

ORIGINAL ARTICLE

Assessment of psychological disorders in Egyptian children with hearing impairment

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ABSTRACT

Impairment of hearing is a common birth defect which may be associated with varieties of psychological abnormalities in childhood. Knowledge and research of such issue are much lacking in Egypt; so the aim of the current study was to characterize and assess various psychological co-morbidities which could occur among hearing-impaired children. This prospective study has been conducted on a total of 40 male children, with age range between 7 and 12 years, divided into two groups. Group I included 20 children with different degrees of hearing impairment (HI), and Group II included 20 age-matched, healthy children with normal hearing. The studied children have been recruited from two schools (Al Amal School for the Deaf and Dumb, and Copts School) at Minia City, Minia Governorate, Egypt. Psychometric assessment, electroencephalography (EEG), and audiological evaluation were done for all included children. EEG abnormalities and anxiety scores were significantly higher in patients group compared with controls

($p < 0.05$); however, intelligence quotient did not differ. The present study revealed that HI is associated with psychological and EEG abnormalities. Early management of these children is expected to improve their quality of life.

KEYWORDS

Hearing impairment; Children; Psychological disorders; Anxiety; Depression; Electroencephalography.

INTRODUCTION

Hearing impairment (HI) constitutes variable degrees of hearing loss that ranges from hard of hearing to total deafness. According to the type, hearing loss can be classified into conductive, sensorineural, or mixed [1]. According to the decibels (dB) lost, HI is classified into slight hearing loss (16–25 dB), mild hearing loss (26–40 dB), moderate hearing loss (41–70 dB), severe hearing loss (71–90 dB), and profound hearing loss (>90 dB) [2].

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HI is a commonly occurring congenital defect that has a significant effect on both the individual and society [3]. Thirty-two million children (>5%) worldwide have different degrees of hearing loss [4]. In Egypt, the prevalence of HI among children was reported as 13.8% [5] and 20.9% [6]. Additionally, HI becomes more prevalent with increasing age [6].

Impairment of hearing lowers the quality of life and has many undesirable physical, psychological, and social effects [7]. It has been reported that HI can be associated with incident dementia and decreased cognitive function in adults [8]. Similarly, hearing impaired children are known to have more school and mental health problems, moderate to severe depression, and impaired social interaction [9,10]. Also, HI is significantly associated with anxiety [10]. The aim of the current study was to investigate the psychopathological complications, such as anxiety and depression, of hearing impaired children in comparison with those who have normal hearing.

MATERIALS AND METHODS

This prospective study has been conducted on a total of 40 male children, with age ranging between 7 and 12 years, divided into two groups. Group I included 20 children with different degrees of HI, according to audiometry, and is subdivided into Group Ia which included 10 children with severe HI (minimum heard sound at 71–90 dB) and Group Ib including 10 children with profound HI (minimum heard sound more than 90 dB). Group II consisted of 20 age-matched, healthy children with normal hearing. Studied children have been recruited from two schools (Al Amal School for the Deaf and Dumb, and Copts School) at Minia City, Minia Governorate, Egypt during the period from January to June 2016. The study protocol and all procedures performed were in agreement with the ethical standards of the Faculty of Medicine, Minia University, Egypt and the aim and nature of the study was explained for each parent before enrollment. An informed written consent was attained from parents of the included children before enrollment.

Children with any other significant clinical disorder which can affect the psychometric analysis, especially cognition, or cause depression or anxiety were excluded from the study. Disorders leading to exclusion were autism, attention deficit hyperactivity disorder, epilepsy, and chronic somatic diseases (e.g., diabetes mellitus, chronic kidney disease).

All studied children were subjected to the following assessments:

- A. Thorough history taking with special attention on the history of infection, drug exposure, trauma, and perinatal history (including features of congenital infection). Full developmental history was obtained to collect pertinent information (such as sitting, crawling, walking, and talking), and also a family history of deafness and consanguinity.
- B. Clinical examination such as general condition, vital signs, psychological assessment, and neurological examination to detect or exclude other associated diseases.
- C. Psychometric evaluation to measure the intelligence quotient (IQ) of the included children by an expert psychologist, using Stanford-Binet Intelligence Scale fifth edition [11].
- D. Electroencephalography (EEG): To detect the presence or absence of any abnormalities in the electrical activity of the brain. EEG records were done using an EEG machine (model LS-703A/AA, Nihon-Kohden corp., Japan), which were performed at the Pediatric Neurology Unit at Minia University Children and Maternity Hospital.
- E. Audiological evaluation: This was done to determine the degree of HI or to prove normal hearing. It was performed with Biologic Navigator Pro Click Evoked Potential System, using a machine (model Eclipse EP15/25 v4.4, Interacoustics A/S, Denmark) by an audiometric expert at Audiology Unit of Minia University Hospital.
- F. Two psychological assessment questionnaires (for anxiety and depression):
 1. Child Depression Inventory questionnaire: This assesses the severity of symptoms related to depression in children. It is formed of 27-item scale

that is self-rated and symptom-oriented, based on how they think and feel, with each state being identified with a scale from 0 to 2.0. The questionnaire was translated into Arabic version by an expert psychologist at Minia University Hospital.

2. The State-Trait Anxiety Inventory: It consists of 40 self-report items related to anxiety and a commonly used measure of anxiety trait and state. Higher scores mean higher anxiety level.

DATA ANALYSIS

Data were entered and analyzed using the SPSS program, version 20. Quantitative data were presented as mean \pm standard deviation (SD), while qualitative data were presented as frequency (%). Analysis was done by Chi-square, one-way analysis of variance, *t*-test, and Mann–Whitney *U* test when necessary. Probability value (*p*-value) of <0.05 was considered to be significant.

RESULTS

The results showed that there were no significant differences between Group I (HI children) and Group II (control) regarding age, residence, and socioeconomic status (Table 1). Table 2 shows the IQ means and classification of different groups. There was no significant difference between HI children group (either severe or profound HI subgroups) and control group regarding IQ mean or classification. There were two cases (20%) with an average IQ in the severe HI subgroup, seven cases (70%) in profound HI subgroup, and 12 cases (60%) in control group.

Regarding EEG findings (Table 3), there was a significant increase in EEG abnormalities in patients' group compared with control; three cases (30%) in the severe HI group and six cases (60%) in the profound HI group versus two cases (10%) in the control group. However, there was no significant difference between severe and profound HI subgroups concerning EEG abnormalities. The same trend of EEG results was obtained in anxiety and depression, the degree of both anxiety and depression was

significantly higher in HI patients (either severe or profound) compared with controls (Table 3). The results revealed that IQ classification was not significantly affected by EEG findings, anxiety, or depression in both HI patients and controls. In the same line with our findings, cases with moderate anxiety and depression had significantly higher EEG abnormalities in patients' group than control. There was no significant relation between the occurrence of depression or anxiety and EEG abnormalities in the same group (Table 4).

DISCUSSION

HI is a common birth defect which significantly affects persons and their relation with society, especially children [4]. Generally, hearing impaired children are highly susceptible to impaired psychological development, with social and emotional life difficulties [9].

The finding of the current study revealed no differences between HI children and controls regarding socio-economic status. However, a strong association has been reported between HI in children and poor social conditions such as family dysfunction, negative parenting behavior, and psychopathology, early separation from parents, parental poverty, and low levels of education [12]. Additionally, the frequency of parents having low levels of education was found to be higher among hearing-impaired children (42.2%) compared with normal hearing children (31.1%) [13].

Regarding the results of IQ, there was no obvious difference in IQ level between hearing impaired and normal children. Similar results have previously been reported [14]. Since children with HI may have a low score in verbal IQ test, we used in our study non-verbal test, with the help of an interpreter, to remove barriers faced by the hearing impaired child to easily understand the test. This, In addition to the small sample size, might have been reflected in finding, no noticeable difference in IQ level between them and normal hearing children. It has been reported that children with HI have lower IQ and communication skills when compared with normal ones [10]. The IQ level

Table 1 - Sociodemographic characteristics of studied children.

Variable	Group I patients (n = 20)	Group II control (n = 20)	p value
Age, years (Mean ± SD)	9.3 ± 1.7	10.1 ± 1.5	0.122 ^{NS}
Residence, No. (%)			
Rural	11 (55%)	8 (40%)	0.223 ^{NS}
Urban	9 (45%)	12 (60%)	
Socio-economic status, No. (%)			
Low	9 (45%)	5 (25%)	0.393 ^{NS}
Middle	9 (45%)	13 (65%)	
High	2 (10%)	2 (10%)	

NS, not significant.

Table 2 - IQ and classification of different groups.

Variable	Group I patients		Group II control (n = 20)	p value
	Group Ia Severe HI (n = 10)	Group Ib profound HI (n = 10)		
IQ (Mean ± SD)	100 ± 16.4	94.7 ± 9.8	99.9 ± 12.6	0.539 ^{NS}
IQ classification, No. (%)				
Superior	2 (20.0%)	0	3 (15.0%)	0.438 ^{NS}
High average	2 (20.0%)	0	2 (10.0%)	
Average	2 (20.0%)	7 (70.0%)	12 (60.0%)	
Low average	3 (30.0%)	1 (10.0%)	3 (15.0%)	
Borderline impaired	1 (10.0%)	2 (20.0%)	0	

NS, not significant.

Table 3 - EEG findings, anxiety, and depression among groups.

Variable	Group I patients		Group II control (n = 20)	p value
	Group Ia severe HI (n = 10)	Group Ib profound HI (n = 10)		
EEG				
Normal	7 (70%) ^b	4 (40%) ^b	18 (90%) ^a	0.014*
Abnormal	3 (30%)	6 (60%)	2 (10%)	
Anxiety				
Mild	4 (40%) ^b	3 (30%) ^b	15 (75%) ^a	0.011*
Moderate	6 (60%)	7 (70%)	5 (25%)	
Depression				
Mild	7 (70%) ^b	3 (30%) ^b	17 (85%) ^a	0.018*
Moderate	3 (30%)	7 (70%)	3 (15%)	

*Significant ($p < 0.05$).

^{a,b}Values with superscripts are significantly different.

Table 4 - Relation between anxiety, depression, and EEG findings in different groups.

Variable	Group I patients		Group II control		p value
	Normal EEG (n = 11)	Abnormal EEG (n = 9)	Normal EEG (n = 18)	Abnormal EEG (n = 2)	
Anxiety					
Mild	5 (45.5%) ^b	2 (22.2%) ^b	13 (72.2%) ^a	2 (100%) ^b	0.011*
Moderate	6 (54.5%)	7 (77.8%)	5 (27.8%)	0	
Depression					
Mild	5 (45.5%) ^b	5 (55.6%) ^b	15 (83.3%) ^a	2 (100%) ^b	0.018*
Moderate	6 (54.5%)	4 (44.4%)	3 (16.7%)	0	

*Significant ($p < 0.05$).^{a,b}Values with superscripts are significantly different.

of children was significantly correlated with mental status, which was highly influenced by HI [13,15]. It has been suggested that HI is associated with impaired cognitive function and incident dementia, which strongly affect the IQ level [16]. Moreover, Peelle et al. [17] reported that different degrees of HI affect the brain and neural functions, thalamus, bilateral superior temporal gyri, and brain stem.

The present results indicated that EEG abnormalities were significantly higher in the patients' group compared with the control group (p -value: 0.013). Similar findings were found by Van et al. [13] and Bailly et al. [18], both noticed more frequent EEG abnormalities among hearing-impaired children compared with normal hearing ones and was attributed to brain dysfunction among such children. A study by Remine and Brown [19] to assesses hearing loss effects on the function of the brain reported delayed brain function by hearing loss based on EEG findings, as occurrence of hearing loss results in overlapping of brain areas responsible for other senses, such as vision or touch, to the areas of the brain which normally process hearing. On the other hand, Dammeyer [20] reported no differences between hearing-impaired children and normal ones in terms of EEG findings.

Our results revealed that patients' group had a significant increase in the presence of anxiety and depression compared with the control group; however, no significant differences were found

between severe HL and profound HL subgroups. Our results were in agreement with Kvam et al. [21], who reported higher depression and anxiety levels among hearing-impaired children in comparison with controls. Also, Theunissen et al. [10] found similar results. This could be explained by the associated communication problems among such children which lead them to worry from contact with others and manifest with difficulties in emotional and social contact. Additionally, Rostami et al. [22] reported higher degrees of anxiety and insomnia among hearing impaired people. Although Theunissen et al. [23] did not find a significant difference regarding anxiety disorders among children with HI and controls, Valentijn et al. [24] reported more depressive symptoms in comparison with normally hearing children.

Accordingly, Tambs [25] reported the association of higher degree of depression and loss of self-esteem with hearing loss among young individuals. Additionally, other researchers indicate a higher prevalence of mental health problems, two to three times among children with HI [19,20]. This could be attributed to the presence of communicative barriers, stigma or discrimination, or the etiology of hearing loss [21]. Additionally, the low ability to express demands with subsequent impaired interests and activities make affected individuals more vulnerable to mental health harms, especially depression. In our study,

we noticed that normal hearing children were suffering from mild to moderate depression and anxiety and this may be due to the fact that anxiety and depression can be normal during childhood development and every child goes through its phases.

The present results showed a significant relation between EEG abnormalities and the prevalence of depression in hearing impaired children. These results were supported by many investigators [26,27], who found some depression and anxiety related EEG changes, manifesting as abdominal distress, nausea, depersonalization or derealization, and paresthesias caused by panic attacks. Decreased volume of dorsolateral prefrontal cortex and subgenual gyrus altered activity and connectivity in frontal and anterior cingulate cortex networks, altered growth factors, and inflammatory cytokines, are among the anatomical, physiological, and metabolic events reported in depression [28–30]. Also, elevated EEG alpha activity during rest in depressed persons has been reported [31]. Moreover, Begic et al. [32] reported increased delta, theta, and beta activity and decreased alpha activity in both schizophrenia and depression.

CONCLUSIONS

HI is significantly linked to EEG abnormalities. Also, the presence of both anxiety and depression was found to be significantly increased in hearing-impaired children compared to those with normal hearing. Both anxiety and depression, the commonest psychological disorders in children with HI, are preventable and curable. Further studies, with larger sample size, to evaluate the psychopathological complications of HI and to study the impact of other variables such as methods of education, parental factors, and its effects on the child are warranted.

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