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Child's Communicative Status and Associated Factors at Pre-cochlear Implant Assessment

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ABSTRACT

Objective: Our study will highlight child's communicative status and associated factors at the time of pre-cochlear implant speech therapy assessment.

Study Design: It is a cross-sectional study.

Place and Duration of Study: The data collection was done form June 2020 till January 2021, from a rehabilitation hospital in Pakistan (AFIRM).

Material and Methods: A questionnaire and informal speech therapy clinical assessment was administered to collect data from the parents and children coming for pre-cochlear implant communication fitness assessment in Speech Therapy Department, Armed Forces Institute of Rehabilitation Medicine Pakistan. Data collection took almost 15-20 mins. SPSS was used for evaluation**.**

Results: 93% of the children did not undergo hearing aid and speech habilitation trail before proceeding to cochlear implant. Most of the children were using distinct expressive skills to communicate and had age-appropriate play skills. These skills can help design appropriate speech therapy goals post-cochlear implant speech therapy. 10% of the children had oro-motor deficits. The p-value was significant for socio-economic status, mother's education and linguistic background.

Conclusion: The children adapted communication skills even with hearing loss and it was augmented by strategies like lip reading and play patterns. Hence, strength and deficits of hearing-impaired children considering oro-motor deficit and prior adequate therapeutic trail should be considered during post and pre cochlear implant speech therapy.

Key Words: *Cochlear implant, speech therapy, Communication patterns.*

INTRODUCTION

The lack of access to natural language during the first five years of critical period of language acquisition can lead to a phenomenon known as language deprivation. This can negatively affect the development of first language (L1).[1] The development of language can be affected because of many disabilities and one of the leading causes is hearing deficit.[2] Pakistan has a high prevalence of hearing loss.[3] The most

common cause of hearing is otitis media (76%) and 2.5:1 is the ratio of conductive hearing loss (CL) to sensorineural hearing loss (SNHL).[4] Profound hearing loss has been reported in Pakistan with a prevalence of 1.6 per 1000 cases.[6]

If we consider how early lack of auditory exposure because of hearing loss effects cognition, language and emotions, it can be commented that signed language is usually a precondition for child's ability to use and understand spoken and written languages because sign language helps access first language. Mental health problems have been reported with a greater prevalence in the population of deaf, this finding supports the usefulness of development of effective and early communication with loved ones like family and friends. There is a further risk of adverse health side effects of having no language or way of communication at all. There is also a greater risk of physical and emotional neglect, sexual trauma, anxiety and depression because of abuse.[1] Receptive language ability and phonological awareness, that are the predictors of reading ability, has also been poorly affected because of hearing loss [8]

Upon the diagnosis of hearing loss in infants, the major concern is their development of language and cognition and social skill that are highly dependent on normal language acquisition process. Often the importance of sign language is undermined when an intervention of medical and education type is planned, for example use of hearing aids or cochlear implant, focusing on only one mode of communication, i.e. spoken/verbal output can in fact encourage poor language acquisition process.[1]

Hence, our study will highlight child's communicative status and associated factors at the time of pre-cochlear implant speech therapy assessment. So that findings can help encourage the use of appropriate therapeutic techniques, understanding of individual strengths, deficits and potential for adequate support and management of the child.

MATERIAL AND METHODS

A questionnaire (design by the author) and informal speech therapy clinical assessment was administered to collect data (proforma attached in appendix) from the parents and children coming for pre-cochlear implant communication assessment in Speech Therapy department, Armed Forces Institute of Rehabilitation Medicine Pakistan. The data was collected after approval of (IRB) ethical review committee AFIRM. The data collection was done form June 2020 till January 2021.The questionnaire was reviewed by 2 Speech Therapist, 2 Rehabilitation Specialist for validity and reliability. Purposive sampling technique was used, data was obtained from parents and children after getting consent. Interview and data collection took almost 15-20 minutes. The collected responses were then entered in SPSS for evaluation**.**

Inclusion criteria: Children coming to speech therapist for pre-cochlear implant fitness assessment. Children with hearing impairment who were declared fit for cochlear implant

Exclusion criteria: Children who were deemed unfit for cochlear implant after assessment by speech therapist or by any other multidisciplinary team member.

RESULTS

Most of the children (93%) did not undergo speech therapy with hearing aids at the time of assessment. Only 4% of children were exposed to special education setup. 7% of children had exposure to speech therapy with hearing aids and 10% had oral motor deficits like cleft palate, ankyloglossia etc. Most of the children (99%) had age-appropriate play skills and 90% of children were on lip reading for verbal input and output **(table 1).**

During pre-cochlear implant Speech therapy assessment, it was noted that child's communication status had following properties: 77% of children had good communication skills, that is persistence, turn taking, social reciprocity, appropriate eye contact and joint attention during the communication. 88.6% of the children could follow simple commands given non-verbally. 57% of children were using gestures and vocalizations like /a/, /o/, /e/ up to one second, to communicate effectively. 91% of children had intentional communication. However, speech production of only 5.7% was short simple phrases whereas most of the children were using vocalizations **(table 2).**

TABLE 1: Demographics Factors (n=70)

Demographics Factors		Frequency	Percentage
Child underwent speech	No	65	(93.0)
Therapy with hearing aids	Yes	05	(7.0)
Special education exposure	No	67	(96.0)
	Yes	03	(4.0)
Lip reading	Absent	07	(10.0)
	Present	63	(90.0)
Oral-motor deficit	Absent	63	(90.0)
	Present	07	(10.0)
Play skills	Not age appropriate	01	(1.0)
	Age appropriate	69	(99.0)

TABLE -2: Pre-cochlear implant Child's Communication status (n=70)

Pre-cochlear implant Child's Communication status		Frequency	Percentage
Communication skill	Poor	2	2.9
	Average	14	20.0
	Good	54	77.1
Receptive skills	Unable to follow any command given non verbally	3	4.3
	Able to follow simple commands given non verbally	62	88.6
	Follow complex command given Verbally with gestural prompt / Identify maximal pairs in close set	5	7.1
Expressive skills	No functional communication	5	7.1
	Gestures (gross)	5	7.1
	Gestures with vocalizations	40	57.1
	Sign language	7	10.0
	Fine gesture with few phonemes	7	10.0
	Fine gesture + short phrases 1-3	4	5.7
	Complex sentences with Articulatory errors	2	2.9
Communicative intent	Non-intentional	2	2.9
	Intentional	64	91.4
	Variable	4	5.7
Speech production	Nil	6	8.6
	Vocalization	40	57.1
	Babbling	18	25.7
	Short simple phrases	5	7.1
	Complex sentence	1	1.4

TABLE-3: Correlation of Demographic Factors

Correlation r, p-value	Socioeconomic status	Mother's education	Father's Education	Familial Hearing History of loss	Area
Spoken Language Urdu = 7 Punjabi=23 Sindhi=2 Phusto=22 Other =16	R= -0.072, P=0.007	-0.034, 0.032	0.043, 0.791	-0.09 7, 0.159	-0.25, 0.148

Correlation **r, p-value**	**Socioeconomic status**	**Mother education**	**Father Education**	**Familial History of Hearing loss**	**Area**
Previous Hearing Trail Yes =39 No=31	R=0.063, P= 0.622	0.059 0.462	0.207, 0.244	-0.016, 0.894	0.182, 0.128

No linear correlation was found in area, father education, familial history of hearing loss and language spoken however P value was significant for socio-economic status and mother education($p<0.05$).

No linear correlation was found in previous hearing aid trail with socioeconomic, parent education, hearing loss and area **(table 3).**

DISCUSSION

In our study, most (93%) of the children did not undergo speech therapy trail with hearing aids. Undergoing hearing aid or speech therapy rehabilitation is considered one of the protocols prior to cochlear implant activation and a study notified that infants undergoing hearing aid trial prior to cochlear implant had better auditory skills scores than infants how did not have any habilitation and hearing aid trail.[12, 15]

99% of the children in our study had age-appropriate play skills that can become a good prognostic factor for therapy progress after cochlear implant. Assessing play skills prior to therapy is important as highlighted that assessment of play pattern can be used therapeutically to determine how play would be an appropriate intervention strategy for children with clinical diagnoses, and can help to track their therapeutic progress.[11, 16]

In present study, oral motor deficits were reported in 10% of children during pre-cochlear communication assessment, oral motor deficit included ankyloglossia, dental caries, malocclusion, cleft palate etc. Such oro-motor deficit can become a hurdle in post implant speech therapy. Oral deficit is a common presentation in children with special needs as indicated in a study poor oral hygiene is a common presentation in children with sensory deficits which is enhanced by reduced access to proper dental care and their physical inability because of communication deficits they are unable communicate with dental professionals, hence they have a higher risk of developing dental aliments. According to study lack of awareness of sign language and communication aids poses a major barrier for health professional to deliver their services to children with hearing impairment.[5, 17]

In our study, as a part adaptive strategy to understand their environment 90% of children were using lip reading. Auditory deprivation, such as in hearing loss or deafness, can promote neuroplasticity in auditory cortex in particular cross modal type in which support of non-auditory sensory functions is obtained when these auditory regions reorganize to vision. Many studies claimed that for cochlear implant (CI) users cross modal plasticity can be harmful for speech outcomes as it interferes with sound processing, while others have highlighted that visual language related to plasticity may be beneficial for speech recovery.[13] Evidence of cross modal reorganization was noted in cochlear implant users stating that this phenomenon does not significantly predict poor speech outcomes. However, speech outcomes and cross modal activation during lip reading are dependent on differences or strategies adapted in audiovisual speech communication by CI users.[13,18]

In our study expressive skills of children in cochlear implant pre-assessment for communications was as follows. 10% of children were using sign language, 57% were using gestures accompanied with vocalizations, fine gesture with few phonemes (10%), 5.7% were using fine gestures in addition with short phrases like come, baba come (/AO/, /BABA AO/) and 2.7% were using complex sentences with articulatory errors. Such presentation is due lack of adequate auditory experience at appropriate stages of life. However, these modified ways of expression can prove to be beneficial in post implant speech therapy period. A study highlighted mode of communication and role of sign language in children with cochlear implant. It was found that some form of signed

communication was used by parents (15-20%) and teachers 30% respectively. Qualitative findings revealed that even though the main aim was to develop spoken language, many parents, teachers valued Australian Sign Language and Signed English because according to them sign language bolstered academic, social and personal development It was also noted that young people who communicated through signs, efficiently switched the mode according to topic, settings and communication partner.[7]

Our study sample of 70 children belonged to a variety of linguistic background, Urdu=7, Punjabi=23, Sindhi=2, Phusto =22, Other (Shina, Balti, Potohari etc) =16. No correlation of previous hearing aid trail with socio-economic status (SES), parental education, hearing loss and area of residence. However, p value ($p<0.05$) was significant for SES, mother education and spoken language. A study indicated that mothers play a vital role in linguistic development of children with cochlear implant. It depends of mother sense of self efficacy and involvement and interaction, considering this impact in order to support better outcomes in speech therapy post-cochlear implant, professional should effectively design goals that incorporate linguistic input, self-efficacy and involvement of caregivers.[10]

A systematic review highlighted notable impact of linguistic input of parents during initial stages of cochlear implant and later linguistic outcome. In intervention comparatively weaker and more heterogeneous data was found for parental education and effects of parental involvement in intervention.[14] Cochlear implants encourages hearing skills development in children and by providing early access to sound in both ears best outcomes can be achieved. However, limitation in social determinants of health and medical comorbidities can add complexity in outcome and care.[9] After cochlear implant child's linguistic development was affected by socioeconomic status (SES), proximal environment variables.[14]

CONCLUSION

Every child adapts a unique set of communication patterns even with hearing loss. And there is also a chance of unnoticed oro-motor deficits in these children due to inability to effectively communicate. Most of the children with hearing loss used lip reading to understand the message and many children did not have adequate trail of hearing and speech habilitation before proceeding towards cochlear implant. Hence, the strength and deficits of child with hearing loss, adequate therapeutic trail, physical impairments should be considered to design effective therapeutic goals. In addition, further research can be done to find out impact of such approach in post-cochlear implant speech therapy.

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Authors' contribution

RS: Proposed topic, basic study design, material and methods and manuscript writing, literature review & referencing, data collection, statistical analysis and interpretation result.
MS: Data collection, statistical analysis and interpretation of result etc.
GS: Quality insure, interpretation of result etc.
LI. Col. SNM: Quality insure, manuscript review
HSM: Manuscript review
SAHS: Manuscript review

All the authors have approved the final manuscript draft and accept the responsibility of research integrity.