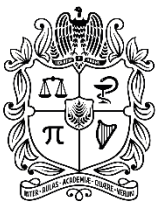

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Desenlaces comunicativos en niños con implante coclear y su relación con el coeficiente intelectual de su cuidador primario

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2019

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Tesis o trabajo de investigación presentado como requisito parcial para optar al título de:
Otorrinolaringólogo

Director:
Dr Juan Carlos Izquierdo Velásquez
Otólogo y Neurotólogo

Universidad Nacional de Colombia
Facultad de Medicina
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Acknowledgement

The authors thank Dr. Juan Pablo Alzate Granados for help with statistical analysis. They also thank Dr. Carlos Parra for his help in data collection in Cucuta city. Thanks to CINDA foundation Bogota, Colombia for being open for health improvement in children's with cochlear implant.

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Resumen

Objetivo: Evaluar la correlación entre el coeficiente intelectual (CI) del cuidador primario y los resultados comunicativos en niños con implante coclear (IC) en niños sordos pre linguales colombianos.

Métodos: Se realizó un estudio analítico de observación transversal con pacientes con implante coclear unilateral entre 3 y 11 años. El tamaño de la muestra de 46 personas se calculó para detectar una correlación de 0,4, con un nivel de significación estadística de 0,05 y una potencia del 80% para correlacionar el coeficiente intelectual del cuidador primario, con la puntuación PLS-3 en el paciente. Se excluyeron los pacientes o cuidadores con algún grado de déficit cognitivo diagnosticado previamente, trastornos psiquiátricos, sordera poslingual e implante coclear bilateral.

Resultados: Entre enero de 2016 y agosto de 201 se incluyeron 46 usuarios de IC. 19 hombres, 27 mujeres. Edad media a la implantación de 40 meses. La media del coeficiente de inteligencia primario del cuidador fue de 76,15, y la media del resultado en la prueba PLS-3 en pacientes fue de 25 meses. El resultado comunicativo se calculó midiendo la diferencia entre la edad auditiva esperada, menos la edad del lenguaje encontrada por PLS-3. Hubo una correlación inversa entre el rendimiento de CI en el cuidador principal y la diferencia en el resultado de PLS-3 respectivamente ***(rho de Spearman = -0,37, P = 0,0114).*** No hubo una fuerte correlación entre los resultados comunicativos en el paciente y el nivel socioeconómico del cuidador o el tipo de filiación de seguro de salud **(*chi2: 3,177. P = 0,3652, chi2: 0,95. P = 0,81).***

Conclusiones: La inteligencia de rendimiento en el cuidador principal, especialmente la cognición social / de memoria, se correlaciona con el resultado del habla postoperatoria en los usuarios de IC. Por lo tanto, la rehabilitación postoperatoria, incluido un programa domiciliario dirigido, podría ayudar a maximizar los resultados comunicativos postoperatorios.

Palabras clave: Implante de Coclear, Coeficiente intelectual, desenlaces comunicativos, cuidador primario.

The relationship between communicative skills in cochlear implant patients and the IQ score of the primary caregiver.

Abstract

Objective: Assess the correlation between primary caregiver Intellectual Coefficient (IQ) and the communicative outcomes in children with Cochlear implant (IQ) in Colombian pre lingual deaf children.

Methods: An analytical, observational cross-sectional study was performed with patients with unilateral cochlear implant between 3 and 11 years. Sample size of 46 people was calculated to detect a correlation of 0.4, with a statistical significance level of 0.05 and a power of 80% to correlate the IQ of the primary caregiver, with the PLS-3 score in the patient. Patients or caregivers with any degree of cognitive deficit previously diagnosed, psychiatric disorders, post-lingual deafness and bilateral cochlear implant were excluded.

Results: 46 CI users were included between January 2016 and August 2018. 19 males, 27 females. Median age at implantation of 40 months. The mean average of primary caregiver IQ was 76,15, and the average of result in PLS-3 test in patients was 25 months. The communicative outcome was calculated measuring the difference between the expected auditive age , less found language age by PLS-3. There was an inverse correlation between the IQ performance in the primary caregiver and the difference in the PLS-3 result respectively (***Spearman's rho= -0,37, P = 0,0114).*** There was no a strong correlation between communicative outcomes in patient and socioeconomic level of the caregiver or type of health insurance filiation **(*chi2: 3,177. p=0,3652, chi2:0.95. p=0,81*).**

Conclusions: Performance intelligence in the primary caregiver, especially social/memory cognition, is correlated with the postoperative speech outcome in CI users. Therefore, postoperative rehabilitation, including a directed home program—might help to maximize the postoperative communicative outcomes.

Keywords: Choclear implant, IQ, communicative Outcomes, primary caregiver

1. Introduction

The incidence of congenital sensorineural hearing loss (SNHL) oscillates about 1 per 650 live births [1, 2, 3]. The late diagnosis of deafness and the incorrect patient rehabilitation represents a problem of general interest with direct repercussions on the quality of life of individuals and their families as well as a negative impact on the economy of a society[4].

The placement of a cochlear implant (CI) at timely age does not guarantee the development of appropriate communicative skills in the deaf patient [5, 6]. It has been seen that communicative outcomes in oral and written language differ between individuals implanted with similar characteristics and disease contexts [7, 8]. In this way, the primary caregiver of the patient with a cochlear implant plays a fundamental role in the diagnosis, treatment, and rehabilitation of the deaf patient [9, 10].

Measuring the ability to solve problems, abstraction and perceptual reasoning in the child implanted through an intellectual coefficient (IQ) test is a task that has been done previously [11, 12, 13]. However, to measure the IQ of the primary caregiver of the child with a CI has never been done before and the authors strongly believe could provide relevant data for the otolaryngologist and audiologist in charge about the process of hearing rehabilitation in the children.

The main objective of this study is to determine the relationship between communicative outcomes in children with CI and the IQ of their primary caregiver as a predictor of success or failure in the process of aditory rehabilitation and the development of verbal and communicative skills in a developing country.

2. Materials and methods

An analytical, observational cross-sectional study was performed in patients with unilateral cochlear implant between 3 and 11 years of age from different type of health insurance, including private Otolaryngology consultation. The less time of auditory age for apply to the study was 2 years, and rehabilitation auditive therapy access after the surgery was mandatory. The exclusion criteria included any degree of cognitive deficit previously diagnosed (in patient or caregiver), any psychiatric disorders (in patient or caregiver), post-lingual deafness and bilateral cochlear implant. We assessed the IQ of the primary caregiver of the patient with cochlear implant using the Wechsler Adult Intelligence Scale IV **(WAIS-IV)** that was correlated with the communicative outcomes in the child implanted with a closed set of word recognition, validated for the Spanish language with the word identification test: Preschool Language Scale **(PLS-3)**

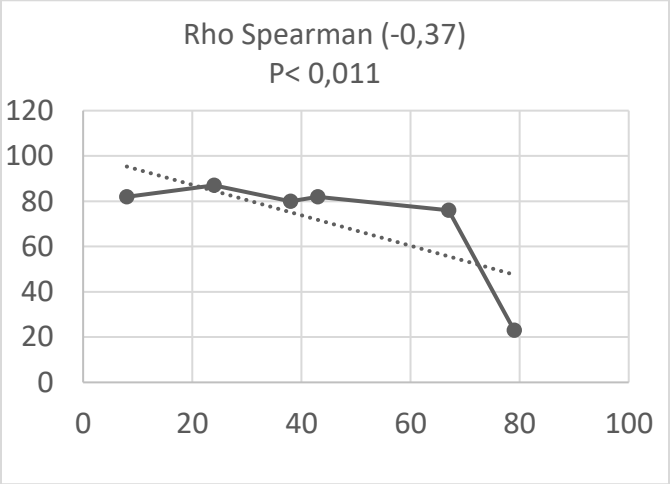
We calculated a sample size of 47 people to detect a correlation of 0.4, with a statistical significance level of 0.05 and a power of 80% to correlate the IQ of the primary caregiver of the child, with the PLS-3 score. Data was stored in Microsoft Excel base data and processed in STATA 11.0. This study was approved by the Institutional Review Committee of the Universidad Nacional de Colombia. Parents or legal guardians signed a consent that explained the procedure and potential risks.

3. Results

The communicative outcome was measured by calculating the difference between the expected hearing age in months, on the auditory age found by the PLS-3 test.

1. It shows 46 patients. Rho Spearman coefficient -0.37, Moderately negative relationship. P> 0.011. Show graph

1.1. There is an inverse relationship between the IQ of the primary caregiver and the calculated hearing age of the patient with a cochlear implant. Although it helps determine the outcome of the language of the implanted patient, it is not a determinant in the final result.



2. There is no correlation between the IQ result of the primary caregiver and the opportunity for diagnosis and agility in the placement of the implant. Rho Spearman: 0.10 (p> 0.49).

3. When WAIS IV is compared to the result of PLS-3, without standardizing, the result is not statistically significant. Rho Spearman: 0.21 (p> 0.15).

Table 1. Distribution of the population according to the scheme of affiliation to the General System of social security in health:

RÉGIMEN	N	%
Contributive	33	71%

Subsidized	9	20%
SISBEN	1	2%
Special	3	6%
Total	46	100%

1. There is no significant difference between the speed of implant placement after diagnosis, comparing them by affiliation regime.

1.1. There is a bias in the distribution of the sample, because 70% of the sample corresponds to the contributory regime. Chi2: 5.35 (p 0.25)

Table 2. Distribution by diagnosis

Diagnóstico	**N**	**% Percentage**
Congenital hearing loss	34	78%
Early Neonatal Hypoxia	4	10%
Neonatal meningitis	2	4%
Ototoxicity by Antibiotics	1	2%
Sx Waardenburg	2	4%
Sx Usher	1	2%

Table 3. Distribution by city of origin

City	**N**	**% Percentage**
Bogotá	15	32%
Cúcuta	31	68%

Table 4. Distribution by kinship of the primary caregiver:

Primary caregiver	N	% Percentage
Mother	30	65%
Father	10	22%
Grandmother	5	11%
Grandfather	1	2%

Table 5. Sociodemographic variables

Variable	Average	SD	Range
Chronological age (years)	**8,08**	**3,83**	**3-11**
Age of diagnosis (months)	**23**	10,5	3-48
Implant age (years)	**3,34**	1,23	1-6
Minutes of weekly therapy (min)	**95,8**	30	30 - 420
Expected hearing age (months)	**58,93**	44,9	6-216
Auditory age found (months)	**25,95**	20,97	4-84
PLS- corrected (months)	**32,97**	39,5	26-132

Table 6. Distribution according to the result of WAIS IV in the primary caregiver

Variable	Average	SD	Range
WAIS IV	**76,15**	**19,01**	**41-121**
Verbal comprehension	75,91	21,6	35-127
perceptual reasoning	68,36	19,9	12-106
Work memory	72,02	23,9	7-121
Processing speed	70,58	24,0	1-107

3. There is no difference in time between diagnosis and implant placement, according to socioeconomic status (chi2: 3,177, p = 0,3652)

3.1. There is also no difference between the difference in expected age and age found (corrected hearing age) and the socioeconomic stratum (chi2: 0.95, p = 0.81)

4. There is no correlation between each of the domains of the WAIS IV test, with the corrected auditory age of the patient. Verbal comprehension (-0.1342), Perceptual reasoning (-0.2195), Work memory (-0.1592), Procedure speed (0.0712)

Discussion

There exist so many variables that have been recognized as predictors of success in children with prelingual deafness who are taken to CI surgery. Age of diagnosis of deafness, age of CI placement (children implanted early achieve better results - Anderson et al., 2004; Colleti et al., 2005); and among these Miyamoto, et al in 2010 and Preisler in 2011, propose that the level of stimulation within the family and access to basic health conditions are a fundamental component in the auditory and language success in the implanted child.

It is hypothesized that the insertion of an implant and the consequent access to auditory information should be followed by an increase in the number of different words used in the spontaneous play interaction predetermined by the primary caregiver, these one must have the basics cognitive abilities to ensure the adequate psychomotor and neuropsychological development in the patient with CI. Nowadays the need for directed rehabilitation at home demands that therapist should focus domiciliary work in such a way that facilitates their understanding and subsequent reproduction from the primary caregiver, emphasizing their neurocognitive and motor strengths. It follows, then, a different rehabilitation process, involving both parties actively, creating learning and teaching programs of speech, in a directed and individual way.

To determine objectively the cognitive substrate of the guardian give us the tools to predict how successful and agile can be the home rehabilitation in the child and how feasible is that the primary caregiver provides the necessary stimuli for the development of oral and written language skills. Although there are many variables that influence the success of the cochlear implant, the author strongly believe that

The post-surgery period requires reorganization of the family's social world. Family members, in order to cope with the new demands that accompany implantation, have to assume new roles and adjust household dynamics (Allegretti, 2002). We found, as the studies of Spahn et al. (2004) and Punch and Hyde (2010) reported, that during the habilitation process mothers tend to leave their jobs in order to become the main caregiver, while fathers become the economic provider. This role change reflects the family need to adapt to the new social environment after surgery and their attempt to maintain cohesionand unity to cope with the habilitation process.

To recognize the difficulties parents face when they cannot match their cognitive understanding of it with their feelings and expectations. Understanding that cochlear implantation is a human experience

in which silence, stress, anguish, and solitude are factors that parents reported to have dealt with on an everyday basis, helps us to view implantation as a bio-psychosocial reality that requires competent and accurate communication levels between medical staff and families. How parents perceive cochlear implantation is framed by the combination of individuals' life trajectories and their socio-cultural context, however this perspective needs further research. Consequently, it is important to promote the creation of support groups that can work jointly with medical staff.

However the final outcome in paediatric implantation is yet not entirely predictable as there are a large number of factors which alone or in combination will decide the outcome of cochlear implantation.2,3 Categorizing these determinants increases the ability of clinicians to offer educated preoperative prognosis and might potentially allow for manipulation of variables in an attempt to achieve the best possible outcome

The cochlear implanted children showed improvement in their auditory skills in the first year of cochlear implant device use. Most studies of paediatric cochlear implant surgery have focused on assessing auditory skills and speech.6,7 In this study, we have evaluated the correlation of performance measures of auditory skills by Meaningful Auditory Integration Scale and Speech by Meaning use of Speech Scale measures done one to three years after Cochlear Implantation.

Conclusions

Performance intelligence in the primary caregiver, especially social/memory cognition, is correlated with the postoperative speech outcome in CI users. Therefore, postoperative rehabilitation, including a directed home program—might help to maximize the postoperative communicative outcomes.

Disclosure Statement

The authors have no conflicts of interest to declare

Funding Sources

Own resources

References

1. A. Kochhar, M.S. Hildebrand, T. Smith. Clinical aspects of hereditary hearing loss. Genet. Med., 9 (2007), pp. 393-408.

2. 2. R.L. Snoeckx, P.L. Huygen, D. Feldmann, S. Marlin, F. Denoyelle, J. Waligora, *et al.* GJB2 mutations and degree of hearing loss: a multicenter study. Am. J. Hum. Genet., 77 (2005), pp. 945-957.

3. M.L. Tamayo M. Olarte, et al. Molecular studies in the GJB2 gene (Cx26) among a deaf population from Bogota, Colombia: Results of a screening program. International Journal of Pediatric Otorhinolaryngology (2009) 73, 97—101.

4. Anderson, I, Weichbold, V., D'Haese, P. S. C., Szuchnik, J., Quevedo, M. S., Martin, J., Dieler, W.S, & Phillips, L. Cochlear implantation in children under the age of two-what do the outcomes show us? *International Journal of Pediatric Otorhinolaryngology, 68*, 425-431. 2004.

5. Andrea De Giacomo a, Francesco Craig, ET AL. Children with cochlear implants: Cognitive skills, adaptive behaviors, social and emotional skills. International Journal of Pediatric Otorhinolaryngology 77 (2013) 1975–1979.

6. Ashley Wackym, Aline Tran. Cochlear Implantation: Patient Evaluation and Device Selection. Part vPart VII. Otology and Neurotology, and skull base surgery. Otorhynolatyngology, Cummings.
7. R. Semenov, Rodrigo Martinez-Monedero, MD, Cochlear Implants Clinical and Societal Outcomes. International Journal of Pediatric otorhinolaryngology 77 (2013) 1975–1979.

8. Himanshu Swami , Surg Cmde E. James. A study to determine factors influencing outcomes of paediatric cochlear implants. Medical journal armed forcesindia 69 (2013) 366 e368.

9. Klatter-Folmer, J., Kolen, E., Van Hout, R., & Verhoeten, L. Language development in deaf children's interactions with deaf and hearing adults: a Dutch longitudinal study. *The Journal of Deaf Studies and Deaf Education, 11*, 238-251. 2006.

10. Gifford RH, Shallop JK, Peterson AM. Speech recognition materials and ceiling effects: considerations for cochlear implant programs. Audiol Neurootol 2008; 13(3):193–205.

11. Ivette Cejas,Christine M. Mitchell, et al. Comparisons of IQ in Children With and Without Cochlear Implants: Longitudinal Findings and Associations With Language . Ear and heraing. April 2018.

12. Chen M[1], Wang Z, et al. Intelligence development of pre-lingual deaf children with unilateral cochlear implantation. Int J Pediatr Otorhinolaryngol. 2016 Nov;90:264-269.

13. Park M, Song JJ. The Relation between Nonverbal IQ and Postoperative CI Outcomes in Cochlear Implant Users: Preliminary Result. Biomed Res Int. 2015;2015:313274.

14. Martínez C, Estienne P, Tomassi D, Rufiner H, Torres M. "Batería para la evaluación del reconocimiento del habla en pacientes con prótesis auditiva". Revista Federación Argentina de Sociedades de Otorrinolaringología. Vol. 4; Nº 1, pp.17-24, año 2007.

15. Furmanski H, Flandin M, Howlin M, Sterin M, Yebra S: "Test P.I.P. Prueba de identificación de palabras". Revista Fonoaudiológica. Asociación Argentina de Logopedia, Foniatría y Audiología. Tomo 43, Nº 2; pp. 13-18, año1997.

16. Chin, S. B., & Pisoni, D. B. A phonogical system at 2 years after cochlear implant. *Clinical Linguistics and Phonetics, 14*, 53-73. 2000.

17. Colletti, V., Carner, M., Miorelli, V., Guida, M., Colletti, L., & Fiorino, F. G. Cochlear Implantation at under 12 months: Report on 10 Patients. *Laryngoscope, 115*(3), 445-449. . (2005)

18. Fryauf-Bertschy, H., Tyler, R., Kelsay, D. M., & Gantz, B. Performance over time of congenitally deaf and postlingually deafened children using a multichannel cochlear implant. *Journal of Speech and Hearing Research, 35*(4), 913-920. (1992).

19. Little, K.U. Schnabel & J. Baumert (Eds.), *Modeling longitudinal and multilevel data: Practical issues, applied approaches and specific examples* pp. 15-32- 2005.

20. Le Maner-Idrissi, G., Pajon, C., Baligand, Z., Dardier, V., Deleau, M., Tan-Bescond, G., & Godey, B. Implant cochléaire et développement des échanges conversationnels.*Revue canadienne des sciences du comportement*, *40(2*), 120-127. (2008).

21. Le Normand, M. T., Ouellet, C., & Cohen, H. Productivity of lexical categories in French-speaking children with cochlear implants*. Brain and Cognition, 53*, 257-262. (2003).

22. Le Normand, M. T., Parisse, C., & Cohen, H. Lexical diversity and productivity in french preschoolers developmental and biosocial aspects by development, gender and sociocultural factors. *Clinical Linguistics and Phonetics, 22*(1), 47-58. (2008).

23. Lenarz, T. Cochlear implants: what can be achieved? *American Journal of Otology, 18*(6 Suppl), S2-3. (1997).

24. Miyamoto, R. T., Kirk, K. I., Svirsky, M., & Seghal, S. Longitudinal communication skill acquisition in pediatric cochlear implant recipients. *Advances in Otorhinolaryngology, 57*, 212-214. (2000).

25. Cynthia G. Clopper, David B. Pisoni, and Adam T. Tierney. Effects of Open-Set and Closed-Set Task Demands on Spoken Word Recognition. J Am Acad Audiol. Author manuscript; available in PMC 2012 April 11.

26. Tait, M., Lutman, M. E., & Robinson, K. Preimplant measures of preverbal communicative behavior as predictors of cochlear implant outcomes in children. *Ear and Hearing, 21*, 18-24. (2010).