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Research Article

Effect of Speech Therapy on Main-stream Education Attendance in Kazakhstan Effect of Speech Therapy on Main-stream Education Attendance in Kazakhstan

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Abstract

Cochlear implants can be used to treat children with sensorineural hearing loss. In many countries for example Kazakhstan, resources are limited to treat and rehabilitate children. This study reports on the incidence of children with a cochlear implant that attend mainstream education, attending three main CI centers in Kazakhstan.

Our experience showed that the creation of specialized centers, which includes all the elements of preoperative preparation, surgical treatment and the postoperative period, can achieve results that allow the majority of children to attend regular kindergartens or schools.

Keywords: Cochlear Implants; Kazakhstan; Hearing Loss

Introduction

Greater than 32 million children worldwide have a disabling hearing loss [1,2]. Most of the children affected live in low-income or middle-income countries [1]. "For children hearing is key to learning spoken language, performing academically, and engaging socially. Hearing loss poses a barrier to education and social integration. As such children with hearing loss can benefit greatly from being identified early in life and offered appropriate interventions" [1]. Cochlear implants are frequently used to treat hearing loss. However, even in a developed country such as the US,

surgical implantation with a cochlear implant occurs in relatively few cases. Approximately 3 in every 1000 children born in the US each year are diagnosed with a hearing loss from newborn hearing screening [3], from a population of approximately 73 million children in the US [4]. Roughly 118,100 devices were implanted in adults and 65,000 in children [5]. That so few children are implanted relative to children with a hearing loss is mainly because the costs of cochlear implants are high. In some countries the reported costs of a cochlear implant are as much as 18000 US dollars, which is approximately two years income in respect of the average national wage [6].

However, in many countries the financial aspects are not the only problem. There is a lack of facilities and equipment to address hearing loss. In countries such as Kazakhstan only 29% of medical organizations have the audiological equipment needed to diagnose hearing loss [7].

A 2014 report indicates that if children in Kazakhstan are implanted with a CI, the age of implantation is comparatively late in children because audiological screening, due to the lack of medical equipment, is poor. This also leads to longer than usual rehabilitation periods, which draws on limited resources further and that only a minority of children attend mainstream education [7]. The duration of rehabilitation therapy depends on the type of hearing loss, age, and the CI user's level of motivation. In general, children implanted at a young age do better after cochlear implantation [8].

Resources in Kazakhstan were so limited [7], that support in the field of hearing loss has focused on the improvement in the procurement of equipment for earlier detection of children with a hearing loss, and to strengthen rehabilitation services after CI [7]. In 2010, our center was established, where a multi-component system of activities related to cochlear implantation was implemented.

Currently, the Corporate Fund "University Medical Center" (hereinafter - CF" UMC") is the clinical base of the Autonomous educational organization "Nazarbayev University". UMC consists of three leading clinics in Kazakhstan with different medical directions: "National Research Center for Maternal and Child Health" (hereinafter-NRCMC)", Republican Diagnostic Center "(hereinafter – RDC), and" National Children's Rehabilitation Center" (hereinafter – NCDC). Our cochlear hearing loss treatment center is based on the aforementioned centers.

The aim of the study is to evaluate the success of these three clinics' endeavors, integrated in one center, in the treatment of children with sensorineural hearing loss. We aimed to report on the progress achieved in Kazakhstan since the center has been established and report on the incidence of children with a cochlear implant that attend mainstream education, which has not been reported or quantified in Kazakhstan, and detail the age at implantation of children now seen in a clinical setting.

Methods

A retrospective analysis of the patients files at the clinic between since 2010 was performed.

Since the UMC program started integrating cochlear implantation in children, to 2019, 81 patients were operated, including 50 boys and 31 girls. Among the children operated on 55 were from Nur-Sultan and 26 from the other regions of the Republic of Kazakhstan.

In the preoperative period, patients underwent General clinical examination, examination of ENT organs, complete audiological examination, and computer tomography of the temporal bones with a cross section of 1 mm. The Commission with the participation of a surdologist, a surdopedagogue, a speech pathologist, a neuropathologist, a pediatrician, and other specialists sat in selection of candidates for surgery.

The complete audiological examination of candidates for cochlear implantation included audiometric testing, evaluation of the effectiveness of auditory prostheses, and an assessment of the level of auditory perception and speech development. Speech testing was performed using the Little Ears Auditory Questionnaire at 7 days or 24 months after activation.

Surgery was performed according to a standard technique with mastoidectomy and posterior tympanotomy and the introduction of the electrode into the cochlea through the round window. During the operation, an electrically induced reflex of the stapedius muscle was recorded and thresholds for the potential of action of the auditory nerve were determined. No intraoperative complications were noted.

3-4 weeks after cochlear implantation the speech processor is configured. From this moment, the child can hear the sounds, but for proper perception and understanding a long course of habilitation classes with a sign teacher is required. Connection of the speech processor and further settings were carried out on the basis of the NCDC, by audiologists and so called 'defectologists', teachers of children with additional needs. From this moment, the child can hear the sounds, but for proper perception and understanding classes with a sign teacher were undertaken. For this purpose, patients are hospitalized for a short period (3-5 days) in NCDD 3-4 times a year.

Children implanted with a MED-EL Medical Electronics device were selected and a chart review of the intervention received and their educational outcomes was performed.

Results

The age of the children (n = 40) at cochlear implantation was 4.28 ± 2.68 years (mean ± standard deviation). The mean duration of deafness was 2.22 ± 1.65 years. The etiology of hearing loss was prematurity (n = 16), unknown (n = 12), congenital (n = 3), meningitis (n = 2), ototoxicity (n = 2), meningoencephalitis (n = 2), meningitis n = 2, or pneumonia (n = 1). The details of the demographic data collected are shown in table 1.

Child Number	Etiology of Hearing Loss	Age at implantation (years)	Bilateral/ Unilateral	Duration of deafness (years)
1	Unknown	3	Right	1.5
2	Congenital	3	Right	1.5
3	Prematurity	2	Right	1
4	Ototoxic drugs	2	Right	1
5	Prematurity	2	Right	1
6	Unknown	3	Left	1
7	Unknown	4	Right	3
8	Meningoencephalitis	4	Right	1
9	Unknown	3	Left	1.5
10	Prematurity	2	Right	1
11	Prematurity	2	Right	2
12	Unknown	5	Right	3
13	Unknown	5	Right	3
14	Prematurity	5	Left	3
15	Meningoencephalitis	5	Right	1
16	Unknown	5	Left	2
17	Prematurity	3	Right	1.4
18	Unknown	3	Right	1
19	Prematurity	6	Left	4
20	Progressive HL	9	Right	7
21	Ototoxic drugs	10	Left	8
22	Meningitis	7	Right	5
23	Progressive HL	12	Right	1
24	Prematurity	6	Left	3.5
25	Prematurity	7	Right	3
26	Unknown	11	Right	4
27	Pneumonia	1	Right	1
28	Unknown	3	Left	1.5
29	Unknown	5	Left	2
30	Congenital	2	Right	2
31	Prematurity	4	Right	3
32	Prematurity	4	Right	1
33	Unknown	7	Right	4
34	Prematurity	3	Left	1
35	Prematurity	2	Right	2
36	Meningitis	3	Right	1
37	Congenital	1	Right	1
38	Prematurity	4	Right	2
39	Prematurity	1	Left	1
40	Prematurity	2	Right	1

Among the children operated by us, the main part is taught among hearing children, 18 of them attend a regular kindergarten, 8 a public school, 7 are at home in an individual lesson, 5 are engaged in an integrated kindergarten and only 2 children study in a specialized kindergarten (Table 2).

Results of the Little Ears Auditory Questionnaire are shown in table 2.

Child Number	Education	Duration of Rehabilitation	Tools	Speech Testing
1	Regular kindergarten	24	Individual lessons with speech therapist	7/26
2	Regular kindergarten	24	Individual lessons with speech therapist	3/27
3	Regular kindergarten	24	Individual lessons with speech therapist	0/27
4	Regular kindergarten	24	Individual lessons with speech therapist	1/28
5	Regular kindergarten	24	Individual lessons with speech therapist	1/27
6	Regular kindergarten	24	Individual lessons with speech therapist	4/29
7	Regular kindergarten	24	Individual lessons with speech therapist	4/31
8	Regular kindergarten	24	Individual lessons with speech therapist	6/31
9	Regular kindergarten	24	Individual lessons with speech therapist	2/28
10	Regular kindergarten	24	Individual lessons with speech therapist	2/29
11	Regular kindergarten	24	Individual lessons with speech therapist	2/29
12	Regular kindergarten	24	Individual lessons with speech therapist	5/30
13	Regular kindergarten	24	Individual lessons with speech therapist	5/32
14	Regular kindergarten	24	Individual lessons with speech therapist	2/27
15	Regular kindergarten	24	Individual lessons with speech therapist	5/32
16	Regular kindergarten	24	Individual lessons with speech therapist	4/32
17	Regular kindergarten	24	Individual lessons with speech therapist	4/29
18	Regular kindergarten	24	Individual lessons with speech therapist	5/31
19	Public school	24	Individual lessons with speech therapist	7/32
20	Public school	24	Individual lessons with speech therapist	7/30
21	Public school	24	Individual lessons with speech therapist	7/27
22	Public school	24	Individual lessons with speech therapist	5/25
23	Public school	24	Self-training at home	25/33
24	Public school	24	Individual lessons with speech therapist	8/30
25	Public school	24	Individual lessons with speech therapist	9/29
26	Public school	24	Individual lessons with speech therapist	17/30
27	Home/individual lesson	24	Individual lessons with speech therapist	0/25
28	Home/individual lesson	24	Individual lessons with speech therapist	4/29
29	Home/individual lesson	24	Individual lessons with speech therapist	8/29
30	Home/individual lesson	24	Individual lessons with speech therapist	2/27
31	Home/individual lesson	24	Individual lessons with speech therapist	2/27
32	Home/individual lesson	24	Individual lessons with speech therapist	7/28
33	Home/individual lesson	24	Individual lessons with speech therapist	8/28
34	Integrated kindergarten	24	Individual lessons with speech therapist	11/27
35	Integrated kindergarten	24	Individual lessons with speech therapist	2/26
36	Integrated kindergarten	24	Individual lessons with speech therapist	15/27
37	Integrated kindergarten	24	Individual lessons with speech therapist	2/25
38	Integrated kindergarten	24	Individual lessons with speech therapist	4/24
39	Specialized kindergarten	24	Individual lessons with speech therapist	1/20
40	Specialized kindergarten	24	Individual lessons with speech therapist	2/23

Discussion

The most important component of the whole complex of measures for cochlear implantation is postoperative auditory-speech rehabilitation. Without it, it is impossible to achieve the optimal result after cochlear implantation in the formation and development of natural auditory-speech behavior skills. Most children involved in a comprehensive rehabilitation program can attend main-stream education.

Many other social and educational factors can influence the children's performance after cochlear implantation [9], such as the child's predominant mode of communication prior to implantation [10], the familial involvement and expectations [11], and of course their socioeconomic status [12]. Wu., *et al*. indicated that among pediatric cochlear recipients that those from non-English speaking, socioeconomically disadvantages backgrounds develop speech perception slower than their 'non-disadvantaged' counterparts.

Research largely funded by UNICEF Kazakhstan, showed that in Kazakhstan "there are large discrepancies in child well-being outcomes between different regions and that high levels of economic output do not necessarily go hand in hand with improved outcomes in terms of poverty and well-being". In earlier times (2014) in the Republic of Kazakhstan there was limited audiological screening due to the lack of medical equipment, which lead to late detection of hearing-impaired children and a long rehabilitation period, which ultimately drew on already limited resources [7]. The age of cochlear implantation in children was late [7]. Age at cochlear implantation and the mode of oral communication used are the most important known determinants of later speech perception in young children [13]. Children implanted under one year of age can reach age equivalent levels of language development and better vocabulary than children implanted later [8].

Most centers were unable to undertake screening, leading to a significant loss in the early identification of children with hearing loss [7]. Implantation at an early age was only possible for a small minority of children. According to our data, upon preliminary assessment, patients who underwent cochlear implantation in the first years of their life achieved the best results in rehabilitation and this became possible since our center was established.

Late detection of hearing-impaired children often led to a long rehabilitation period, which ultimately drew on already limited resources [7]. Only a small number of school-age children with a cochlear implant attended general schools. Among the children that were operated on by us, the majority are taught among 'normal' hearing children; 18 of them attend a regular kindergarten, 8 a public school, 7 are home taught in individual lessons, 5 are engaged in an integrated kindergarten, while only 2 children study in a specialized kindergarten.

Conclusion

Our little experience shows that the creation of specialized centers, which includes all the elements of preoperative preparation, surgical treatment and the postoperative period, can achieve good results in patients with severe hearing loss, and as a result of the rehabilitation course after cochlear implantation, children can attend a regular kindergarten and study in secondary school, having successfully completed the process of integration.

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