

First auditory brainstem implantation in Poland: auditory perception results over 12 months

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Abstract

Auditory brainstem implants (ABIs) are a modern method of treatment of total bilateral deafness in cases of extracochlear origin. In most cases therapy is applied in patients with neurofibromatosis type 2 (NF2). This paper presents the results of surgical treatment and rehabilitation in a 28-year-old woman with bilateral, multiple tumours of the central nervous system causing total deafness. Simultaneous removal of the tumours and implantation of ABI allowed treatment of the potentially lethal pathology and hearing restoration. Improving auditory skills and excellent tests results were noted in the year following implantation.

Key words: Brain Stem; Prosthesis Implantation; Neurofibromatosis 2; Rehabilitation of Hearing Impaired

Introduction

Auditory brainstem implants (ABI) are a modern method of treatment for total bilateral deafness in cases of extracochlear origin. Development of this highly specialized programme was possible thanks to the close collaboration of many specialists in anatomy, audiology, otosurgery, neurosurgery, biomedical engineering, psychology, speech therapy and special education. The first successful ABIs were performed in Los Angeles almost 20 years ago. Other centres in the USA, Germany and France have also reported good results with this treatment.^{1,2}

Materials and method

The aim of this paper is the presentation of the results of rehabilitation of the first Polish patient who received the brainstem implant on 9 January 1998 in Warsaw. This procedure was performed with the cooperation of specialists from the ENT and neurosurgery clinics of the University of Würzburg, University of Innsbruck and the MED-EL Company.

Our patient was a 28-year-old woman with bilateral deafness caused by NF2. Three years ago, she noticed facial paresthesia as the first symptom of tumours. On computed tomography (CT) and magnetic resonance imaging (MRI), bilateral neuro-mas of the VIIIth nerves were found. The patient did not accept the neurosurgical treatment proposed at that time. In January 1997, after pregnancy, the patient started to lose hearing bilaterally. Five months later she was operated on the left side by

neurosurgeons in another clinical centre. Post-operatively, facial nerve paresis occurred. In the next MRI examination further progression of the pathology on the right side was detected and additionally a new tumour was found in the right hemisphere of the cerebellum pressing against the transverse sinus. After analysis of all the data, an international team of oto- and neurosurgeons made the decision to operate on the patient from the suboccipital approach, that enabled removal of both tumours and simultaneous implantation of the ABI. A 12-channel brainstem implant MED-EL Combi 40+ was fixed in the occipital bone during the final stage of an 11-hour procedure. Six weeks after the operation the first fitting was performed in the Intensive Care Unit. There were no stimulation side-effects. During the following control sessions some parameters were optimized. Limited migration of the electrode array was observed a few weeks after surgery. Finally the eight channels were stimulated using a fast CIS (continuous interleaved sampling) speech coding strategy.³

Results

Proper fitting of the implant and development of auditory skills of the patient brought excellent results in logopaedic tests. She is able to detect and identify most environmental sounds and is able to hear music. There was continuous improvement of her auditory skills and very importantly, no changes in the stimulation parameters nor in the electrode

TABLE I
POST-OPERATIVE AUDITORY SKILLS DEVELOPMENT

Test	3 months (%)	6 months (%)	1 year (%)
Discrimination of phonemes	56	61	80
Identification of vowels	29	33	67
Identification of consonants	29	39	40
Numbers	82	93	95
Sentences (open set)	2	41	65
Monosyllabic words (open set)	13	12	45

placement were detected. One year after operation the patient is able to:

- (1) communicate easily with other people in Polish and German (she is a German translator);
- (2) take care of her two-year-old child;
- (3) go shopping alone;
- (4) speak over the telephone with her family (simple sentences);
- (5) learn Italian (as a third language) using tapes and books simultaneously.

Table I presents a summary of the development of her auditory skills in the first year of rehabilitation.

Conclusions

In conclusion, the results confirm that the aims of treatment and of the whole programme can be achieved by a multidisciplinary approach. Simultaneous removal of the tumours and ABI implantation allows for treatment of lethal pathology and hearing restoration.

References

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