Psychopathology in hearing-impaired children

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CHAPTER 4

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Anxiety in children with hearing aids or cochlear implants, compared to normally hearing controls

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ABSTRACT

Objectives
The objectives of this study were to examine the levels of anxiety in hearing-impaired children with hearing aids or cochlear implants, as compared to normally hearing children, and to identify individual variables that were associated with differences in the level of anxiety.

Study design
Large retrospective cohort study.

Methods
Self- and parent-reports concerning General anxiety, Social Anxiety, and Generalized Anxiety Disorder were used. The study group (mean age 11;09) consisted of three age-matched subgroups: 32 children with cochlear implants, 51 children with conventional hearing aids, and 127 children without hearing loss.

Results
Levels of anxiety in children with cochlear implants and normally hearing children were similar. Early implantation was associated with lower levels of General and Social anxiety. Remarkably, children with conventional hearing aids had higher levels of Social anxiety and their parents also reported more Generalized anxiety disorder.

Conclusions
The outcomes demonstrate that in their level of anxiety children with cochlear implants might be more comparable to normally hearing children than to children with hearing aids. This positive finding can be the consequence of audiological factors or other aspects of the cochlear implant rehabilitation program.

INTRODUCTION

Hearing-impaired (HI) children encounter communicative, social, and emotional problems beyond those experienced by their normally hearing (NH) counterparts. These additional difficulties may increase the risk of developing psychopathology, such as anxiety disorder. 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 of childhood [1]. It has a substantial impact on children's quality of life and daily social and occupational functioning, generating an economic burden to society [1-4]. Furthermore, it is a precursor to multifarious psychiatric diagnoses later in life, such as panic disorder, depression, somatization, and bipolar disorder [5, 6], and a risk factor for substance abuse [6]. Pediatric anxiety disorders affect approximately 17% to 24% of all children [1, 4]. Despite of anxiety being highly prevalent, the disorder is poorly recognized in clinical practice and hence frequently undertreated, especially in children [1, 7, 8]. Concerning the prevalence of anxiety in HI individuals, scant and at times contradictory literature exists. Three studies show higher levels of anxiety in HI children when reported by themselves [9, 10] or by their parents [11]; two studies claim that there is no significant difference in the level of anxiety [12, 13]. Unfortunately, these studies did not make a distinction between subtypes of anxiety, such as general and social anxiety. Moreover, these five studies have been conducted with just two groups, i.e., HI versus NH participants, without accounting for the type of device (conventional hearing aid or CI), while in previous studies the devices have been proved to affect mental health [14].

Hence, there is a paucity of data guiding how often anxiety is being detected in HI children, although these children tend to identify the world as more fear-provoking and intimidating than NH children [9]. Additionally, it is not yet evident whether cochlear implants (CI) enable children to reduce or overcome anxiety. In this study, the main goal was to examine the level of anxiety in HI children with CIs or with conventional hearing aids, as compared to NH children. There is a need to study these emerging fears and related anxieties in order to achieve better understanding of the emotional needs of this population and to prevent the development of anxiety disorders [9]. Furthermore, we aimed to provide better insight into the potential and individual factors associated with anxiety, in order to reduce anxiety in HI children. Therefore, we investigated the influence of degree of hearing loss, age at onset of hearing loss, mode of communication, school placement, socioeconomic status, age at implantation, duration of device use, cognitive ability, and language skills.

METHODS

Participants

In total 210 children participated in this study. We chose the age range of nine to fifteen years old, because over this period children become able to reproduce and reflect upon their own behavior and emotions [15]. Children living in the Netherlands or in the Dutch speaking part of Belgium could be included. The exclusion criteria were experiencing mild

and/or postlingually detected hearing loss or having any other medical or developmental disability, like mental retardation, visual impairment, or speech motor problems. The Medical Ethics Committee of the Leiden University Medical Center granted permission for the study.

The inclusion criteria for the children with hearing loss were having moderate (40 - 60 dB) – severe (60 – 90 dB) to profound (> 90 dB) hearing losses in both ears (this residual hearing was calculated by averaging unaided hearing thresholds at 500, 1,000, and 2,000 Hertz) that were detected pre- or perilingually. All children were born into hearing families, except for one child, whose parents both were deaf. The HI children who received a CI were implanted between 1;02 and 10;09 years old (*M* = 4;07, *SD* = 2;11). The total duration of CI use varied between 0;10 and 12;08 years old (*M* = 7;05, *SD* = 2;08). Table 1 shows descriptive statistics. No significant differences in age, gender, or socioeconomic status were found between the HI and control group. In addition, the groups were compatible concerning their IQ and language performance. For the HI sample, also no gender, age, IQ, language, or socioeconomic status differences were found between children who received CIs and children who received conventional hearing aids.

Procedure

In order to reach the complete spectrum of HI children and to reduce any possible selection bias, the HI children were recruited from Speech and Hearing centres, hospitals, and primary, and secondary schools (special schools for the deaf and mainstream schools). The children were in schools that promoted the development of auditory and oral skills, with or without the use of signs. The 127 controls were recruited at primary and secondary mainstream schools. Parental consent was obtained for all children. Prior to starting with the test session, children were assured that their responses would be processed anonymously. Instructions were provided clearly and simply, in an appropriate communicative way to ensure children's understanding. According to the preferred mode of communication, HI children could choose between two versions: a written version or a version in which each item was presented in written text and sign language simultaneously. Fifty-six children (68%) chose the written version and 27 children (32%) chose the simultaneous version.

Materials

A shortened version of the *Fear Survey Schedule for Children - Revised* (FSSC-R) was used to measure general levels of fearfulness of children aged 7 to 17 [16]. This self-report consists of 25 items that measure the intensity of children's fears of failure and criticism (e.g., "Making mistakes"), the unknown (e.g., "Going to bed in the dark"), small animals (e.g., "Spiders"), danger and death (e.g., "Being hit by a car or truck"), and medical affairs (e.g., "Getting a shot from the doctor"). Each item consists of a self-evaluation sentence with a score in the direction of severity from 1 (*no fear*) to 3 (*a lot of fear*). In other studies, this instrument has shown to have high consistency and reliability and it has also been used in studies with children with physical disabilities [17, 18]. The questionnaire had a high internal consistency, for both the HI and the NH group (Table 2).

Table 1 Demographic and medical profile of participants

	Total sample (*N* = 210)		**HI sample (*n* = 83)**	
	HI	**Controls**	**CI**	**Hearing aid**
Number of children - *n* (%)	83	127	32	51
Age mean in months (*SD*)	11;11 (1;08)	11;08 (1;04)	11;08 (1;08)	12;01 (1;08)
Age range (in months)	110 - 192	99 - 176	110 - 192	110 - 188
Gender - *n* (%)				
Male	40 (48%)	57 (45%)	15 (47%)	25 (49%)
Female	43 (52%)	70 (55%)	17 (53%)	26 (51%)
Socioeconomic status mean (*SD*) [a]	11.6 (2.1)	12.2 (2.3)	12.1 (2.4)	11.2 (1.9)
Socioeconomic score range	7.3 - 15.0	5.3 - 15.0	8.0 - 15.0	7.3 - 15.0
Language skills mean (*SD*)				
Sentence comprehension	52.1 (32.9)	52.3 (28.7)	53.1 (34.7)	51.5 (32.1)
Story comprehension	47.7 (34.5)	51.1 (29.5)	40.1 (34.6)	52.7 (33.9)
Nonverbal IQ mean (*SD*)				
IQ norm score Picture arrangement	10.7 (3.4)	10.7 (3.4)	10.4 (3.4)	11.0 (3.4)
IQ norm score Block design	10.1 (3.2)	10.7 (3.0)	9.6 (3.9)	10.5 (3.4)
Degree of hearing loss - *n* (%) [b]				
Moderate (40-60 dB)	20 (24%)		0 (0%)	20 (39%)
Severe (61-90 dB)	16 (19%)		0 (0%)	16 (31%)
Profound (>90 dB)	42 (51%)		30 (94%)	12 (24%)
Unknown	5 (6%)		2 (6%)	3 (6%)
Preferred mode of communication - *n* (%)				
Oral language only	56 (68%)		21 (66%)	38 (69%)
Sign-supported Dutch	25 (30%)		11 (34%)	14 (27%)
Sign language only	2 (2%)		0 (0%)	2 (4%)
Type of education - *n* (%)				
Regular education	49 (59%)		17 (53%)	32 (63%)
Special education	34 (41%)		15 (47%)	19 (37%)
Age at onset of hearing loss - *n* (%)				
Prelingual	66 (80%)		28 (88%)	38 (74%)
Perilingual	9 (11%)		1 (3%)	8 (16%)
Unknown	8 (9%)		3 (9%)	5 (10%)

[a] Socioeconomic status score was measured by parental education, job, and net income.
[b] Degree of hearing loss was calculated by averaging unaided hearing thresholds at 500, 1,000, and 2,000 Hertz.

Table 2 Psychometric properties and descriptive statistics of General anxiety, Social anxiety, and Generalized anxiety disorder

	Range	Cronbach's Alpha		Mean scores *(SD)*	
		HI	Controls	HI	Controls
SR General anxiety	1 - 3	.90	.90	1.76 (.38)	1.67 (.37)
SR Social anxiety	1 - 3	.79	.79	1.63 (.45)	1.56 (.44)
PR Generalized anxiety disorder (CSI)*	1 - 4	.84	.76	1.50 (.46)	1.36 (.35)

Note. SR is Self-report; PR is Parent-report.
*$p < .05$.

To assess social anxiety, a short index consisting of six items was developed especially for this study by a team of child psychologists, targeting the key aspects of social anxiety. Sentences were formulated short and simple, so HI children with language comprehension problems would be able to understand these items and respond to them coherently. Example items are "I'm afraid of being bullied" or "I'm afraid of talking with someone I don't know". Children could answer each item to which extent they experienced this kind of fear: 1 (*(almost) never*) to 3 (*(almost) always*). Cronbach's Alpha's for each group were good (Table 2).

The *Child Symptom Inventories - 4* (CSI-4) are parent-completed rating scales that allow for the screening of emotional and behavioral disorders [19]. The complete questionnaire comprises four scales, but only the scale assessing Generalized anxiety disorder was used, consisting of seven items concerning anxiety (i.e. "Has difficulty controlling worries"). Each item could be scored with the answers *never, sometimes, often,* or *very often*. Unfortunately, not all parents sent this questionnaire back to us (in total 72 parents of the hearing-impaired children and 98 parents of the controls completed the questionnaire). Again the internal consistency was high (Table 2).

The nonverbal intelligence of the children was assessed with two subtests of the *Wechsler Intelligence Scale for Children - Third Edition:* Block Design (copying geometric designs with cubes) and Picture Arrangement (sequencing pictures to make logical stories) [20, 21]. All raw scores were transformed into age equivalent standard scores (10 = average). Of 5 HI and 16 NH children IQ tasks were not administered.

Two types of language skills were assessed; a *Sentence comprehension task* and a *Story comprehension task*. These two tasks were administered to ensure that participants would have sufficient language knowledge to understand and interpret the items of the questionnaires. HI children using oral language and NH controls received two subtests of the Dutch version of the *Clinical Evaluation of Language Fundamentals® - Fourth Edition* (CELF® - 4) [22, 23]. HI children who use sign or sign-supported language received subtests of the Assessment Instrument for Sign Language of the Netherlands [24]. The language areas evaluated with these subtests are (auditory) comprehension of language, memory, logic, syntax, and semantics. All language scores were transformed to age equivalent scores to enable calculation of one Sentence comprehension score and one Story comprehension score. Of 11 HI and 16 controls the Sentence comprehension task was not administered and of 7 HI and 16 NH controls the Story comprehension task was not administered.

Statistical analyses

In order to compare the levels of anxiety between the HI and NH children and all subsamples of the HI group (i.e., type of device, degree of hearing loss, preferred mode of communication, and type of education) *t*-tests and Analysis Of Variance (ANOVA) with Bonferroni correction were carried out. The Bonferroni correction was chosen, because we wanted guaranteed control over the Type I error rate. The relations between the individual variables and anxiety were established by means of (partial) Pearson's correlations. The program *Statistical Packages for the Social Sciences* version 19.0 was used.

RESULTS

Anxiety in HI and NH children

First, the total group of HI children (with and without CIs) was compared to the NH control group (Table 2). The scores on the self-reports for General anxiety nor Social anxiety revealed a difference between the two groups, $t(208) = -1.71$, $p = .088$ and $t(208) = -1.11$, $p = .267$, respectively. However, parents of HI children reported more Generalized anxiety than parents of NH children, $t(168) = -2.20$, $p = .029$.

Anxiety in subsamples of HI group

Subsamples were derived from the total group of HI children. All subsamples were comparable regarding age and gender. ANOVAs were carried out to examine differences on the three types of anxiety between CI recipients, children with conventional hearing aids, and NH controls. The outcomes in Figure 1 show that differences were found for Social anxiety, $F(2,207) = 3.85$, $p = .023$, and Generalized anxiety disorder, $F(2,167) = 3.70$, $p = .027$. No differences were identified for General anxiety, $F(2,207) = 2.10$, $p = .127$. Post-hoc analyses with Bonferroni correction showed that CI recipients reported significantly lower scores on the Social anxiety scale than children who received conventional hearing aids, $p = .036$, and that HI children with hearing aids had a significantly higher score on the Generalized anxiety disorder scale than NH controls, $p = .022$.

Besides a differentiation within the HI group based on hearing device, we additionally examined the degree of hearing loss, preferred mode of communication and type of education (Table 3). Again, Social anxiety caused a difference within the HI group. The ANOVA showed significant differences on Social anxiety between participants with moderate, severe, or profound hearing losses, $F(2, 75) = 4.06$, $p = .021$. Post-hoc analysis with Bonferroni correction revealed that HI children with profound losses reported less Social anxiety than children with moderate losses, $p = .020$. No other differences appeared.

In order to further examine the extent to which the Degree of hearing loss is related to Social anxiety, or whether the low score for Social anxiety in the group with profound hearing losses is due to the fact that only this group consists of CI children ($n = 30$), we performed an additional ANOVA on Social anxiety without CI children. Without the CI recipients, Degree of hearing loss was no longer related to the level of Social anxiety.

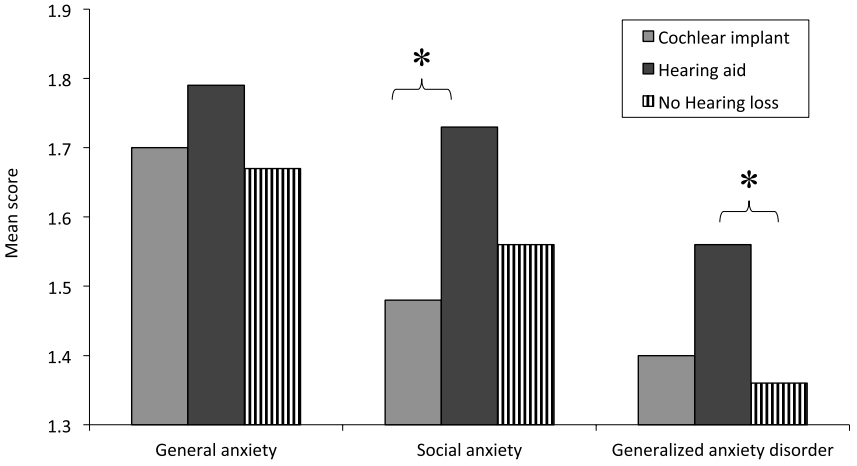

Figure 1 Mean scores of children with CIs, with hearing aids, and NH children.
*$p < .05$.

Table 3 Descriptive statistics of subsamples of HI group

		General anxiety	Social anxiety	Generalized anxiety disorder (CSI)
	n	***M (SD)***	***M (SD)***	***M (SD)***
Type of device				
Cochlear implant	32	1.70 (.40)	1.48 (.44)	1.40 (.42)
Hearing aid	51	1.79 (.37)	1.73 (.43)	1.56 (.47)
Degree of hearing loss [a]				
Moderate	20	1.77 (.38)	1.83 (.51)	1.63 (.44)
Severe	16	1.85 (.34)	1.68 (.29)	1.52 (.46)
Profound	42	1.68 (.39)	1.50 (.44)	1.42 (.46)
Preferred mode of communication				
Oral language only	56	1.73 (.41)	1.65 (.47)	1.51 (.43)
Sign language or sign-supported Dutch	27	1.82 (.33)	1.63 (.46)	1.47 (.52)
Type of education				
Regular education	49	1.73 (.42)	1.66 (.50)	1.54 (.45)
Special education	34	1.79 (.33)	1.59 (.36)	1.42 (.47)

[a] Degree of hearing loss was calculated by averaging unaided hearing thresholds at 500, 1,000, and 2,000 Hertz.

The mean score for Social anxiety in the group with profound hearing losses was 1.61 (*SD* = .44) for children with a hearing aid.

Relations between Anxiety and individual variables

Table 4 shows Pearson's correlations between the three different Anxiety scales and several individual variables. Gender was related to General and Social anxiety, with more anxiety in girls. Story comprehension was negatively related to General anxiety whilst positively related to Generalized anxiety disorder. Duration of CI use was negatively related to General and Social anxiety. Socioeconomic status, Sentence comprehension, IQ, and Age at detection were not associated with any of the three types of Anxiety.

Secondly, we controlled all correlations for the effect of age, because past research has shown that age can significantly influence the level of anxiety. The significant correlations kept their significance after controlling, except for Age at CI implantation: a younger age was related to lower levels of General and Social anxiety.

Table 4 Pearson's correlations between Anxiety and individual variables of HI participants

	General anxiety		**Social anxiety**		**Generalized anxiety disorder**	
	r	**Partial *r***	***r***	**Partial *r***	***r***	**Partial *r***
Age	-.17	-	-.11	-	.06	-
Gender [a]	.21*	.19*	.23*	.22*	.04	.04
Socioeconomic status [b]	-.14	-.19	-.15	-.18	-.23	-.22
Language skills						
Sentence comprehension	-.13	-.09	.03	.05	.14	.15
Story comprehension	-.26*	-.22*	.04	.07	.25*	.26*
Nonverbal IQ						
IQ norm score Picture arrangement	-.11	-.09	.11	.13	.04	.03
IQ norm score Block design	-.12	-.13	.04	.04	-.02	-.01
Age at detection of hearing loss	.06	.05	.17	.16	.09	.10
CI characteristics						
Age at CI implantation	.11	.35*	.29	.45**	.09	.11
Duration of CI use	-.35*	-.33*	-.44**	-.42*	-.13	-.13

Note. The partial correlations were controlled for age.

[a] Male is 0; female is 1.

[b] Socioeconomic status score was measured by parental education, job, and net income.

*p (one-tailed) < .05; ** p < .01.

DISCUSSION

Anxiety and related disorders are critical aspects in determining psychological well-being and social functioning in HI children and adolescents. Therefore, the purpose of this study was to explore the level of anxiety in a HI population aged 9 to 15 years and to identify the medical and audiological factors that contributed positively or negatively to the prevalence of anxiety. As stated earlier, 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. Nevertheless, the large heterogeneity existing in the HI population has essential implications for reporting levels of anxiety accurately and precisely. To our knowledge, our study is the first that accounted for this diversity, by separating the HI group by type of device, and the first in which different types of anxiety were analyzed.

First of all, we 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 on the levels of both General and Social anxiety: 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. Hence, the CI appears to have a positive influence on the prevention of anxiety. By offering the patient hearing sensitivity within the speech range, the child's potential has been improved as never before.

Taking HI children with conventional hearing aids into consideration, we found that these children reported more Social anxiety than children with CIs. Subsequently, parents of the children with hearing aids reported their children as being more prone to developing Generalized anxiety disorder than did parents of the NH controls. Yet, consistent with previous studies, degree of hearing loss was not associated with the level of anxiety [10, 11].

These results are indeed 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 [26]. Possibly, CI children have attended rehabilitation programs, where they have increased access to speech therapists, psychologists, social workers, and other professionals, in order to prevent or diminish psychopathology or any developmental gaps in the areas of speech, language, and socialization. Niparko et al. have already shown that early implantation is the most important factor for good spoken language development [27]. 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. Hence, it is evident that professionals always have to consider the heterogeneity of the HI group, and have to account for the type of device used by the participants.

CONCLUSION

This study indicates that in their level of anxiety HI children with CIs might be more comparable to NH children than to HI children with conventional hearing aids. In addition, early implantation is associated with a reduction of the possible negative effects of hearing loss, such as anxiety disorders, in order to maximize the long-term benefits for CI recipients. Children with conventional hearing aids showed higher levels of Social anxiety and their parents also reported more Generalized anxiety disorder. Therefore, this study underlines the importance of high-quality diagnostic procedures to allow accurate diagnoses of anxiety disorders in HI children, particularly the children with conventional hearing aids.

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