Clinical audit of outcomes in Cochlear Implantation an Indian experience

Article *in* Indian Journal of Otolaryngology and Head & Neck Surgery · January 2006

DOI: 10.1007/BF02907745 · Source: PubMed

4 authors:

Mohan Kameswaran
Madras ENT Research Foundation
228 PUBLICATIONS **1,186** CITATIONS
SEE PROFILE

Raghu Nandhan
Madras ENT Research Foundation, Chennai, India
141 PUBLICATIONS **271** CITATIONS
SEE PROFILE

Kiran Natarajan
Independent Researcher
47 PUBLICATIONS **125** CITATIONS
SEE PROFILE

Naveed Basheeth
Royal College of Surgeons in Ireland
8 PUBLICATIONS **200** CITATIONS
SEE PROFILE

Main Article

CLINICAL AUDIT OF OUTCOMES IN COCHLEAR IMPLANTATION AN INDIAN EXPERIENCE

Mohan Kameswaran, S. Raghunandhan, Kiran Natarajan, Naveed Basheeth*

ABSTRACT: *This retrospective study is based on the assessment of outcomes of Cochlear Implantation taking into account various scoring systems like Category of Auditory Performance (CAP) and Speech Intelligibility Rating (SIR). 100 candidates who were implanted between June 1997- June 2005 at Madras ENT Research Foundation (MERF), a tertiary referral center for cochlear implantation were included in the study. The results were analyzed using the above scoring systems to assess the performance levels of each implantee and to arrive at a cumulative result on the outcome of the implantation. Practical issues of concern to Cochlear Implantation in the Indian subcontinent were also analyzed.*

Key Words: *Cochlear implantation, CAP score, SIR score, auditory verbal habilitation*

Objectives

To study the outcome of 100 patients who underwent Cochlear Implantation at Madras ENT Research Foundation, Chennai between June 1997- June 2005 by evaluating the quality of life after cochlear implantation with Category of Auditory Performance (CAP)[1] scores and Speech Intellegibility Rating (SIR)[2] scores (Tables 1and 2). This study aims to analyze the results and derive a protocol to improve the outcome of the patients undergoing cochlear implantation in terms of speech intelligibility, auditory performance and rehabilitation.

Study design

This is a retrospective study involving 100 patients who underwent cochlear implantation between June 1997- June 2005. Out of the 100 candidates, 86 were pre-lingual and 14 were post-lingual. All patients received a cochlear implant and the implantees were implanted with either Nucleus 22 or Nucleus 24 and the electrode array was either straight array, contour or advanced contour. The coding strategy used in the cochlear implant systems was ACE.

Background

The success of a CI program is directly dependent on its ability to address the issue of patient expectations and balance it with the outcomes.[3] A multidisciplinary approach is required involving the ENT surgeon, Audiologist, Speech therapist, Auditory verbal habilitationist and pediatrician. The patients and their family must also be highly motivated for the implant.

Variables affecting the outcome of CI in children are the duration and etiology of deafness, age at onset of deafness, pre-implant amplification history, communication mode, age at implantation, type of speech processor used and duration of implant usage. In very young children, language acquisition is easier and hence the need for early implantation. Owing to the loss of neural plasticity in older pre-lingual deaf people, the response to implantation may not be optimal and extensive pre-op counseling regarding realistic expectations is vital.[4]

Factors influencing the overall outcomes are the transparency of the program, expertise of the team, patient motivation, family support and facilities for rehabilitation. Difficulties in the Indian perspective have been due to their prohibitive costs, the introduction of a radical technology in a developing country and its impact on deaf culture. The dilemma of balancing an advanced technology with the requirements of a developing country still remains.

Problems unique to the Indian context are the distances between CI facilities and the multi-lingual society forming a language barrier for rehabilitation. These can be overcome by having satellite centers, trained surgeons with adequate theatre facilities and a well equipped audiology unit with access to good schools for hearing challenged, which believe in an auditory verbal approach along with long term

Consultant ENT Surgeons, *Registrar, No.1, 2nd Cross Street, Off. 2nd Main Road, Raja Annamalaipuram, Chennai – 6000028, Tamil Nadu, India

Table 1: Categories of auditory performance[2] (O'donoghue *et al* 1999)

Category	Criteria	Before implant	Time after implantation (months)				
			0	6	12	24	36
7	Uses telephone						
6	Understands conversation						
5	Understands phrases						
4	Discrimination of sounds						
3	Identifies environmental sounds						
2	Response to speech sounds						
1	Awareness of environmental sounds						
0	No awareness to environmental sounds						
	Total numbers						

Table 2: Speech intelligibility rating[3] (O'donoghue *et al* 1999)

Category	Criteria	Before implant	Time after implantation (months)				
			0	6	12	24	36
5	Connected speech intelligible to all listeners. Child understood everyday contexts.						
4	Connected speech is intelligible to a listener who has little experience of a deaf person's speech.						
3	Connected speech is intelligible to a listener who concentrates & lipreads.						
2	Connected speech is unintelligible. Intelligible speech is developing in single words when context & lip reading cues are available.						
1	Connected speech is unintelligible. Prerecognizable words in spoken language; primary mode of communication may be manual.						

commitment to the implantees. A lingual map[5] needs to be charted for uniform rehabilitation of various implantees in their own mother tongue with the child's parents themselves forming an active and integral part of auditory verbal habilitation. In Indian subcontinent there is the unique problem of distances (often patients have to travel thousands of kilometers to reach their implant clinics) and a plethora of languages, which poses a unique set of challenges to our auditory verbal therapists.

Habilitation material has to be developed in regional languages[5] and bearing in mind the extreme paucity of qualified and trained auditory - verbal therapists, the task seems to be daunting. Despite these very real hurdles, the cochlear implantation programs have grown exponentially. The cochlear implant programme at Madras ENT Research Foundation (MERF), Chennai lays emphasis on after care and support with auditory verbal therapy as an integral part of the clinic.

MATERIALS AND METHODS

The study was done by collecting data through patient registers, fully completed clinical records and information regarding the present performance levels of the implantees from health care professionals like ENT surgeons, Audiologists, Auditory Verbal habilitationists. The communication strategy involved discussion with cochlear implantees and their guardians about the outcomes. Children belonging to the age group 1-5 years were majority (39%) and adults 14%. 86 were prelingual and 14 were postlingual

candidates. Questionnaires were distributed to make a cumulative assessment of each implantee vis-a-vis the effectiveness of the implant. The discussion also included feedback from Auditory Verbal habilitationists about the performance of each cochlear implantee, the post-operative period after implantation at which the patients attained speech abilities and reached the respective categories of CAP scores and SIR scores. Wherever available, serial video recordings of Auditory verbal therapy sessions of implantees were used to evaluate performance levels.

Measuring level of performance

The outcome of cochlear implantation was measured using Category of Auditory Performance (CAP)[1] score described by O'Donoghue *et al*, 1999. The extent of auditory perception in terms of utility of auditory mechanisms to pursue day to day tasks from awareness of environmental sounds to making telephonic conversations were assessed. The ability to discriminate and understand speech with or without lip reading was also assessed and the results were categorized accordingly and a score was given, taking into account the number of months taken to achieve it.

Similarly, one more outcome measure, Speech Intelligibility Rating(SIR)[2] by O'Donoghue *et al*, 1999 was utilized to measure the outcome of cochlear implantation with respect to speech, measuring the intelligibility of speech and the quality, which might be recognizable by the listener. The analysis also included the extent to which speech is understood and discriminated by the listener. The results were assessed and categorized accordingly and a score was given taking into account the number of months taken to achieve it.

The study also laid emphasis on the comparison of the outcomes with respect to the protocols followed in the institution and the protocols given in the guidelines given in the Cochlear Implant Group of India (*CIGI)*[6]. The effectiveness of the protocols were assessed and the practical difficulties in implementing them were discussed highlighting the special issues which needs concern and introspection in the present Indian scenario.

Cochlear implantation protocols at MERT

Initially the patient was assessed by ENT consultants and audiologist and if he / she was found to be an ideal candidate a comprehensive audiological evaluation including BERA / ASSR / OAE / PTA / Speech Audiometry / BOA / middle ear analysis / aided audiogram and hearing aid trial was done. The candidate also underwent radiological procedures like CT / MRI scan to detect any congenital deformities of the cochlea and eighth nerve.

The importance of counseling was always acknowledged and each candidate was counseled for cochlear implantation explaining the surgical procedure, the types of implants, the working procedure switch on, mapping. The patient's speech, language and auditory skills were assessed. The candidates and parents were made to meet and interact with other cochlear implantees to have a perspective on the procedure and its outcome. After counseling and interaction with implantees, a questionnaire was given to the candidates and their parents to assess their expectations after cochlear implantation.

Prior to implantation a basic workup including hematological, chest X-ray, ECG, TORCH screen (if required) was conducted. The general physical condition was evaluated by the anesthetist. A specialist's opinion was sought in patients with syndromic etiology of deafness. In children pre-implant vaccination was carried out. Cochlear implantation was done and the response of electrodes was confirmed using Neural Response Telemetry (NRT) and effectiveness was assessed especially in children. Facial nerve monitoring was done whenever necessary.

The switch on and speech processor tuning was done 3 weeks after surgery. Mapping is done at periodic intervals till a stable map is achieved. The rehabilitation programme was started out based on baseline skills of the patient, periodical assessments of outcome were done in terms of environmental sound, open set, closed set speech, speech discrimination and telephonic conversation. The recommended period for habilitation at MERF is 1 year. The patient and guardians were asked to stay in Chennai itself to attend the AV habilitation.

Consclusions of comparatives study based on CI protocols

Out of the implantees 39% were between1-5 yrs of age and adults were 14%. Males were 60%and females 40%. The results of CAP score showed that 10% implantees achieved category 7 in 12 months in 1-5 yrs age group and 13% achieved category 6 in 12 months, whereas in 6-10 yrs, 4% got category 7 in 12 months and 9% achieved category 6 (Table 3). Children responded better with very good outcomes with early cochlear implantation. This was also evident with SIR scoring system where in 1-5 yrs, 15% achieved category 5 n 12 months and 7% got category 4.whereas in age group 6-10 it was 8% who got both category 4 and 5 in 12 months and 6 months respectively (Table 4)**.** Open set speech was performed by 65% cases and Closed set by 35%. In adults, 21% achieved open set in 1-5 yrs and 12% achieved closed set (Table 5). 25 children were followed up for more than 1 year and 40 out of 81 children joined normal school.

With early CI in children between 1-5 yrs, the outcome was

Table 3: Age in years *CAP score - category crosstabulation

			CAP score - catagory							
			0	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Age in year	1-5	Count	3	2	3	3	5	13	10	30
		% of Total	3.0	2.0	3.0	3.0	5.0	13.0	10.0	39.0
	6-10	Count		1	2	2	7	9	4	25
		% of Total		1.0	2.0	2.0	7.0	9.0	4.0	25.0
	11-20	Count				3	7	5	7	22
		% of Total				3.0	7.0	5.0	7.0	22.0
	21-30	Count	1				2		3	6
		% of Total	1.0%				2.0		3.0	6.0
	Above 30	Count					1	3	4	8
		% of Total					1.0	3.0	4.0	8.0
Total		Count	4	3	5	8	22	30	28	100
		% of Total	4.0	3.0	5.0	8.0	22.0	30.0	28.0	100.0

Table 4: Age in years *SIR crosstabulation

			SIR					
			0	**2**	**3**	**4**	**5**	**Total**
Age in year	1-5	Count	7	4	6	7	15	39
		% of Total	7.0	4.0	6.0	7.0	15.0	39.0
	6-10	Count		3	6	8	8	25
		% of Total		3.0	6.0	8.0	8.0	25.0
	11-20	Count			8	5	9	22
		% of Total			8.0	5.0	9.0	22.0
	21-30	Count	1		2		3	6
		% of Total	1.0		2.0		3.0	6.0
	Above 30	Count				1	7	8
		% of Total				1.0	7.0	8.0
Total		Count	8	7	22	21	42	100
		& of Total	8.0	7.0	22.0	21.0	42.0	100.0

very gratifying. So we encourage very early implantation to facilitate a series of developmental processes occurring in the critical period of initial language acquisition. Early cochlear implantation[7] tends to yield normalization of audio-phonologic parameters, which enables us to consider the performance of children implanted very early as being similar to that of their normally hearing peers.

Special issues like the following demands introspection with respect to the Indian scenario

- Multilingual population. (Tower of Babel.) Which poses problems for AV rehabilitation.
- Distance from place of domicile to implant centre.
- Availability of efficient Auditory Verbal units.[12]
- Cost factor of cochlear implants.

Table 5: Crosstabs age in years* speech

			Speech		Total
			Open set	Closed set	
Age in years	1-5	Count	27	12	39
		% of Total	27.0	12.0	39.0
	6-10	Count	15	10	25
		% of Total	15.0	10.0	25.0
	11-20	Count	12	10	22
		% of Total	12.0	10.0	22.0
	21-30	Count	3	3	6
		% of Total	3.0	3.0%	6.0
Total		Count	65	35	100
		% of Total	65.0	35.0	100.0

These special issues could be addressed based on the results of successful application of the protocols at MERF.

1. These problems can be overcome by advocating the parents / guardians to stay at Chennai to aid AV therapy, if not atleast for 6-12 months so that the continuous process of AV therapy is not disengaged.
2. Negativism of professionals needs to be alleviated by more hands on training and workshops. Satellite centres and interaction must bridge distance by video conferencing.
3. A lingual map needs to be charted for uniform rehabilitation of various implantees in their own mother tongue with the guardians forming an active and integral part of AV habilitation
4. Last but not the least, the cost factor of implants. At MERF the protocol includes helping the financially weak patients to try and get help from social organizations and NGOs who are in constant touch with the institution. Moreover this hospital also runs a charity scheme where a part of the surgical expenses is sponsored by the hospital itself. Such charity schemes and public awareness to help such charitable trusts, medical insurance, bank loans might help the financially incapable patients to meet atleast part of their expenses.

So, in conclusion, the concept of solving the above mentioned issues could be done by analyzing the results of our study which shows beyond doubt that practical measures taken in view of these issues has given good outcomes statistically. Only a comprehensive, coercive and integral team approach by all professionals, surgeons, audiologists, physicians, psychologists and AV units can yield a productive outcome.

SUMMARY

The study included 100 cochlear implantees and measured their auditory and speech performance levels using scores like CAP and SIR. The emphasis is on early impalntation with intensive auditory verbal habilitation after the procedure.

REFERENCES

1. Archbold S, Lutman ME, Marshall DH. Categories of Auditory Performance. Ann Otol Rhinol Laryngol Suppl 1995;166:312-4.
2. Allen C, Nikolopoulos TP, Dyar D, O'Donoghue GM. Reliability of a rating scale for measuring speech intelligibility after pediatric cochlear implantation. Otol Neurotol 2001;22:631-3.
3. Colleti, Vittorio MD, Carner, Marco MD, Miorelli, Veronica MD. Cochlear Implantation at under 12 months: Report on 10 patients. Laryngoscope 2005;115:445-9.
4. O'Neill C, O'Donoghue GM, Archbold SM, Nikolopoulos TP, Sach T. Variation in gains in auditory performance from pediatric Cochlear Implantation. Otol Neurol 2002;23:44-8.
5. Tait M, Lutman ME. Predictive value of measures of preverbal communicative behaviour in young deaf children with cochlear implants. Ear Hearing 1997;8:472-8.
6. Consensus document of COCHLEAR IMPLANT GROUP OF INDIA, 2000(CIGI).
7. Osberger MJ. Cochlear implantation in children under 2 years. Candidacy considerations. Otolaryngol Head Neck Surg 1997;117:145-8.

Address for Correspondance
Dr. Mohan Kameswaran
Madras ENT Research Foundation (P) Ltd,
No.1, 2nd cross street, off. 2nd main road,
Raja Annamalaipuram,
Chennai – 6000028,
Tamil Nadu, India,
E-mail: merfmk@vsnl.net