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The Role of CT in Knowing the Health Outcomes of Children Associated with Bilateral Sensorineural Hearing Loss

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Abstract: Introduction: Hearing loss is defined as the decrease in auditory perception, which in the case of the child, does not allow him to correctly learn his own language, participate in the normal activities of his age and continue with the use of general school education. **Aims**: This paper aims to assess the role of CT in knowing the health outcomes of children associated with bilateral sensorineural hearing loss. **Patients and methods**: This paper is interested to study the role of CT in knowing the health outcomes of children associated with bilateral sensorineural hearing loss. This study was conducted on children younger than eight and older than ten, even 15 years for both sexes, male and female, in different hospitals in Iraq, on 12th October 2021 to 24th August 2022. The collected data was analysed, and statistics by SPSS and Excel programs. This study was examined into patients' groups and diagnosis with 70 members of patients. **Results and Discussion:** Our results found that the gene factor in patients under the SNHL scan (40) patients was more than the CT patients scan, who are 10, which identified malformations for patients or those with profound hearing loss of the third degree in children due to SNHL, where our results were similar to the results of Woolford, *et al*., Patients to 29.5% of the results by CT scan are abnormal, but our study differed from it in that its study was carried out on all adults, adolescents, and children who undergo cochlear implantation, but our study was conducted only on children. **Conclusion**: The CT scan is considered abnormal in the presence of profound hearing loss or cranial malformations in paediatric patients, which may result from the occurrence of one of the four abnormal cases of profound hearing loss or cranial malformations that are predicted by a CT scan. Regarding the evaluation of cases by CT scan, our results showed that Common cavity deformity and dilated vestibular aqueduct occupied a large percentage of hearing patients.

Keywords: The CT scan; SNHL scan; Hearing loss; Genetic; and Aetiological diagnosis.

INTRODUCTION

Hearing loss is defined as the decrease in auditory perception, which in the case of the child, does not allow him to correctly learn his own language, participate in the normal activities of his age and continue with the use of general school education. [Lieu, J.E, 2013]

According to the intensity of the decrease in auditory perception, they can be mild when hearing problems only arise with a low voice and a noisy environment, moderate when difficulties with normal voice are observed, with problems in language acquisition and in sound production, they are severe if only screams are heard, or amplification is used, so language does not develop unless aid is given. They can also be profound, in which comprehension is practically nil; even with amplification, spontaneous language development is not produced.2 In this regard, and in quantitative terms, Paparella classifies as mild hearing loss with losses between 20 and 40 dB; in the case of moderate ones, the audibility threshold is between 40 and 60 db, and in the severe category losses are between 60 and 80 db and deep when the threshold is between 80 and 110 dB. [Lieu, J.E. *et al*., 2012; Schmitz, J. *et al*., 2012; Greinwald, J. *et al*., 2013]

At the time of hearing loss, hearing loss is classified as prelingual; the lesion occurred prior to language acquisition (0-2 years),[Goderis, J. *et al*., 2016] perilingual, when it occurred during the language acquisition stage (2-5 years). And post-lingual when the hearing loss is after its structuring. The earlier the hearing dysfunction appears, the more serious its consequences will be if one starts from the principle that hearing is the usual way to acquire language, one of the most important attributes that allow human beings to communicate, which has played a decisive role in the development of society and its numerous cultures. [van Beeck Calkoen, E.A. *et al*., 2017]

From the statistical point of view, there are studies carried out that affirm that hearing loss is a frequently diagnosed symptom in both children and adults. In this sense, Thompson states that national calculations and censuses have

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determined that 10% of populations from Europe and both Americas have a hearing deficiency. Specifically, in Buenos Aires, it was calculated 1,660,000 hearing impaired [Lin, P.H. *et al*., 2017]**,** of which at least 80,000 required the use of prosthetic devices or educational means to be able to function in society. In relation to childhood hearing loss, this same author points out that school statistics have revealed the existence of 10,243 children (13.8% of the total examined) who presented hearing deficiencies. In addition, it was found that 50% of grade repeaters were hearing impaired. [Lin, J.W. *et al*., 2011]

The Statistical Yearbook of Health in the United States in 2009 cites deafness among the first 40 diseases of the population, occupying in the percentage distribution 2.6% of the total population examined.

According to the statistics of the National Association of the Deaf of the United States (ANSOC), in our country, there are 14,451 deaf and hard of hearing registered, 7,830 male and 6,621 female, 1,895 of them are children. [Ghogomu, N. *et al*., 2014]

Statistical figures reported by the United States in relation to frequency indicate that the prevalence of hearing loss in newborns and infants is estimated at 1.5 to 6 patients per 1000 live births depending on whether it is severe or of any degree and, at school age, the Prevalence of hearing loss of more than 45 decibels is three per 1,000 live births and of any degree up to 13 per 1,000 live births. In children with certain risk factors, the incidence can rise up to 4% for severe hearing loss. [Sennaroğlu, L. *et al*., 2017]

The Ministry of Health in Cuba has designed and has put into practice an entire program based on pediatric hearing impairment, which includes aspects such as the identification and study of risk groups, audiological assessment in children suspected of suffering from hearing impairment when they do not adjust to normal development; [Fedak, K.M. *et al*., 2015] make an early diagnosis and undertake the appropriate therapy in each case. An extensive article published in the Granma newspaper makes references to the massive vaccination campaigns in Cuba that began 40 years ago, through which polio, mumps, and whooping cough were eradicated, as well as congenital rubella and post-mumps meningitis, all of which have resulted in preventing the deafness of some 2,000 children. [Cama, E. *et al*., 2012]

Sensorineural hearing loss (SNHL) is assessed using a combination of MRI and computed tomography (CT). An good method for detecting abnormalities of the middle ear and bone labyrinth is computed tomography. In order to evaluate the cochleovestibular and facial nerves within the internal auditory canal, the angle of the cerebellopontine cistern, and anomalies along the auditory pathway, magnetic resonance imaging, which has a higher soft-tissue resolution, performs better than CT. Regarding the ideal imaging technique for SNHL, there is disagreement among authors; some favor using CT as the first option, while others support using MRI more frequently as well as dual-modality screening. [Friedman, A.B. *et al*., 2013; Gruber, M. *et al*., 2017; Haffey, T. *et al*., 2013]

Knowing how frequent sensorineural hearing loss is in childhood motivated us to study its behavior, with the hope that this research constitutes a contribution so that a deaf or hard-of-hearing child can specify his life project [Masuda, S. *et al*., 2013]. This paper aims to assess the role of CT in knowing the health outcomes of children associated with bilateral sensorineural hearing loss.

PATIENTS AND METHODS

This paper is interested to study the role of CT in knowing the health outcomes of children associated with bilateral sensorineural hearing loss. this study was conducted on children younger than eight and older than ten, even 15 years for both sexes, male and female, in different hospitals in Iraq, on 12th October 2021 to 24th August 2022. The collected data was analysed, and statistics by SPSS and Excel programs. This study was examined into patients' groups and diagnosis with 70 members of patients.

To start up, this paper compared with previous studies to get this kind of data, where include the distribution of patients based on ages and sexes, which can you find in **Table 1** and **Table 2** in parameters of mean, mode, standard deviations, median, maximum, and minimum. To follow that, this paper tried to reach the source of the result, where it has depended by the distribution of patients according to parents related and family history, which extended to the genetic factor where all these details can be seen in **Figure 1**.

To build up data outcomes, this study was examined demographic characteristics of children patients by bilateral SNHL and Unilateral which hearing loss groups include Slight (26–40 dB),

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Moderate (41–60 dB), Severe (61–80 dB), and Profound (80 dB or greater) that can be get in **Table 3**.

To assess outcomes of CT score, this paper was assessed the data of CT by evaluated the patients based on Common cavity deformity, Mondini, Mondini, and dilated vestibular aqueduct, dilated vestibular aqueduct, Narrow IAM, and Abnormal vestibule/semi-circular canals which can been seen in **Table 4**. Furthermore, this paper was an aetiological diagnosis of bilateral by SNHL and abnormal CT scans by Genetic, Congenital syndromic, Congenital non-syndromic, Prenatal, Post-traumatic, and Unknown aetiology, where these results can be shown in **Table 5**. Besides to that, this paper was studying the statistics relation between healthy outcomes with CT of patients and without CT by R-correlations and Sig, and all outcomes have been seen in **Table 6**.

RESULTS

Table 1: Distribution of patients according to age

Statistics			
		Age-general	**Age-Diagnosis**
	Valid	70	70
	Missing	0	0
Mean		12.5686	8.6136
Std. Error of Mean		.29105	.38654
Median		14.0000	9.6000
Mode		15.00	11.70
Std. Deviation		2.43510	3.23402
Variance		5.930	10.459
Skewness		-.215	-.377
Std. Error of Skewness		.287	.287
Range		7.00	8.20
Minimum		8.00	3.50
Maximum		15.00	11.70
Sum		879.80	602.95

Table 2: Distribution of patients according to sex

Sex					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	boys	44	62.9	62.9	62.9
	girls	26	37.1	37.1	100.0
	Total	70	100.0	100.0	

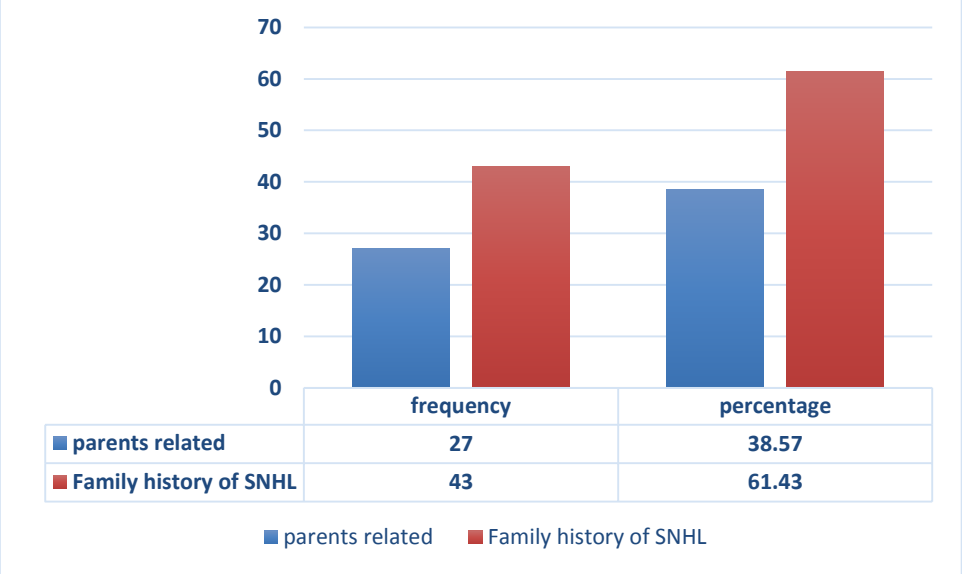

Figure-1: Distribution of patients according to parents' related and family history

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Table 3: Demographic characteristics of children patients by bilateral SNHL and Unilateral

Hearing loss groups	Total	N (%)	Unilateral (n)	%	Bilateral (n)	%
Slight (26–40 dB)	13	18.57%	5	7.14%	8	11.43%
Moderate (41–60 dB)	15	21.43%	6	8.57%	9	12.86%
Severe (61–80 dB)	21	30%	10	14.29%	11	15.71%
Profound (80 dB or greater)	21	30%	9	12.86%	12	17.14%
Number of patients	70	100%				

Table 4: CT outcomes score

Variables	Frequency	Patients
Common cavity deformity	15	21.43%
Mondini	11	15.71%
Mondini and dilated vestibular aqueduct	9	12.86%
Dilated vestibular aqueduct	14	20.00%
Narrow IAM	13	18.57%
Abnormal vestibule/semicircular canals	8	11.43%

Table 5: Aetiological diagnosis of bilateral by SNHL and abnormal CT scans

Parameters	SNHL Scan (n)	CT patients scan (n)
Genetic	40 (57.14%)	10 (14.29%)
Congenital syndromic	5 (7.14%)	1 (1.43%)
Congenital non-syndromic	8 (11.43%)	1 (1.43%)
Prenatal	4 (5.71%)	2 (2.86%)
Post-traumatic	10 (14.29%)	3 (4.29%)
Unknown aetiology	3 (4.29%)	3 (4.29%)

Table 6: Statistic relation between healthy outcomes with CT of patients and without CT.

Healthy outcomes	CT	Without
R	+0.88	-0.613
Sig	0.029	0.04

DISCUSSION

Our results found that the gene factor in patients under the SNHL scan (40) patients was more than the CT patients scan, who are 10, which identified malformations for patients or those with profound hearing loss of the third degree in children due to SNHL, where our results were similar to the results of Woolford, *et al*., [Nakano, A. *et al*., 2013]. Patients to 29.5% of the results by CT scan are abnormal, but our study differed from it in that its study was carried out on all adults, adolescents, and children who undergo cochlear implantation, but our study was conducted only on children. While previous research by Zalzal [Paul, A. *et al*., 2017] found a prevalence of 6.8% aberrant CT findings in kids with SNHL, Shusterman observed a yield of 12.85%. This wide range of CT results may be partially explained by advancements in imaging technology and a better knowledge of inner ear abnormalities associated with SNHL throughout time, as well as by the diverse populations that the various research focused on. The majority of the children having SNHL 40 individuals in our research were male. There was not a statistically significant distinction between the sexes in the degree of hearing loss or the results of the CT scan. Male aberration has yet to be adequately explained, although theories include genetic variations, boys being more frequently referred to tertiary hearing facilities, and men having more probable to hear the age of the dam. The third most prevalent homing disorder is Mondini dysplasia, which is characterized by a cochlea with normal basal flexion and a distal sac14. It occurs as a solitary finding in three instances and in conjunction with a dilated vestibular duct in four cases. In 41 out of 98 instances with abnormal CT scans (41%), Jackler [Yi, J.S. *et al*., 2013] discovered this aberration, which they classified as an incomplete segment. They hypothesized that this anomaly may be caused by a development arrest during the seventh

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week of pregnancy. These authors similarly noted dilated vestibular canals in 10 of 41 ears (24%) but hypothesized that DVA was underreported in their research because not all of their patients had access to lateral polytomograms. According to our findings, Pendred Syndrome, a hereditary disorder characterized by congenital hearing loss, goiter, or a positive chlorate test, is thought to be the cause of 11 of our infants with Mondini. According to our findings, the 14 instances of Pendred syndrome that they looked at had dilated vestibular ducts, and Mondini-type dysplasia was another frequent finding. Hearing loss, pre-intestinal pits, renal anomalies, branchial and pinna fistulas, and abnormalities of the external auditory canal are the main characteristics of the autosomal dominant condition known as branchio-oto-renal (BOR) syndrome. Semicircular duct anomalies were the second most frequent anomaly in our dataset, occurring in 8 out of 70 cases (11.43%), according to previously published findings. [Jonard, L. *et al*., 2010]

CONCLUSION

The CT scan is considered abnormal in the presence of profound hearing loss or cranial malformations in paediatric patients, which may result from the occurrence of one of the four abnormal cases of profound hearing loss or cranial malformations that are predicted by a CT scan. Regarding the evaluation of cases by CT scan, our results showed that Common cavity deformity and dilated vestibular aqueduct occupied a large percentage of hearing patients. Moreover, our study diagnosed all patients by making a comparison between SNHL scan and CT scan, where it was found that 40 patients obtained genetic status through SNHL scan, while ten patients through CT scan evaluated aetiological diagnosis of bilateral SNHL and abnormal CT scans. This study concluded that Unilateral patients were got less injured and had symptoms than Bilateral patients.

REFERENCES

1. Lieu, J.E. “Unilateral hearing loss in children: speech-language and school performance.” *B-ENT*. 21 (2013):107-115.
2. Lieu, J.E., Tye-Murray, N. and Fu, Q. "Longitudinal study of children with unilateral hearing loss." *The Laryngoscope* 122.9 (2012): 2088-2095.
3. Schmitz, J., West, K.P. and Khatry, S.K, *et al*. "Vitamin A supplementation in preschool children and risk of hearing loss as adolescents and young adults in rural Nepal: randomised trial cohort follow-up study." *Bmj* 344 (2012).
4. Greinwald, J., DeAlarcon, A. and Cohen, A, *et al*. "Significance of unilateral enlarged vestibular aqueduct." *The Laryngoscope* 123.6 (2013): 1537-1546.
5. Goderis, J., Keymeulen, A. and Smets, K, *et al*. "Hearing in children with congenital cytomegalovirus infection: results of a longitudinal study." *The Journal of pediatrics* 172 (2016): 110-115.
6. van Beeck Calkoen, E.A., Aliaga, E.S. and Merkus, P, *et al*. "High prevalence of abnormalities on CT and MR imaging in children with unilateral sensorineural hearing loss irrespective of age or degree of hearing loss." *International Journal of Pediatric Otorhinolaryngology* 97 (2017): 185-191.
7. Lin, P.H., Hsu, C.J. and Lin, Y.H, *et al*. "Etiologic and audiologic characteristics of patients with pediatric-onset unilateral and asymmetric sensorineural hearing loss." *JAMA otolaryngology–head & neck surgery* 143.9 (2017): 912-919.
8. Lin, J.W., Chowdhury, N. and Mody, A, *et al*. “Comprehensive diagnostic battery for evaluating sensorineural hearing loss in children.” *Otol Neurotol*. 32.2 (2011):259-264.
9. Ghogomu, N., Umansky, A. and Lieu, J.E. "Epidemiology of unilateral sensorineural hearing loss with universal newborn hearing screening." *The Laryngoscope* 124.1 (2014): 295-300.
10. Sennaroğlu, L. and Bajin, M.D. "Classification and current management of inner ear malformations." *Balkan medical journal* 34.5 (2017): 397-411.
11. Fedak, K.M., Bernal, A., Capshaw, Z.A. and Gross, S. "Applying the Bradford Hill criteria in the 21st century: how data integration has changed causal inference in molecular epidemiology." *Emerging themes in epidemiology* 12 (2015): 14.
12. Cama, E., Inches, I. and Muzzi, E, *et al*. “Temporal bone high-resolution computed tomography in non-syndromic unilateral hearing loss in children.” *ORL J Otorhinolaryngol Relat Spec*74.2 (2012):70-77.
13. Friedman, A.B., Guillory, R. and Ramakrishnaiah, R.H, *et al*. "Risk analysis of unilateral severe-to-profound sensorineural hearing loss in children." *International Journal of Pediatric Otorhinolaryngology* 77.7 (2013): 1128-1131.

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14. Gruber, M., Brown, C., Mahadevan, M. and Neeff, M. "Concomitant imaging and genetic findings in children with unilateral sensorineural hearing loss." *The Journal of Laryngology & Otology* 131.8 (2017): 688-695.
15. Haffey, T., Fowler, N. and Anne, S. "Evaluation of unilateral sensorineural hearing loss in the pediatric patient." *International journal of pediatric otorhinolaryngology* 77.6 (2013): 955-958.
16. Masuda, S., Usui, S. and Matsunaga, T. "High prevalence of inner-ear and/or internal auditory canal malformations in children with unilateral sensorineural hearing loss." *International journal of pediatric otorhinolaryngology* 77.2 (2013): 228-232.
17. Nakano, A., Arimoto, Y. and Matsunaga, T. "Cochlear nerve deficiency and associated clinical features in patients with bilateral and unilateral hearing loss." *Otology & neurotology* 34.3 (2013): 554-558.
18. Paul, A., Marlin, S. and Parodi, M, *et al*. "Unilateral sensorineural hearing loss: medical context and etiology." *Audiology and Neurotology* 22.2 (2017): 83-88.
19. Yi, J.S., Lim, H.W., Kang, B.C., Park, S.Y., Park, H.J. and Lee, K.S. "Proportion of bony cochlear nerve canal anomalies in unilateral sensorineural hearing loss in children." *International journal of pediatric otorhinolaryngology* 77.4 (2013): 530-533.
20. Jonard, L., Niasme-Grare, M. and Bonnet, C, *et al*. "Screening of SLC26A4, FOXI1 and KCNJ10 genes in unilateral hearing impairment with ipsilateral enlarged vestibular aqueduct." *International journal of pediatric otorhinolaryngology* 74.9 (2010): 1049-1053.

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