

Ear findings and hearing analysis in cleft palate patients in Nepal



Sanjeev Kumar Thakur¹, Baleshwar Yadav², Manish Agrawal³, Kailash Khaki Shrestha⁴, Raj Kumar Bedajit⁵

^{1,2}Lecturer, ⁵Professor, Department of Otolaryngology, Nobel Medical College, Biratnagar, Nepal, ³Assistant Professor, Department of Oral and Maxillofacial Surgery, Birat Medical College, Biratnagar, Nepal, ⁴Coordinator (Public health Program), Edenburgh International College, Biratnagar, Nepal

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ABSTRACT

Background: The orofacial cleft is the most common birth anomaly with a prevalence rate ranging from 1/1000 to 2.69/1000. The middle ear diseases are known to be associated with cleft palate, however, the prevalence and the magnitude of the condition is usually underestimated. **Aims and Objectives:** The purpose of this study was to find out the various existing ear abnormalities, to assess the middle ear function and hearing status in patients with cleft palate and confirm the existence of these manifestations and their significance. **Materials and Methods:** All the patients with cleft palate with or without cleft lip over one-year duration from January to December 2018 at the teaching hospital were included after informed consent. The patients with only cleft lip were excluded. General ENT examination and Otoscopy was performed. Tympanometry and Pure tone Audiometry was done (in those above 5 years). The degree of hearing loss was categorized using the WHO guidelines. **Results:** Out of a total of 56 patients, there were 30(53.6%) male and 26(46.4%) female. The age range was from 2 years to 31 years. The mean age was 12.8 years. Maximum number of patients were in the 10-20 years age group 29(51.8%) followed by 22 (39.3%) in the less than 10 years age group. 53 (47.3%) of 112 ears examined had dull tympanic membrane, followed by retraction of tympanic membrane in 42 (37.5%) ears. Other findings were central perforation in 5 (4.5%), bulging tympanic membrane in 2 (1.8%) and atticofacial disease in 1 (0.9%) ear. 8 (7.1%) ears had normal findings. There was one case with right ear atresia (0.9%). In Tympanometry findings, the maximum number of ears, 51 (48.1%) had type B curve, followed by 33 (31.2%) ears with type As curve. 16 (15%) of ears had type C curve. 6 (5.7%) ears had type A curve. B type curve was found more common in less than 10 years age group. A chi Square test was performed and the findings had statistically significant association. (P value: 0.03 for Right ear tympanometry; P value: 0.043 for left ear tympanometry). In Pure tone audiometry findings of 105 ears, 72 (68.6%) ears had mild conductive hearing loss. 10 (9.5%) ears had moderate conductive hearing loss, while 1 (1%) ear had mixed hearing loss. 22 (20.9%) ears had normal hearing level. **Conclusion:** This study assessed the common ear problems prevalent in cleft patients, along with the hearing loss. Since, ear disease were quite common in these patients, these patients should be evaluated regularly by an otolaryngologist to detect, treat and prevent such problems in these patients so that long term morbidity could be avoided.

Key words: Cholesteatoma; Otitis media with effusion; Middle ear effusion; Pure-tone audiometry; Tympanometry

INTRODUCTION

The orofacial cleft is the most common birth anomaly with a prevalence rate ranging from 1/1000 to 2.69/1000.¹

Children born with this defect have various developmental problems, including difficulty with hearing and ear problems, which persists to adulthood. The middle ear diseases are known to be associated with cleft palate,

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Address for Correspondence:

Dr Sanjeev Kumar Thakur, Lecturer, Nobel Medical College, Kanchanbari, Biratnagar, Morang, Nepal.
Tel no: +977 984 208 9844. E-mail: sanjeevkr055@gmail.com

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however, the prevalence and the magnitude of the condition is usually underestimated. In spite of having paid a lot of attention to the repair of the facial deformity, little attention has been given to the various associated ear problems and significance of hearing disorders. Various studies and the literature have reported a high incidence of middle ear pathologies and hearing loss in patients of orofacial clefts.^{2,3} Otoscopy is a basic primary modality of evaluation of external auditory meatus and the tympanic membrane (TM). This also helps in diagnosing the middle ear pathology. Tympanometry is an objective test to assess middle ear function. It is the gold standard investigation in detecting otitis media with effusion. The type of tympanometric curve obtained is classified according to the Lidén and Jerger's classification.^{4,5} The classification of these curves is: a. Type A: Suggestive of normal middle ear function b. Type AS: Suggestive of a less compliant middle ear system c. Type Ad: Suggestive of highly compliant middle ear system d. Type B (low and high): Low – suggestive of middle ear dysfunction, high – suggestive of grommet or perforation e. Type C: Suggestive of eustachian tube dysfunction. Type A curve is considered normal and all others (Types B, C, As, and Ad) as abnormal.

Pure tone audiometry can be used to facilitate the diagnosis of middle ear pathology by finding out the type of hearing loss as to be conductive or mixed type of hearing loss. This method requires the cooperation of the patient and may therefore be unsuitable for children under three years of age.⁶

AIMS AND OBJECTIVES

The purpose of this study was to find out the various existing ear abnormalities, to assess the middle ear function

and hearing status in patients with cleft palate and confirm the existence of these manifestations and their significance.

MATERIALS AND METHODS

This study included all the patients with cleft palate with or without cleft lip presenting to the outpatient department (OPD) for general ENT check up over a one-year duration from January to December 2018 at the teaching hospital. The patients with only cleft lip were excluded. The participants were recruited in the study after obtaining informed consent. All the subjects underwent a detailed ear, nose, and throat (ENT) examination, including Otoscopy. Middle ear function was assessed by Tympanometry and hearing was assessed in those who were of 5 years age and above using audiological test pure tone audiogram (PTA) at frequencies 250, 500, 1000, 2000, 4000 Hz and 8000 Hz. Tympanometry was done in all the patients to assess the middle ear. The degree of hearing loss was categorized using the WHO guidelines.⁷

RESULTS

Out of a total of 56 patients, there were 30(53.6%) male and 26(46.4%) female, as shown in Table 1. The age range was from 2 years to 31 years. The mean age was 12.8 years. Maximum number of patients were in the 10-20 years age group 29 (51.8%) followed by 22 (39.3%) in the less than 10 years age group. The otoscopy findings were as shown in Table 2. The findings were expressed as number of ears affected. 53 (47.3%) of 112 ears examined had dull tympanic membrane, followed by retraction of tympanic membrane in 42 (37.5%) ears. Other findings were central perforation in 5 (4.5%), bulging tympanic membrane in

Table 1: Age and sex distribution

Age range (years)	Male	Percentage	Female	percentage	Total	Percentage
≤10	15	26.8	7	12.5	22	39.3
>10-20	13	23.2	16	28.6	29	51.8
>20-30	2	3.6	2	3.5	4	7.1
>30	0	0	1	1.8	1	1.8
Total	30	53.6	26	46.4	56	100

Table 2: Otoscopy findings (112 ears)

Otoscopy findings	Right ear number	Percentage	Left ear number	Percentage	Total ears number	Percentage
Dull	27	48.2	26	46.4	53	47.3
Retraction	20	35.7	22	39.3	42	37.5
Central perforation	3	5.4	2	3.6	5	4.5
Bulging	1	1.8	1	1.8	2	1.8
Atresia	1	1.8	0	0	1	0.9
Atticoantral disease	0	0	1	1.8	1	0.9
Normal	4	7.1	4	7.1	8	7.1
Total	56	100	56	100	112	100

2 (1.8%) and atticofacial disease in 1 (0.9%) ear, 8 (7.1%) ears had normal findings. There was one case with right ear atresia (0.9%). Tympanometry was done in 106 ears, as shown in Table 3. The maximum number of ears, 51 (48.1%) had type B curve, followed by 33 (31.2%) ears with type As curve. 16 (15%) of ears had type C curve. 6 (5.7%) ears had type A curve. B type curve, suggestive of otitis media with effusion, adhesive otitis media and varied severity of Eustachian tube dysfunction was found more common in less than 10 years age group. A chi Square test was performed to see the relation of the types of curve of tympanometry for right and left ear separately to the age groups, as shown in Table 4, and the findings had statistically significant association. (P value: 0.03 for Right ear tympanometry; P value: 0.043 for left ear tympanometry). Pure tone audiometry was done in 105 ears, as shown in Table 5. 72 (68.6%) ears had mild conductive hearing loss according to WHO criteria. 10 (9.5%) ears had moderate conductive hearing loss; while 1 (1%) ear had mixed hearing loss. 22 (20.9%) ears had normal hearing level.

DISCUSSION

Patients with orofacial clefts often are seen and managed by the plastic surgeons. However, the ear symptoms, including deafness, are often subtle and tend to be overlooked. Surgical repair of cleft palate can produce satisfactory cosmetic results, however, the problem of otitis media with effusion (OME) persists, causing hearing loss.^{8,9} Abrams et al. found a high prevalence rate of middle ear

pathologies (65%) in patients with orofacial clefts.⁸ A poor Eustachian tube (ET) function leads to decreased middle ear pressure and tympanic membrane (TM) retraction, that contributes to the increased incidence of cholesteatoma in these children. Various studies have attempted to establish an association between the orofacial cleft and middle ear diseases.^{3,8}

We have analysed 56 [30(53.6%) male and 26(46.4%) female] cases of cleft palate for ear diseases to provide an estimate of the prevailing ear diseases and hearing loss in the orofacial cleft population. The study population had an age range of 2-31 years (mean age 12.8 years).

On Otoscopy of 112 ears, in our study, several cases had findings suggestive of Eustachian tube dysfunction and otitis media with effusion - dull tympanic membrane in 53 (47.3%) ears and various grades of retracted tympanic membrane in 42 (37.5%) ears. Several other findings like central perforation in 5 (4.5%) and bulging tympanic membrane in 2 (1.8%) were found. 1(0.9%) ear even had atticofacial disease. Only 8 (7.1%) ears had normal findings. There was one case with right ear atresia (0.9%).

Similar findings were described by Khan and Colleagues in 56 ears of 28 individuals. The ears were chronically affected in 87.5% of cleft palate patients. Only 7 (12.50%) ears were normal with an intact normal tympanic membrane, 36 (64.28%) ears had an intact but dull tympanic membrane, 4 (7.14%) ears presented with an active effusion with different grades of retraction 8 (14.28%) ears had chronic suppurative otitis media (central perforation) and one (1.85%) ear had an attic pathology with cholesteatoma.²

Severied A reported that the Eustachian tube dysfunction was present in 84% of cleft patients. According to him, this dysfunction decreases with the age of the patient. He further stated that 7.1% of such patients developed cholesteatomas despite regular otological examination.¹⁰ Similar high rate of 74.7% prevalence of middle ear effusions was observed in children with clefts in the younger age group in a study by Flynn et al from study reported from Sweden. They reported otitis media with effusion (OME) as the leading cause of hearing loss in 83.1% of ears.¹¹ Apart from mild conductive hearing loss, MEE usually does not cause any other symptoms

Table 3: Tympanometry findings (106 ears)

Type of curve	Total number	Percentage
A	6	5.7
As	33	31.2
B	51	48.1
C	16	15
Total	106	100

Table 4: Chi square test

Chi Square test	Right ear tympanometry B-type curve	Left ear tympanometry B-type curve
Age group ≤10 years	15 (28.3%)	15 (28.3%)
P-value	0.03	0.043

Table 5: Pure tone audiometry findings (total=105 ears)

Severity of hearing loss	Right ear number	Percentage	Left ear number	Percentage	Total	Percentage
Normal	13	12.4	9	8.6	22	20.9
Mild conductive hearing loss	34	32.4	38	36.2	72	68.6
Moderate conductive hearing loss	5	4.7	5	4.7	10	9.5
Mixed hearing loss	0	0	1	1	1	1
Total	52	49.5	53	50.5	105	100

of discomfort and is therefore easily overlooked. If left untreated, this could progress to middle ear retraction and chronic otitis media.

Djurhuus and colleagues stated that despite the surgical correction of clefts and the early treatment of OME, structural changes of the tympanic membrane progressed to develop retraction pockets and cholesteatomas in up to 9.2% of the patients. Children with cleft palates had a higher probability of developing cholesteatoma than children without a cleft palate.¹²

Tympanometry is a common method of measuring pressure changes in the middle ear and the compliance of the eardrum.^{13,14} Tympanometry was done in 106 ears in our study and most of the ears, 51 (48.1%) had type B curve, apart from type As curve in 33 (31.2%) and type C curve in 16 (15%). Only, 6 (5.7%) ears had normal tympanic membrane as indicated by type A curve. B type curve, suggestive of otitis media with effusion, adhesive otitis media and varied severity of Eustachian tube dysfunction was found more common in less than 10 years age group, which was statistically significant.

On tympanometric study by Khan and colleagues, it was found that only 13 ears (23.22%) out of a total of 56 ears in 28 patients examined, had an 'A' type of tympanogram while 42 ears (75%) had a 'B' type of tympanogram indicating recurrent effusions in the middle ear. A significant number from this group (81.81%) had associated conductive hearing loss-mild to moderate degrees. One ear had a 'C' type of curve indicating frank eustachian tube dysfunction with negative middle ear pressure.² A study by Handzik et al. showed similar results with tympanogram curves in cleft children.¹⁵ This high rate of the B type curve may be explained due to the presence of middle ear effusion.

It has been found that compared to healthy children, children with cleft palate were more susceptible to OME.^{3,16} Numerous factors have been proposed as to the development of OME in children suffering from cleft palate, that included: (1) immature development of the Eustachian tube, (2) abnormalities in the muscle associated with the Eustachian tube, and (3) craniofacial bone abnormalities.¹⁴

Pure tone audiometry can be used to facilitate the diagnosis of OME by revealing conductive or mixed hearing loss. This method requires the cooperation of the patient and may therefore be unsuitable for children under three years of age.⁶ Pure tone audiometry was performed in children above 5 years only, who could follow the instructions and give reliable feedback. Conductive hearing loss of mild

degree (upto 30 dB) could result in children with cleft palates due to recurrent or continuous OME, causing atelectasis, ossicular fixation, and tympanosclerosis.^{17,18}

Pure tone audiometry was done in 105 ears in our study where 72 (68.6%) ears had mild conductive hearing loss, 10 (9.5%) ears had moderate conductive hearing loss, while 1 (1%) ear had mixed hearing loss, 22 (20.9%) ears had normal hearing level.

Luthra et al. found that the air conduction thresholds ranged from minimal to mild conductive hearing loss in orofacial cleft children that resulted out of recurrent or continuous OME leading to atelectasis, ossicular fixation, and/or tympanosclerosis.¹⁹ The risk of chronic ear infection was higher even in children with isolated cleft lip cases compared with unaffected controls in another study.²⁰ Researchers have previously shown that, whenever, they have undergone cleft palate repair surgery, as many as 90% of children with cleft palate suffer from OME or conductive hearing loss, while 50% suffer from recurrent otitis.^{21,22} However, the prevalence of conductive hearing loss among children without cleft palate was 12.9%. It was estimated that 50% of the individuals with this condition suffered from permanent conductive hearing loss by the time they reached adulthood.^{23,24} Additionally, 0.9-5.9% of patients with cleft palate developed primary acquired cholesteatoma, the chances of which was very high than among those without cleft palate.^{25,26} Sensorineural losses usually occurs due to the pathologic changes in the inner ear as a result of the inflammation in the middle ear. Toxins produced by long-term inflammation pass through the round window or the oval window into the inner ear, often leading to permanent sensorineural hearing loss.^{14,27}

Long-term hearing loss due to improper treatment for OME could negatively influence language development of children.²⁸ Hearing loss in children suffering from cleft palate can also affect their academic comprehension and learning performance.²⁸⁻³⁰ Bess et al. reported that academic performance can be seriously affected in up to a third of children including those suffering hearing loss in only one ear. They also reported that up to 40% of patients are unable to participate in regular activities or interactions due to hearing loss.³¹ It has been found that children with cleft palate are prone to specific psychological problems.³² Children suffering from this condition may also display behavioral difficulties due to feelings of isolation.³³

Hence a thorough evaluation by an otolaryngologist should be the standard of care in the management of all children with orofacial clefts.

CONCLUSION

This study assessed the common ear problems prevalent in cleft patients, along with the hearing loss. Since, ear disease were quite common in these patients, these patients should be evaluated regularly by an otolaryngologist to detect, treat and prevent such problems in these patients so that long term morbidity could be avoided.

Limitation of the study

The limitation of this study was the small sample size of which only a point prevalence of middle ear diseases and hearing loss has been described. A cohort study with a larger sample size over a long duration must be done to evaluate the long term effects of the pathology.

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Author's Contribution:

SKT- Concept and design of the study, collected data, reviewed the literature, prepared the first draft of manuscript and critical revision of the manuscript; **BY, MA**- Concept, collected data and review of literature and helped in preparing first draft of manuscript; **KKS**- Conceptualized study, literature search, statistically analyzed and interpreted, prepared first draft of manuscript and critical revision of the manuscript; **RKB**- Concept of study, collected data and review of study.

Work attributed to:

Nobel Medical College, Kanchanbari, Biratnagar and PHECT-NEPAL, Kathmandu.

Orcid ID:

Dr. Sanjeev Kumar Thakur - <https://orcid.org/0000-0002-2855-1766>

Dr. Baleshwar Yadav - <https://orcid.org/0000-0002-6057-0780>

Dr. Manish Agrawal - <https://orcid.org/0000-0002-8958-4107>

Dr. Kailash Khaki Shrestha - <https://orcid.org/0000-0002-9515-5405>

Dr. Raj Kumar Bedajit - <https://orcid.org/0000-0001-6111-2442>

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