Austin Journal of Otolaryngology

Open Access

Austin Publishing Group

Research Article

Hearing Loss Associated with Otitis Media with Effusion in Children with Unilateral Cleft Lip and Palate

Jadranka Handzic*
Department for Ear, Nose and Throat, University Clinical Hospital Center, Croatia

***Corresponding author:** Jadranka Handzic, Professor of Otolaryngology, Department for Ear, Nose and Throat, University Clinical Hospital Center, Kispaticeva 12, 10 000 Zagreb, Croatia

Received: August 16, 2016; **Accepted:** September 19, 2016; **Published:** September 21, 2016

Abstract

Objectives: Hearing Loss (HL) in cases of unilateral cleft lip and palate children with respect to the lateralization of the cleft, age and audiometric frequencies is recently not described.

Method: Pure tone audiometry and tympanometry performed for frequencies of 250Hz-4 kHz in seventy-six left unilateral cleft lip and palate patients with repaired cleft lip and palate and long term history of hearing loss. Non-cleft side ears of the same children served as control to the ears of cleft side according to age subgroups of 1-3, 4-7, 8-12yr.

Results: Highest average hearing loss threshold for tested frequencies showed age group of 1-3yr with no ear side difference. Age group of 4-7 year-old children cleft side ears have highest rate of ears with moderate hearing loss. Non-cleft side ears with moderate hearing loss showed improvement of hearing with aging. Cleft side ears showed higher incidence of ears with moderate and severe hearing loss which do not improve hearing threshold with aging than non cleft side eras.

Conclusion: Side of cleft lip and palate showed more structural defects which influenced negatively of the function of Eustachian tube, and caused higher incidence of more severe hearing loss with low rate of improvement with aging as well as decrease of incidence, if compared with non cleft side.

Keywords: Hearing loss; Unilateral cleft lip and palate

Introduction

Non-syndromic cleft lip and palate are accompanied by developmental changes of cranial base, retrognathic maxilla, increased pharyngeal width, smaller middle ear cavity, changes in the petrous portion of the temporal bone, short and high position of the cleft hard palate, hypoplastic and malposed cleft muscles [1,2]. This sequence of pathoanatomical changes causes Otitis Media with Effusion (OME) and peripheral hearing deficit. Recurrent episodes of OME lead to impairment of the central auditory pathways, behavior, cognition, speech, language and social adaptation [3,4]. Otitis media with effusion is found more often in children with Unilateral Cleft Lip And Palate (UCLP) than in non-cleft population [5-7]. Poor mastoid Pneumatization in cleft palates is considered as an additionally etiological factor for high incidence of OME [8,9]. We presumed that different characteristics of craniofacial bony parameters, which are related to the side and severity of the cleft, can predict severity and improvement of the hearing loss with age. The aim of the study was to find out if ears of the left side have higher severity of hearing loss and slower dynamic of improvement in dependence with age and different audiometric frequencies.

Methods

The clinical study included 76 children (29 female and 47 male, median age of 6, 0 yr) with Unilateral Cleft Lip and Palate of the left side (UCLP) (L). All of them have undergone cheiloplasty and palatoplasty under the same standard conditions. At the time of their visit to audiology department all of the patients have had history of conductive hearing loss and of recurrent episodes of upper respiratory pathways infections. All of the patients had undergone otomicroscopy, pure tone audiometry, tympanometry and nasopharyngeal fyberoptic endoscopy. Tympanograms were classified according to Jerger as type A, B or C. Children were subdivided into age groups: 1-3yrs, 4-7yrs, 8 -12yrs and >12 yrs. Pure tone audiometry for audiometric threshold was analyzed during 6 weeks. Tonal audiometry established Median Hearing Loss thresholds (MHL) for 250Hz, 500Hz, 1kHz, 2kHz, 4kHz and the average five-frequency pure tone hearing loss threshold (AHL) for left and right ears respectively. Average hearing loss audiometric threshold groups were classified as mild (11-20dB), moderate (21-40 dB), severe >40 dB and normal (0-10dB). All of UCLP (L) patients who have the established diagnosis of otitis media with effusion (conductive hearing loss presented for 6 weeks on pure tone audiometry accompanied by tympanograms of B type) had undergone insertion of the ventilatory tubes on both tympanic membranes. Tonal audiograms performed before the insertion of ventilatory tubes were taken and analyzed. A comparison between study groups of ears was made by Kruskal Wallis and Mann-Whitney tests. The correlations between variables were analyzed using Spearman correlation coefficient. Chi-square test was performed to evaluate statistically significant differences between proportions. All applied tests were two-sided. P values ≤ 0.05 were considered as statistically significant. Tests were performed using software Stat Soft Statistical 7.1.

Citation: Handzic J. Hearing Loss Associated with Otitis Media with Effusion in Children with Unilateral Cleft Lip and Palate. Austin J Otolaryngol. 2016; 3(3): 1080.

Table 1: Median hearing level, range between minimum and maximum hearing (min-max) level for Average Hearing Loss (AHL), 250Hz- 4kHz for left and right ears.

Age (years) UCLP	N (76)	Ear side	Hearing level (dB) AHL	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Kruskal Wallis test (p value)
			Md (Min-Max)	Md (Min-Max)	Md (Min-Max)	Md (Min-Max)	Md (Min-Max)	Md (Min-Max)	
1-3	10	R	p=0.683 35.0 (16-41)	p=0.398 30.0 (20-40)	p=0.043 40.0 (20-50)	p=0.866 32.5 (15-50)	p=0.906 30.0 (15-45)	p=0.612 30.0 (10-50)	p=0.057
		L	33.0 (20-42)	27.5 (20-45)	30.0 (15-40)	32.5 (15-45)	32.5 (15-50)	32.5 (15-50)	p=0.601
4-7	37	R	p=0.039 21.0 (10-47)	p=0.387 25.0 (10-45)	p=0.062 25.0 (10-55)	p=0.064 20.0 (10-45)	p=0.410 20.0 (10-45)	p=0.003 20.0 (10-55)	p=0.001
		L	25.0 (10-47)	25.0 (10-50)	30.0 (10-45)	30.0 (10-50)	25.0 (10-50)	25.0 (10-50)	p=0.003
8-12	17	R	p=0.906 20.0 (10-41)	p=0.790 20.0 (10-45)	p=0.650 25.0 (10-35)	p=0.979 20.0 (10-50)	p=0.875 20.0 (10-30)	p=0.382 20.0 (10-55)	p=0.294
		L	18.0 (10-47)	20.0 (10-45)	20.0 (10-45)	20.0 (10-55)	15.0 (10-40)	20.0 (10-55)	p=0.028
>12	12	R	p=0.110 16.0 (10-42)	p=0.787 12.0 (10-35)	p=0.866 15.0 (10-50)	p=0.590 17.5 (10-40)	p=0.043 10.0 (10-40)	p=0.075 10.0 (10-45)	p=0.269
		L	18.0 (10-44)	17.5 (10-40)	15.0 (10-40)	17.5 (10-50)	17.0 (10-50)	17.5 (10-60)	p=0.972

Table 2: Changes in hearing level (differences between medians) with aging for left and right ears of children with left unilateral cleft lip and palate. Comparision between groups on cleft and non cleft side. Spearman's correlation coefficient and Kruskall-Wallis test were performed for average hearing loss (AHL), 250Hz, 500Hz, 1 kHz, 2 kHz, 4 kHz with aging on cleft and non cleft side. Significant differences are expressed like † (p<0.05) and ‡ (p<0.001).

Groups (years)	AHL R	AHL L	250 Hz R	500 Hz R	1 kHz R	2 kHz R	4 kHz R	250 Hz L	500 Hz L	1 kHz L	2 kHz L	4 kHz L
(1-3) – (4-7)	**-14†**	-8	-5	**-15†**	**-12.5†**	**-10†**	**-10†**	-2.5	0	-2.5	-7.5	-7.5
(4-7) – (8-12)	-1	**-7.5†**	-5	-2.5	0	-2.5	- 2.5	-5	**-10†**	**-10†**	-12.5	**-7.5†**
(8-12) – (>12)	-4	0.5	0	-7.5	-5	-7.5	-12.5	-5	-5	-5	+ 2.5	-2.5
Correlation coefficient	-0.471‡	-0.459‡	-0.419‡	-0.511‡	-0.423‡	-0.446‡	-0.327†	-0.384†	-0.466‡	-0.418‡	-0.361†	-0.404‡
Kruskall-Wallis test (p value)	0.003	0.006	0.036	0.002	0.015	0.003	0.014	0.033	0.005	0.024	0.029	0.017

Results

None of tested ears had sensorineural hearing loss. No gender differences for Average Hearing Loss threshold (AHL) were found between tested groups of ears. Highest median hearing loss (Md) was found at 500 Hz on non-cleft side (p=0.043). At age group 4-7yr cleft side had higher AHL (25.0 dB, p=0.039) than non-cleft side. The highest significant difference between Md if compared cleft side with non-cleft side was found for 500 kHz at 1-3 yr (10.0 dB, p=0.043). At age 8-12yr there were no differences for Md and AHL between cleft vs. non-cleft side across all of the tested frequencies. At the age of >12yr cleft side ears showed higher values of Md for 2 kHz (17.0 dB, p=0.043) (Table 1).

At age of 1-3 yrs both cleft and non-cleft side have higher rate of ears (80,0%) with moderate average hearing loss threshold (AHL) than other age groups. Horizontal comparison (inter-group) of non cleft side showed significant frequency difference for mild (p=0,014) and moderate category (p<0,001) while on cleft side difference was showed only for moderate category (p<0,001). Vertical comparison (intra-group) of non cleft side (p<0,001) and cleft side (p<0,001) showed significant frequency difference only for 4-7 yr (Figures 1,2).

Non cleft side ears reached significant improvement of AHL (-14 dB) between 1-3 yr and 4-7yr while cleft side showed significant improvement of AHL between 4-7yr and 8-12 yr (-7,5 dB). The improvement of at least 10dB was found at 500Hz, 1 kHz, 2 kHz and 4 kHz on non cleft side, while on clef side the same improvement was found at 500Hz, 1 kHz, and 2 kHz. The lowest improvement with aging was found at 250Hz for both sides. The highest significant improvement of Md (-15 dB) was found on non cleft side ear at 500Hz (p=0.009) between 1-3 yr and 4-7 yr, while the highest significant improvement of Md (-10 dB) on cleft side was found at 500 kHz between 4-7 yr and 8-12 yr (p=0.013). Negative correlation was found between all tested frequencies and aging, AHL and aging, on both sides which means that hearing improves with aging. When sorted categorically, only moderate AHL on non cleft side showed significant negative correlation with aging (rho = -0.409, p=0.016). Cleft side ears showed AHL improvement continuously till the age of 12 yr, when non clefs side achieves improvement till the age of 7 yr. (Table 2).

Discussion

Previous studies of UCLP patients described changes in the length and angulations of the cranial base, a more backward and upward position of the maxilla and smaller sphenopalatine angle as contributing etiological factors for OME. Frequent otologic

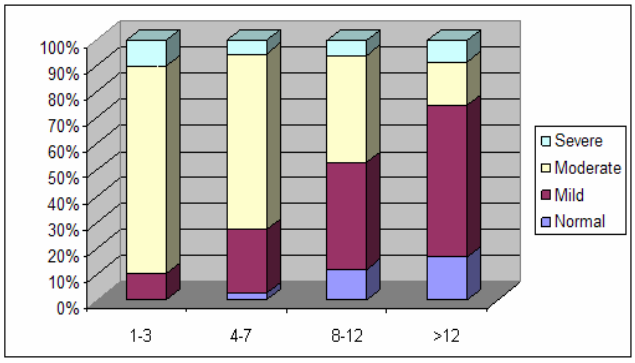

Figure 1: Cleft side ears - proportions of the ears with mild, moderate and severe AHL and normal hearing level by age groups (1-3, 4-7, 8-12, >12). At inter-group comparison significant difference was found for moderate category and at intra-group comparison in age group 4-7.

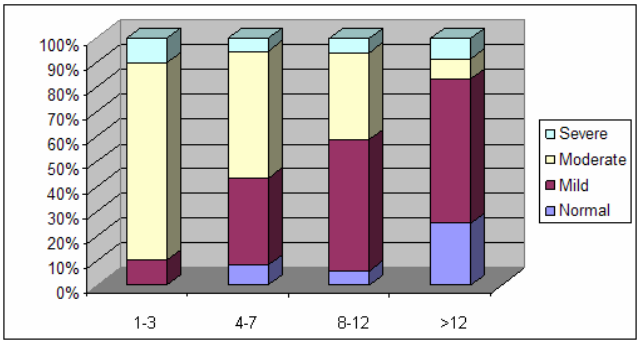

Figure 2: Non cleft side ears - proportions of the ears with mild, moderate and severe AHL and normal hearing level by age groups(1-3, 4-7, 8-12, >12). At inter-group comparison significant difference was found for mild and moderate category and at intra-group comparison only in age group 4-7.

problems were described to be correlated to pathologic clearance and pathoanatomical changes of the Eustachian tube cartilage and increasing pharyngeal width [8-10]. Previous data on cleft lip and palate patients suggested laterality of the ears to have no effect on the hearing loss [11]. Until now there have been no recent studies comparing hearing threshold according to audiometric frequencies between cleft and non cleft side and possible changes over time.

At age of 1-3yrs cleft and non-cleft side ears are characterized by a flat tonal audiometric curve of moderate to severe average hearing loss threshold across speech frequencies with no signs of laterality.

Differences between hearing loss of cleft vs. non-cleft ears became significant at age 4-7yrs. The developmental characteristics of that age are faster growth of the soft tissues and proportionally slower growth of nasopharyngeal bony parameter. Disproportion between volume of the soft tissue and volume of bone surrounding space, whose size is defined by the growth of bony parameter, contributes to the mechanical obstruction of the Eustachian tube. An expected increase in the nasopharyngeal area, which is related to the descent of the hard palate, is additionally disrupted by the presence of a cleft palate and contributes to severe dysfunction and mechanical obstruction of the Eustachian tube, which is in its part also a contribution to the onset of the hearing loss, making cleft side ears pathoanatomicaly more vulnerable for hearing loss. In age group of 4-7 yrs. cleft side ears had middle frequencies register of 1 KHz, 2 KHz, and 4 KHz more affected. Experimentally such effect was explained by accumulation of the fluid in the middle ear which covers and increases tympanic membrane mass and causes impairment of middle register. Otitis media with effusion causes reduction in the sound transmission to the inner ear and intradural time delay impairment in binaural processing abilities with a consecutive deficit in sound localization, which leads to central auditory impairment [3,4]. Contrary to cleft side, at the age of 4-7 yrs non-cleft ears showed more severe hearing loss for low register of 250 Hz to 500 Hz. According to experimental findings mechanism of hearing loss in such ears was explained by more prominent edema of mucosa and smaller amount of the middle ears effusion [12]. It seems that non-cleft side has better pathoanatomical characteristics and middle ear effusion is not as often as for ears on cleft side. Accordingly it can be presumed that etiology of hearing loss is somewhat different for cleft vs. non-cleft ears.

At age >12yrs cleft side ears had significantly more impairment of median hearing loss threshold for frequencies of 2 kHz and 4 kHz probably as a residual sign of recurrent presence of the middle ear effusion in previous age groups and it might be first sign of future sensorineural hearing loss in adult age.

Conclusions

The cleft side showed a significantly higher rate of ears with moderate and severe hearing loss if compared with non-cleft ears. Furthermore, the moderate average of hearing loss across frequencies and median hearing loss for each frequency were more present for the left side ears only at age 4-7yr. Non-cleft ears showed lower incidence of ears with moderate hearing loss which showed normalization but only on level of mid hearing loss level. Cleft side ears showed normalization of moderate and mid hearing loss but it are not significant. Cleft and non cleft lip and palate sides' showed structural differences which are developmentally derived and directly influenced on the function of whole region of the Eustachian tube and middle ear function too.

References

1. Molsted K, Kjaer I, Dahl E. Cleft Palate Craniofac J. 1995; 32:199-205.
2. Molsted K, Kjaer I, Dahl E. Cleft Palate Craniofac J. 1993; 30: 569-573.
3. Hartley deh, Moore DR. Int J Pediatric Otorhinolaryngol. 2005; 69: 757-769.
4. Moore dr, Hartley deh, Hogan SCM. Int J Pediatr Otorhinolaryngol. 2003; 6751: 563-567.
5. Bluestone CD, Wittel RA, Paradise JL. Cleft Palate J. 1972; 9: 93-100.
6. Bluestone CD. Ann Otol Rhinol Laryngol. 1971; 80: 1-30.
7. Kemaloglu YK, Kobayashi T, Nakajima T. Int J Pediatr Otorhinolaryngol. 1999; 47: 57-69.
8. Kyrkanides S, Klambani M, Subtelny JD. Cleft Palate Craniofacial J. 2000; 37: 556-561.
9. Handzic-cuk J, Cuk V, Risavi R, Katusic D, Stajner-Katusic S. Int J Pediatr Otorhinolaryngol. 1996; 37: 227-242.
10. Ravicz ME, Rosowski JJ, Merchant SN. Hear Res. 2004.
11. Tuncbilek G, Ozgour F, Belgin E. Cleft palate Craniofacial J. 2002; 40: 304-309.
12. Heerbeek N, Akkerman AE, Ingels JAO, Engel Jam, Yielhuis GA. Int J Pediatr Otorhinolaryngol. 2003; 67: 861-866.

Austin J Otolaryngol - Volume 3 Issue 3 - 2016
ISSN : 2473-0645 | www.austinpublishinggroup.com

Citation: Handzic J. Hearing Loss Associated with Otitis Media with Effusion in Children with Unilateral Cleft Lip and Palate. Austin J Otolaryngol. 2016; 3(3): 1080.