Middle East Current Psychiatry

RESEARCH

Open Access

Assessing post-cochlear implantation anxiety and correlating it to socio-demographic and clinical characteristics

A. Ghaly[1], E. Nada[1], S. Rabie[2], Y. Ragaey[3] and H. Elkhatib[1*]

Abstract

Background: There is a greater incidence of mental health problems among children with hearing impairment compared to controls. A high proportion of children with hearing impairment experience delays in understanding, recognizing, and using emotional expression. There are additional difficulties in post-cochlear transplant patients that may increase the risk of developing psychopathology, such as anxiety disorder.

Results: Forty mothers of children who underwent cochlear implantation surgery responded to the Spence Preschool Anxiety Scale. Socio-demographic, medical, and perioperative data of children were obtained from medical records. On the Spence Preschool Anxiety Scale, 21 out of 40 children (52.25%) have a positive total score. On obsessive–compulsive disorder, physical injury fears, generalized anxiety, separation anxiety, and social anxiety subscales, the numbers of children who scored positive are 23 (57.5%), 18 (45%), 18 (45%), 10 (25%), and 6 (15%), respectively.

Conclusion: Anxiety disorders are common in post-cochlear transplant children.

Keywords: Cochlear implant, Anxiety, Children, Egypt, Mental health

Background

A cochlear implant is an electronic device that partially restores hearing. It can be an option for people who have severe hearing loss from inner-ear damage who are no longer helped by using hearing aids [1].

Cochlear implants use a sound processor that fits behind the ear. The processor captures sound signals and sends them to a receiver implanted under the skin behind the ear. The receiver sends the signals to electrodes implanted in the snail-shaped inner ear (cochlea) [2].

The signals stimulate the auditory nerve, which then directs them to the brain. The brain interprets those signals as sounds, though these sounds would not be just like normal hearing [3, 4].

Anxiety disorder is characterized by extensive worry, tension, and anxiety, which are problematic to keep under control. This disorder is one of the most common psychiatric disorders in childhood [5]. It has a substantial impact on children's quality of life and daily social and occupational functioning [6]. Furthermore, it is a precursor to multifarious psychiatric diagnoses later in life, such as panic disorder, depression, somatization, and bipolar disorder [7] and a risk factor for substance abuse [8]. Despite anxiety being highly prevalent, the disorder is poorly recognized in clinical practice and therefore frequently undertreated, especially in children [9]. Concerning the prevalence of anxiety in HI individuals, scant and at times contradictory literature exists [10].

In Egypt, only a few researchers studied that topic with scant data available regarding mental health in post cochlear implants.

*Correspondence: hossam.elkhateeb@must.edu.eg

[1] Misr University for Science and Technology, 6Th of October City, Egypt
Full list of author information is available at the end of the article

Methods

- Study design: This study is a retrospective study.

- Study setting and timetable:

➢Forty children with cochlear implants had been included in the study. Six children had been operated on at Misr University Teaching Hospital, 14 children had been operated on at International Golf Hospital, and 20 children were operated on at Air Force Military Hospital during the period from 2014 to 2017, Cairo, Egypt.

➢The study was done 4 years after the last cochlear implant operation.

➢The questionnaire included in the study was obtained from each child's mother.

- Sampling:

a) Sample type: a convenience sample
b) Sample size: using epi info 6 programs 40 children, aged 6 to 12 years, at the time of the study, had been included to obtain the final data in this study
c) Inclusion criteria:

1. Severe to profound sensorineural hearing loss ≥ 70 dB HL at ≥ 2 frequencies (1, 2, 4 kHz)
2. Children with failure to achieve adequate gain from conventional binaural hearing aids (3–6 months hearing aid trial)
3. Multisyllabic Lexical Neighborhood Test (MLNT) or Lexical Neighborhood Test (LNT) scores ≤ 30%
4. Syndromic and non-syndromic severe to profound sensorineural hearing loss.
5. Presence of viable spiral ganglion cells with intact cochleovestibular nerve (CVN) proved by MRI petrous bone

iv) Exclusion criteria:

1. Mild to moderate sensorineural hearing loss with adequate gain from conventional binaural hearing aids (3–6 months hearing aid trial)
2. Severe inner ear deformities proved by radiological evaluation (Michel's aplasia, cochlear aplasia, rudimentary otocyst, cochleovestibular nerve aplasia)
3. Severe mental retardation which interferes with postoperative speech rehabilitation

- Assessment and procedures:

a) Socio-demographic, medical, and perioperative data of children were obtained from medical records.
b) Spence Preschool Anxiety Scale (Arabic version by Abdelaziz Mosa M. Thabet) [11]: 26 questions on a 5-point Likert scale. It has 5 subscales: generalized anxiety, social anxiety, separation anxiety, physical injury fear, and obsessive–compulsive disorder.

- Data analysis:

All analyses were carried out using the IBM SPSS statistics software version 22.0 (SPSS). The results were tabulated and statistically analyzed using suitable statistical parameters.

Qualitative data were presented as numbers and percentages; quantitative data with parametric distribution were presented as mean, standard deviation (SD), and ranges. Student's *t*-test was used to test for statistical significance of variance between the means of the two samples. ANOVA test was used for more than two independent groups with parametric data.

In qualitative data, inferential analyses for independent variables were done using the chi-square test for the differences between proportions and Fisher's exact test for variables with small expected numbers, while correlations were done using Pearson's correlation for numerical parametric data. Linear regression analysis was used to assess the predictors of poor sleep. The confidence interval was set to 95%, and the margin of error accepted was set to 5%. *P*-value was considered significant when $P < 0.05^{*}$ and highly significant when $P < 0.001^{**}$

Results

Descriptive

Forty mothers of children who underwent cochlear implantation surgery responded to the Spence Preschool Anxiety Scale. Socio-demographic, medical, and perioperative data of children were obtained from medical records.

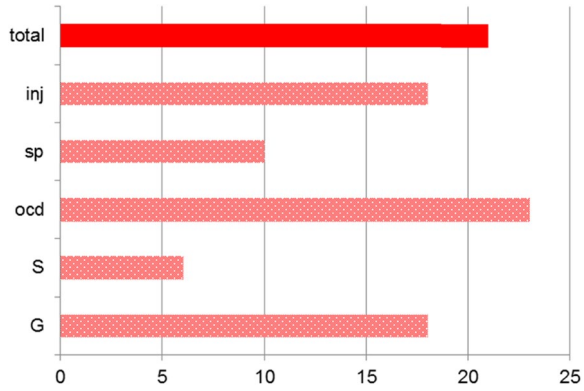

Fig. 1 Children with post-cochlear implants scores on Spence Preschool Anxiety Scale (total *t*-score and subscale scores)

All parents are married except in one family where the parents are divorced. All parents have university education except 2 fathers and 6 mothers. All parents have satisfactory income except 7 of them.

All children have no comorbid medical disorder except one who has Waardenburg syndrome (genetic disorder with hearing loss and altered pigmentation of eyes, hair, and skin).

Ten out of the 40 children (25%) experienced device failure.

The number of siblings ranges from 1 to 3 siblings, 14 have 1 sibling, 23 have 2 siblings, and 3 have 3 siblings.

Children's age ranges from 4 to 12 years old, mean 8.5, SD 1.502. Mothers' age ranges from 25 to 39 years old, mean 32.48, SD 2.801. Fathers' age ranges from 28 to 44 years old, mean 36.82, SD 3.615.

On the Spence Preschool Anxiety Scale, 21 out of 40 children (52.25%) have a positive total score. On obsessive–compulsive disorder, physical injury fears, generalized anxiety, separation anxiety, and social anxiety subscales, the numbers of children who scored positive are 23 (57.5%), 18 (45%), 18 (45%), 10 (25%), and 6 (15%), respectively (Fig. 1).

Analytical

Tables 1 and 2 show that there are no statistically significant correlations between the dependent (PAS scores) and independent (socio-demographic and clinical) variables in post-cochlear implant children.

Comparisons of the means using independent *t*-tests of positive and negative scores on PAS as regards continuous independent variables (child and parents' age) are insignificant.

Table 1 Correlating independent variables to subscales crude scores and PAS total *t*-score using Pearson correlation for continuous variables and Spearman correlation for categorical variables

Statistical test		Generalized anxiety	Social anxiety	OCD	Separation anxiety	Physical injury	Total PAS
Pearson correlation	Child age	−0.172 (0.289)	−0.064 (0.693)	−0.162 (0.317)	0.028 (0.865)	−0.071 (0.662)	−0.130 (0.423
	Mother age	0.40 (0.809)	0.067 (0.680)	0.098 (0.549)	0.112 (0.491)	0.134 (0.410)	0.074 (0,650)
	Father age	−0.071 (0.665)	−0.102 (0.529)	−0.077 (0.635)	0.114 (0.485)	0.141 (0.386)	0.048 (0.768)
Spearman correlation	Number of sibs	0.125 (0.441)	0.128 (0.431)	0.105 (0.520)	0.016 (0.920)	0.114 (0.485)	0.042 (0.795)
	Device failure	0.231 (0.151)	0.260 (0.105)	0.004 (0.979)	0.216 (0.180)	0.17 (0.295)	0.169 (0.297)

Table 2 Comparing the means of positive and negative subgroup scores on the PAS total scale and its subscales across different independent variables (child age, maternal age, father age) using independent samples *t*-test, as well as comparing the distribution of positive and negative subgroup scores on PAS total scale and its subscales as regards categorical independent variables (number of sibs, device failure) using chi-square for independence

Statistical test	Dependent variable; independent variable	Generalized anxiety	Social anxiety	OCD	Separation anxiety	Physical injury	Total PAS
Independent *t*-test	**Child age**	1.28 (0.208)	−0.882 (0.383)	0.316 (0.754)	0.633 (0.533)	−0.209 (0.836)	1.245 (0.221)
	Mother age	−0.275 (0.785)	−1.134 (0.111)	0.330 (0.743)	−0.174 (0.863)	−0.842 (0.405)	−0.337 (0.738)
	Father age	−0.1.07 (0.291)	−1.632 (0.264)	0.260 (0.796)	0.448 (0.657)	−0.624 (0.537)	−0.118 (0.907)
Chi-square	**Number of sibs**	0.328 (0.849)	2.027 (0.363)	2.485 (0.289)	1.031 (0.597)	1.131 (0.568)	0.342 (0.559)
	Device failure	**3.367 (0.067)**	2.353 (0.125)	0.853 (0.356)	1.212 (0.217)	0.135 (0.714)	0.154 (0.926)

Comparisons of the distributions using chi-square for the independence of positive and negative scores on PAS as regards categorical independent variables (number of sibs and device failure) are insignificant as well.

Discussion

Anxiety and related disorders are critical aspects in determining psychological well-being and social functioning in HI children and adolescents. Previous literature showed conflicting evidence, with anxiety levels of HI children that were higher than 9–11 or similar to 13, 25 those of NH children [11].

Nevertheless, the large heterogeneity existing in the HI population has essential implications for reporting levels of anxiety accurately and precisely. In this study, different types of anxiety were analyzed. In this study, we found that 52.25% have positive total scores by using the Spence Preschool Anxiety Scale. On obsessive–compulsive disorder, physical injury fears, generalized anxiety, separation anxiety, and social anxiety subscales, the numbers of children who scored positive are 23 (57.5%), 18 (45%), 18 (45%), 10 (25%), and 6 (15%), respectively.

In this study, there are no statistically significant correlations between the dependent (PAS scores) and independent variables (socio-demographic and clinical) in post-cochlear implant children.

Another study found that CI recipients reported similar levels of general and social anxiety to those found in their NH counterparts. When parents became the informants, again, similar levels of generalized anxiety disorder were detected. Furthermore, age at cochlear implantation and duration of use impacted the levels of both general and social anxieties; the earlier a child had received a CI and the longer a child had been wearing a CI, the lower the levels of these two types of anxiety were. Therefore, the CI appears to have a positive influence on the prevention of anxiety [12].

Similarly, three studies show higher levels of anxiety in HI children when reported by themselves [13, 14], or by their parents; two studies claim that there is no significant difference in the level of anxiety [15, 16]. Unfortunately, these studies did not make a distinction between subtypes of anxiety, such as general and social anxiety.

In another study, parents of the children with hearing aids reported their children as being more prone to developing generalized anxiety disorders than did parents of the NH controls [17, 18]. These results are very encouraging for children with a CI, suggesting fewer social obstacles for children with a CI than for their HI peers with a conventional hearing aid.

However, these positive outcomes for children with CI could also be the result of factors other than the implant itself [18]. Possibly, CI children have attended rehabilitation programs where they have increased access to speech therapists, psychologists, social workers, and other professionals to prevent or diminish psychopathology or any developmental gaps in the areas of speech, language, and socialization [12].

Niparko et al. have already shown that early implantation is the most important factor for well-spoken language development [19]. Another plausible interpretation is that the parents (and teachers) of the CI recipients have higher expectations after implantation and perhaps become less protective and more demanding in raising their child. It is also possible that the children with CIs have more contact with peers in the hearing society and therefore feel less (socially) anxious.

Conclusions

Anxiety disorders are common in post-cochlear transplant children.

Abbreviations

MLNT: Multisyllabic Lexical Neighborhood Test; LNT: Lexical Neighborhood Test; CVN: Cochleovestibular nerve; PAS: Preschool Anxiety Scale by Spence; CI: Cochlear implantation; HI: Hearing impairment; NH: Normally hearing.

Acknowledgements

None

Recommendations

Further research to study and determine the factors related to high levels of anxiety in post-cochlear implant children is necessary.

Authors' contributions

GA, EN, SR, RY, and HE shared the steps of the design, background review, statistical analysis, results in representation, and discussion. The authors read and approved the manuscript.

Funding

None.

Availability of data and materials

Applicable.

Declarations

Ethical approval and consent to participate

Ethical approval was obtained from the ethical committee in the three settings.

Written informed consent was given by the participating mothers of children post-cochlear implants before data collection. The objectives of the study were discussed, and the procedures were explained. It was clarified that participation was free and voluntary and with no direct advantage for her. Additionally, the right to decline or withdraw from the research was granted at any time without reasons or excuses to be required or drawbacks on them. They were guaranteed confidentiality and made aware that their identities would be concealed on publication.

Consent for publication

Written informed consent was given by the participants for publication.

Competing interests

The authors declare that they have no competing interests.

Author details
[1]Misr University for Science and Technology, 6Th of October City, Egypt. [2]Helwan University, Helwan, Egypt. [3]Otorhinolaryngology Department, Beni-Suef University, Beni Suef, Egypt.

Received: 4 April 2022 Accepted: 10 May 2022
Published online: 11 July 2022

References

1. Cochlear implants. National Institute on Deafness and Other Communication Disorders. https://www.nidcd.nih.gov/health/cochlear-implants. Accessed 9 Oct 2019.
2. Before, during, and after implant surgery. U.S. Food & Drug Administration. https://www.fda.gov/medical-devices/cochlear-implants/during-after-implant-surgery. Accessed 8 Oct 2019.
3. What is a cochlear implant? U.S. Food & Drug Administration. https://www.fda.gov/medical-devices/cochlear-implants/what-cochlear-implant. Accessed 8 Oct 2019.
4. Cochlear implant health. American Academy of Otolaryngology-Head and Neck Surgery. https://www.enthealth.org/be_ent_smart/cochlear-implant-health/. Accessed 8 Oct 2019.
5. Chavira DA, Stein MB, Bailey K et al (2005) Child anxiety in primary care: prevalent but untreated. Depress Anxiety 20:155–164
6. Kroes M, Kalff AC, Kessels AGH et al (2001) Child psychiatric diagnoses in a population of Dutch schoolchildren aged 6 to 8 years. J Am Acad Child Adolesc Psychiatry 40:1401–1409
7. Nutt D, Argyropoulosa S, Hooda S et al (2006) Generalized anxiety disorder: a comorbid disease. Eur Neuropsychopharmacol 16:s109–s118
8. Simon N (2009) Generalized anxiety disorder and psychiatric comorbidities such as depression, bipolar disorder, and substance abuse. J Clin Psychiatry 70(suppl 2):10–14
9. Kroenke K, Spitzer R, Williams JBW et al (2007) Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. Ann Intern Med 146:317–325
10. Munk-Jorgensen P, Allgulander C, Dahl AA et al (2006) Prevalence of generalized anxiety disorder in general practice in Denmark, Finland, Norway, and Sweden. Psychiatr Serv 57:1738–1744
11. Spence SH, Rapee R, McDonald C, Ingram M (2001) The structure of anxiety symptoms among preschoolers. Behav Res Ther 39:1293–1316
12. Stephanie CPM, Theunissen MD, Carolien R et al (2012) The American Laryngological, Rhinological and Otological Society, Inc. Laryngoscope 122:654–659
13. Li H, Prevatt F (2010) Deaf and hard of hearing children and adolescents in China: their fears and anxieties. Am Ann Deaf 155:458–466
14. van Eldik T (2005) Mental health problems of Dutch youth with hearing loss as shown on the Youth Self Report. Am Ann Deaf 150:11–16 (Konuk N, Erdogan A, and Atik L, et al. Evaluation of behavioral and emotional problems in deaf children by using the child behavior checklist. Neurol Psychiatry Brain Res 2006;13:59–64)
15. Remine M, Brown PM (2010) Comparison of the prevalence of mental health problems in deaf and hearing children and adolescents in Australia. Aust N Z J Psychiatry 44:351–357
16. King NJ, Mulhall J, Gullone E (1989) Fears in hearing-impaired and normally hearing children and adolescents. Behav Res Ther 27:577–580
17. Bat-Chava Y, Martin D, Kosciw J (2005) Longitudinal improvements in communication and socialization of deaf children with cochlear implants and hearing aid: evidence from parental reports. J Child Psychol Psychiatry 46:1287–1296
18. Khan S, Edwards L, Langdon D (2005) The cognition and behavior of children with cochlear implants, children with hearing aids and their hearing peers: a comparison. Audiol Neurootol 10:117–126
19. Niparko JK, Tobey EA, Thal DJ et al (2010) Spoken language development in children following cochlear implantation. JAMA 303:1498–1506

Publisher's Note