evaluation by pure tone audiometry to establish the type of hearing loss.

Results: A majority of the patients (47.27%) were in the age group of eight-to-fourteen (8-14) years. The Basic Audiologic Evaluation (BAE) revealed that 77.27% of the children had presented with normal hearing; 13.6% had conductive hearing loss and 2.2% had presented with a mixed hearing loss. We noticed that 68.2% of the children had type A curves; 21.2% of the children had type C tympanometry curves; 7.1% had type B curves and 3.5% had Ad curves. The contralateral acoustic reflex was present in 54.5% of the children and 45.5% did not have this reflex. A majority of the patients (46%) showed sclerotic changes in their mastoid air cell systems in the X-rays of the mastoids.

Conclusion: The significantly higher prevalence of SOM in the children with cleft was confirmed by the study. Also, the hearing loss which was associated with SOM was evident and it demonstrated that there was a high prevalence of a mild conductive hearing loss when SOM was present. The cleft palate contributed to the occurrence of the secretory otitis media and it required proper ENT and audiological follow ups.

Key words: Cleft palate, Secretory otitis media, Hearing loss

INTRODUCTION

Cleft palate (with or without cleft lip) occurs in about 1:750-1:2000 births in different societies in the world. The cleft palate individuals have a greater incidence of hearing loss than the general population. They are more likely to develop secretory otitis media (SOM). The association between cleft palate and SOM has been well documented since Alt described the presence of otorrhoea in a child with cleft palate in 1879 [1]. Paradise et al., deduced that the middle ear disease probably develops in all the cleft palate patients [2]. However, the more recent studies have confirmed this figure to be around 90% [3-5]. Due to the incomplete closure, i.e. the cleft of the palate, difficulties arise with the development of feeding, speech, language, dentition, facial structures, and hearing. Specifically, the development of the hearing is affected, as the children with cleft lip and palate and cleft palate universally present with Secretory Otitis Media (SOM) [6-11]. This is often present within the first 6 months of life [7,8,11]. The high prevalence of SOM in children with CLP is due to the Eustachian tube dysfunction. The muscles which are responsible for the opening of the Eustachian tube include the tensor veli palatini and the levator veli palatini [12], which exhibit an abnormal point of insertion in children with CLP, as the palate does not fuse during the foetal development [13]. This lateral point of insertion causes a lack of anchorage which does not allow a proper opening of the Eustachian tube. Therefore, the opening of the Eustachian tube is compromised and the middle ear cavity is not properly ventilated. This lack of ventilation leads to a negative pressure and this results in a retracted tympanic membrane and secretion of mucous from the tissues through osmosis into the middle ear cavity [14]. It may, however, also result from an acute otitis media [15]. Secretory otitis media can lead to a conductive hearing loss which can be persistent or recurrent and variable in degree, and it can affect one or both ears 16. Secretory otitis media is also common in children without CLP. It occurs most often in the first 2 years of life [16,17]. A majority of the current research on the prevalence of SOM in children with CLPs has been conducted retrospectively, with the data being collected through medical records and/or surveys [18,19]. Four studies have prospectively gathered data on children with CLPs and they have demonstrated a higher prevalence of SOM in children with CLPs by means of abnormal tympanometry or abnormal otomicroscopy [20,21]. The audiological assessment for the cleft palate patients is continuous until they are discharged from the care of the cleft and audiology team. It begins with the newborn screening programme and regular audiology appointments follow, so that any hearing loss can be treated responsively. The early detection of the hearing loss is possible through the Basic Auditory Evaluation tests (BAE), which pinpoints the degree and the type of hearing loss, and they also report on the integrity of the entire peripheral auditory system. The Basic Audiologic Evaluation (BAE) includes an evaluation by tympanometry of the middle ear function and an evaluation by pure tone audiometry to establish the type of hearing loss. This study was conducted to determine the incidence of the Secretory

Otitis Media (SOM) that occurs in patients with cleft palates and to confirm the existence of these manifestations with the use of the Basic Audiologic Evaluation (BAE).

MATERIAL AND METHODS

A retrospective study was carried out in the Department of ENT and Head and Neck Surgery, Sree Balaji Medical College and Hospital, Chromepet, Chennai for a period of one year from September 2011 to September 2012. We assessed 44 male and female children who were in the age range of 2 to 14 years, with non-syndromic cleft lips and palates and/or palate clefts. Otoscopy examinations were done in all the cases. The Basic Audiologic Evaluation (BAE) includes an evaluation by tympanometry of the middle ear function and an evaluation by pure tone audiometry to establish the type of hearing loss. The patients who were under five years of age were evaluated by tympanometry to assess the middle ear function and the patients who were more than five years of age were evaluated by tympanometry and pure tone audiometry to establish the type of hearing loss. X-ray of the mastoids (both sides) were done in all the cases to detect the pneumatization of the mastoid air cell system. All the patients who presented with cleft palates (with or without cleft lips) were included in the study. The ones with only cleft lips were excluded.

Pure Tone Audiometry (PTA) is the key hearing test which is used to identify the hearing threshold levels of an individual, which enables the determination of the degree, type and the configuration of the hearing loss. This provides the basis for the diagnosis and management of CLP. PTA is a subjective, behavioural measurement of the hearing threshold, as it relies on the patient response to pure tone stimuli. The audiogram is the chart on which the hearing ability is recorded and it shows the threshold hearing level (in dB HL) against the frequency (in Hz). Air Conduction (AC) testing is the testing of the hearing through headphones, where sound is delivered into the external auditory meatus and where it travels through the middle ear and inner ear before travelling along the auditory nerve to the brain. The air conduction results tell us essentially, at what levels a person can hear sounds in their environment. Bone Conduction (BC) testing is the testing of the hearing by bone vibration, which in effect allows the sound to bypass the middle ear and to travel straight to the inner ear before travelling up to the brain. This enables a clinician to determine whether a hearing loss is due to an abnormality in the middle ear, the inner ear or both.

Impedance audiometry includes both tympanometry and the stapedius reflex test. Tympanometry is an objective test of the middle-ear function. It is not a hearing test, but rather a measure of the energy transmission through the middle ear. Tympanometry is an examination which is used to test the condition of the middle ear and the mobility of the eardrum (tympanic membrane) and the conduction bones, by creating variations in the pressure in the ear canal. This test should not be used to assess the sensitivity of the hearing and the results of this test should always be viewed in conjunction with those of pure tone audiometry. Tympanometry evaluates the middle and outer ear systems, as well as the Eustachian tube. Acoustic impedance is considered to be a response to the acoustic immittance. Acoustic immittance refers to the measurement of the air pressure or energy flow in the eardrum, tensor tympani, ossicular chain, ear canal, cochlea, and the brainstem.

The mass, resistance, and the mobility of the middle as well as the outer ear systems influence the tympanometry test. A probe with a flexible and a soft tip is inserted into the ear canal to obtain an airtight seal. The probe tone in the ear canal is usually 226 Hz and the external ear canal air pressure is varied from +200 to -400 decapascal (dapa).

From the middle ear, the acoustic transmission is most when the air pressures in the ear canal and the middle ear are equal. This is also referred to as a compliance peak. The mobility is indicated by the height of the compliance peak; a low compliance indicates stiffness of the middle ear and the tympanic membrane. The Liden-Jerger system is used to classify the tympanograms. In this system, the response which is recorded can be classified into three types: type A, type B, type C and subtypes like As and Ad.

The type A tympanogram – It is a normal tympanogram. It implies the normal functioning of the middle ear. There is a normal pressure in the middle ear with normal mobility of the eardrum and the conduction bones.

The type As tympanogram – The compliance is low at or near the ambient pressure, which is seen in the fixation of the ossicles, e.g. Otosclerosis. The type Ad tympanogram – A high compliance at or near the ambient pressure, which is seen in ossicular discontinuity.

The type B tympanogram – A flat or dome shaped graph. This indicates an immobility of the drum, which may be due to fluid in the middle ear, when the ear canal volume is large. This can be the result of a perforation or a hole in the tympanic membrane.

The type C tympanogram – When the peak pressure is lower than – 150 dapa, this indicates a negative middle ear pressure. The compliance may be normal or reduced. This could be caused by otitis media, either in the resolving or the developing stages. A type C response could also be the result of Eustachian tube dysfunction.

The stapedius reflex test is to assess the acoustic reflex pathways, which include the auditory brainstem and the cranial nerves. This test, however, does not evaluate the auditory sensitivity directly. This test is used to detect the non-organic hearing loss, to investigate the facial nerve function and to investigate the possible retrocochlear pathology. A reflex can be also be absent due to middle ear dysfunction or severe hearing loss.

RESULTS

A total of 44 male and female children, who were within the 2 to 14 years age range, with non-syndromic cleft palates with or without cleft lips, with the symptoms of SOM, formed the sample size during the study period of one year's duration. A majority of the patients (47.27%) were in the eight-to-fourteen (8-14) years age group. A total of 29.45 % of the patients were in the age group of two-to-five years and 22.27% of the patients were in age group of five to eight years [Table/Fig-1]. In our study, Basic Audiologic Evaluation (BAE) revealed that 34 of the children had presented normal results (77.27%), that six children (13.6%) had very mild conductive hearing loss, that three children (6.8%) had mild hearing loss and that one child (2.2%) had a moderate mixed hearing loss [Table/Fig-2].The results regarding the tympanometric curve and the Contra lateral Acoustic Reflex were analyzed by ear (right and left), making up a total of 85 ears; and in 3 ears, we could not do the test because of tympanic perforations. The contralateral

acoustic reflex was present in 54.5% of the children and 45.5% did not have this reflex [Table/Fig-3].We noticed that 68.2% of the children had type A curves; that 21.2% of the children had type C tympanometry curves; that 7.1% had type B curves and that 3.5% had Ad curves [Table/Fig-3]. A majority of the patients (46%) showed sclerotic changes in their mastoid air cell systems in the X-rays of the mastoids.

Age Group Male Patient Female Patients	No. of male patients	No. of female patients	Total
2-5	5	8	13 (29.45)
5-8	6	6	10 (22.27)
8-14	12	9	21 (47.27)
Total	23	21	44

[Table/Fig-1]: Age and sex distribution in patients with cleft palate+/- cleft lip (No of patients=44)
Cases with isolated cleft lip were not included in the study
Figures in parenthesis are in percentage

Classification in relation to the degree of hearing loss in children, according to Northern and Downs, 2002 [Table/Fig-4].

DISCUSSION

The purpose of this study was to determine the incidence of the secretory otitis media that occurs in patients with cleft palates and to confirm the existence of these manifestations with the use of the Basic Audiologic Evaluation (BAE). A majority of the patients (47.27%) were in age group of eight-to-fourteen (8 – 14) years i.e. 25 males (57%) and 19 females (43%). A statistical analysis was carried out in order to check the independence between the gender and the age. Chu and Mcpherson [22] retrospectively studied 180 charts from Chinese children and indicated that 13.4% of the patients had conductive hearing loss and that 23.7% of the patients had altered tympanometric results. As it happened in our study, age and gender did not show any significant correlations with the altered results. In another chart analysis study which was done on 101 patients with CLPs, who were in the ages between 8 and 25 years, which was carried out by Goudy et al., [23] they noticed a higher conductive hearing loss incidence. Of the patients who had conductive hearing loss, 75% had the mild type loss, 21% had moderate loss and only 4% had severe hearing loss of the mixed type. Our study revealed that 34 children presented normal results (77.27%), that 6 children (13.6%) had very mild conductive hearing loss, that 3 children (6.8%) had mild hearing loss and that one child (2.2%) had moderate mixed hearing loss. In our study, we did not find any severe hearing loss, but we found one child with moderate mixed hearing loss. The results regarding the tympanometric curve and the Contra lateral Acoustic Reflex were analyzed by ear (right and left), making up a total of 85 ears; and in 3 ears, we could not do the test because of tympanic perforations. The contralateral acoustic reflex was present in 54.5% of the children and 45.5% did not have this reflex .We noticed that 68.2% of the children had type A curves; 21.2% of the children had type C tympanometry curves; 7.1% had a type B curves and that 3.5% had an Ad curves. Very few studies have been found in the literature which were done on the incidence of the type Ad curves, which have been described as being associated with a laxity of the tympanic-ossicular system which was caused by recurrent cases of otitis media and/or ossicular chain disruptions [24]. In our study, the two children who had type Ad curves had numerous otitis media episodes which were reported in their interviews. The type C tympanometric curve was the most frequent alteration which was found. It was characterized by a peak of maximum admittance, which was shifted for a negative pressure, which matched that of the auditory tube dysfunction. Mastoid bone cellularity is an indicator of the middle ear infection. The individuals who suffer from repeated middle ear infections have a proportionate loss of cellularity in their mastoid air cell systems. In our study, a majority of the patients (46%) showed sclerotic changes in their mastoid air cell systems in the X-rays of the mastoids.

A late diagnosis and a consequent lack of proper treatment can cause acute complications of prolonged episodes of otitis media, hearing impairment and consequent effects on the child's linguistic and cognitive development [25]. Numerous studies which have been associated a high incidence of the auditory tube dysfunction with CLP patients as well as associating to it the main cause of secretory otitis media in these children, since the anatomical and/or functional conditions here are altered and favour permanent inflammation and build up of sterile fluid in the tympanic cavity [26,27]. With respect to the auditory involvement that a child with CLP can have, we stress the importance of otorhino-laryngological and audiological follow ups, as soon and as complete as possible, which involve the central and the peripheral hearing. The proper treatment for secretory otitis media depends not only on a proper

	Classification									
	Normal		Very mild conductive		Mild Conductive		Moderate Mixed		Total	
	N	%	N	%	N	%	N	%	N	%
Female	13	68.4	3	15.78	2	10.5	1	5.26	19	43.2
Male	21	84	3	12	1	4	0	0	25	56.8
Total	34	77.27	6	13.63	3	6.2	1	5.26	44	100

[Table/Fig-2]: Children with clefts, according to the hearing loss type and degree classification, as to gender

		Tympanometric curve				Acoustic Reflex	
		A	B	C	Ad	Present	Absent
Male	RE	15	2	6	2	15	10
	LE	16	1	7	1	15	10
Female	RE	16	0	2	0	9	10
	LE	11	3	3	0	9	10
Total		58 (68,2%)	6 (7.1%)	18 (21,2)	3 (3,5.%)	48 (54,5%)	40 (45,5%)

[Table/Fig-3]: Male and female children with clefts, according to the results from the immittance tests in the right (RE) and left (LE) ears

Classification	Mean Hearing Loss (500, 1, 2 and 3KHz)
Normal	0 - 15 dB
Very mild	16 - 25 dB
Mild	26 - 40dB
Moderate	41 - 70 dB
Severe	71 - 90 dB
Profound	Above 91 dB

[Table/Fig-4]: Classification in relation to the degree of hearing loss in children, according to Northern and Downs, 2002

ENT diagnosis and approach, but also on the periodic follow ups.

It is important to stress that even mild and very mild hearing losses can cause significant losses for the child with respect to the language development, learning and school performance, since one loses acoustic clues, especially those which are associated with the vowel sounds. Thus, proper medical and audiological treatments will help in avoiding the onset of irreversible central and peripheral hearing damages in children with CLPs, which can affect the development of the oral and written languages, thus causing problems in learning, school performance and the social life.

CONCLUSION

The significantly higher prevalence of SOM in children with cleft palates was confirmed by this study. Based on the results of our study, we conclude that in this group of 44 children with CLPs, recurrent episodes of otitis media during infancy were present .Mild conductive hearing loss was more frequently found and the altered tympanometric curve which was more frequently found was the type C curve, thus suggesting eustachian tube tube dysfunction. A significant number of patients with cleft palates had middle ear effusions and infections, which had led to sclerotic changes in their mastoid air cell systems. The cleft palate contributed to the occurrence of secretory otitis media and this required proper ENT and audiological follow ups.

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