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Language development in sensorineural hearing loss children using cochlear implants

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Abstract

A child with hearing loss is facing certain problems arising from deficits in spoken language abilities. Deficient language commonly leads to reading problems, limits academic performance. Many studies have demonstrated that children with severe-to profound hearing loss understand and produce spoken language better when they have a cochlear implant at younger age, rather than hearing aids. To evaluate language development in sensorineural hearing loss children using cochlear implant. This study included 50 children with sensorineural hearing loss children using unilateral cochlear implants, age ranging from 5years to 10years. All children will be assessed with Preliminary Diagnostic Procedures (Parents interview and history taking), IQ assessment, Audiological evaluation, language assessment. All language parameters are affected by duration of deafness, age of implantation, and duration of rehabilitation. Short period of deafness, early age of implantation, and regular rehabilitation improve language ability in children with unilateral cochlear implant.

Keywords: Cochlear implant, Children language, Post CI outcome.

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1. Introduction

Normal hearing is vital to normal development of oral speech and language. Hence, limited or no access to environmental sounds and speech caused by the children's deafness may interfere with their development of overall language skills [1]. Young children who experience severe-to-profound sensorineural hearing loss (SNHL) face challenges in developing spoken language since they are unable to detect acoustic-phonetic cues, which are essential for speech recognition. This is also the case when they are fitted with traditional amplification devices (hearing aids). Cochlear implantation is the treatment of choice for the vast majority of children identified with early, severe-to-profound SNHL [2]. Moreover, speech perception and spoken language development occur rapidly following cochlear implantation in young children [3]. Explaining this variability in speech perception and language outcomes, with the goal of developing targeted interventions, is one of the most important research and clinical goals in the field of pediatric cochlear implantation [4]. Factors such as earlier age at implantation, shorter duration of deafness before implantation, better residual hearing prior to implantation, quality of speech-language rehabilitation and use of auditory-oral language modalities predict positive speech and language outcomes following implantation [3].

1.1. Aim of the work

To evaluate language development in sensorineural hearing loss children using cochlear implant.

2. Patients and method

This study included 50 Egyptian children using unilateral cochlear, age ranging from 5years to 10years.It included 28 males and 22females, 31 children were fitted with Speech processors OPUS2 and 19 children were fitted with Cochlear synchrony. All children will be assessed with Preliminary Diagnostic Procedures (Parents interview and history taking), IQ assessment, Audiological evaluation, language assessment).

3. Result

In this study, 21(42%) had positive family history and 29(58%) were negative family history. there were 19(38%) are positive consanguinity and 31(62%) are negative consanguinity. There were 43(68%) had irrelevant complication and 7 (14%) were preterm babies (Table 1).

There were 40(80%) positive history of jaundice and 10(20%) were negative history of jaundice. There were 4(8%) who had a positive history of incubation and 46(92%) had negative history of incubation. The mean and standard deviation of age of first word is 38.9±19.14 with range (12-96) months. The mean and standard deviation of age of first sentence is 61.71±21.195 with range of (24-120) months History of hearing, Onset of hearing loss were congenital in 42(84%) of child and acquired or late in 8(16%) of child (Table 2). The course of hearing loss was progressive in 15(30%) of child and stationery in 35(70%) of child. The mean and standard deviation duration of deafness is34.4±14.01 with range (6-60) months (Table 3). There were 9(18%) child with right severe hearing loss, 35(70%) child with right severe to profound hearing loss, 6(12%) child with right profound hearing loss and4 (8%) child with left severe hearing loss,38(76%) child with left severe to profound hearing loss, 8(16%) child with left profound hearing loss (Table 3). The mean and standard deviation of duration of using hearing aid before implantation is 16.28±12.66. The mean and standard deviation of age of hearing aid fitting before implantation is 25.1±14.4. The mean and standard deviation of age of child at implantation is 45.64±12.47 with range (23-72) ms. The mean and standard deviation of duration of use CI implant is 45.70±20.47 with range (12-92) ms (Table 3). The mean and standard deviation of IQ assessment is 85.47±4.25 with range (80-97). The mean and standard deviation of mental age is 78.98±18.28 with range (50 -110) months (Table 4). Nine (18%) children had poor vocabulary and 41(82%) children had rich vocabulary. 22(44%) children had single word 12(24%) child had two-word sentence and 8(16%) children had three to four sentence, 8(16%) child had long sentence (Table 5).

4. Discussion

The cochlear implant is a revolutionary solution for hearing rehabilitation that aims to improve the life quality of children with severe to profound and profound sensorineural hearing loss. Language development is an important scale for evaluation of successful cochlear implantation surgery, the completion of language acquisition means the end of the language rehabilitation stage and the start of a successful academic journey. In this study, there were delay age of first sentence and first word utterance. This result may be explained by the long duration of deafness and old age of child at implantation. This agreed with Dettman et al. [5] who reported that Early CI fitting, before the age of 12 months, provides children who are HH or deaf the ability to develop sufficient speech perception and recognition to achieve nearly age-appropriate spoken language development. In This study, there were 9 (18%) children who had poor vocabulary and 41(82%) children had rich vocabulary. 22(44%) children had single word 12(24%) child had two-word sentence and 8(16%) children had three to four sentence, 8(16%) child had long sentence. This is due to delay in first word and first sentence utterance that due to late implantation effect on language development in two ways; first, it longer the period of deafness which is associated with a lower rate of language learning and development. This agreed with Tomblin et al. [6] who stated that children with HL lag their age-peers with NH in spoken language skills highlights that, despite newborn hearing screening, early bilateral HA fitting, or bilateral implantation, HL is still a risk factor for age-appropriate development of spoken language skills in early childhood.

Table 1: Sociodemographic data

Variables	Descriptive statistics
Family history:	
Positive	21(42%)
Negative	29(58%)
Consanguinity:	
Positive	19(38%)
Negative	31(62%)
Prenatal complication:	
Irrelevant	43(86%)
Any complications	7(14%)
Perinatal history:	
Weight at birth:	
Normal weight	43(86%)
Low birth	7(14%)
Jaundice:	
positive	40(80%)
negative	10(20%)
Incubation:	
Negative	46(92%)
Positive	4(8%)
Neonatal cyanosis and post natal complication :	
Negative	50(100%)
Positive	0(0%)

Table 2: Developmental milestone

Age of 1st ward	M±SD 38.9±19.14 Range(12-39)
Age of 1st sentence	M±SD 41.9±33.8 Range (24-120)

Table 3: Audiological history

Audiological history:	
Onset congenital Acquired late	 42(84%) 8(16%)
Course Progressive Stationary	 15(30%) 35(70%)
Duration of deafness	34.4±14.01
Degree of hearing loss:	
Right: Severe Severe to profound Profound	 9(18%) 35(70%) 6(12%)
Left: Severe Severe to profound Profound	 4(8%) 38(76%) 8(16%)
Time of using hearing aids	16.28±12.66
Age of aid	25.1±14.4
Time of implantation(age)	45.64±12.47 Range (12-92)

Table 4: IQ assessment

IQ	M±SD 85.47±4.25 Range (80-97)
Mental age	M±SD 78.98±18.28 Range (50-110)

Table 5: language assessment

• APA of language and speech	
1. Passive vocabulary: Poor Rich	 9(18%) 41(82%)
2. Active vocabulary: Single words 2 words sentence 3-4 words sentence Long sentence Can tell story	 22(44%) 12(24%) 8(16%) 8(16%) 0(0%)

5. Conclusions

Short period of deafness, early age of implantation, and regular rehabilitation improve language ability in children with unilateral cochlear implant.

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