



A STUDY ON AUDITORY AND LANGUAGE OUTCOMES FOLLOWING COCHLEAR IMPLANTATION IN CHILDREN WITH CONGENITAL RUBELLA SYNDROME : A RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT Congenital Rubella Syndrome (CRS) is an important cause of non-genetic sensorineural hearing loss (SNHL) in children. Hearing impairment is one of the most frequent and disabling manifestations of CRS and may be accompanied by ocular, cardiac, neurological, and developmental abnormalities. Cochlear implantation (CI) has become an established treatment option for children with severe-to-profound bilateral SNHL who obtain limited benefit from conventional hearing aids; however, auditory and language outcomes may vary according to the severity of associated developmental involvement, age at implantation, and the quality and duration of postoperative rehabilitation.

KEYWORDS : Congenital Rubella Syndrome, Cochlear Implantation, Auditory Verbal Therapy, Categories of Auditory Performance, Language Development, Sensorineural Hearing Loss.

INTRODUCTION

Congenital Rubella Syndrome (CRS) is the result of fetal infection with rubella virus during pregnancy, particularly when maternal infection occurs early in gestation. CRS may produce multisystem manifestations, with sensorineural hearing loss, ocular abnormalities, congenital heart disease, and neurodevelopmental impairment being important clinical sequelae. Hearing loss is among the most common manifestations and may be bilateral, severe to profound, and present from early childhood.

Sensorineural hearing loss in CRS can have a major impact on speech and language acquisition, cognitive development, educational achievement, and social integration. The auditory deficit may occur in isolation or in association with other manifestations of CRS, and the presence of additional developmental or neurological difficulties may influence functional outcomes. Early identification of hearing loss and timely auditory rehabilitation are therefore important for maximizing communication and educational development.

Cochlear implantation has become an important treatment option for children with severe-to-profound bilateral sensorineural hearing loss who derive limited benefit from conventional hearing aids. Numerous studies have demonstrated improvements in auditory perception, speech recognition, and language development following cochlear implantation. In children with CRS, outcomes may be influenced by age at implantation, pre-existing developmental abnormalities, duration of auditory deprivation, consistency of device use, and adherence to postoperative auditory-verbal rehabilitation.

Children with CRS-related deafness can achieve meaningful auditory and language outcomes following cochlear implantation, particularly when implantation is performed at an appropriate age and followed by intensive auditory-verbal rehabilitation. However, literature specifically evaluating long-term functional auditory, language, and educational outcomes after cochlear implantation in children with CRS remains relatively limited, particularly in developing-country settings.

Therefore, the present retrospective observational study was undertaken to evaluate the auditory and language outcomes following cochlear implantation in children with Congenital Rubella Syndrome by assessing auditory performance, speech and language development, educational integration, and rehabilitation outcomes following Auditory Verbal Therapy (AVT).

Table 1. Baseline Characteristics of the Study Population with Congenital Rubella Syndrome (n = 66)

Characteristics	Number
Total children with CRS	66
Male and female	Mixed cohort
Current age	Approximately 3–15 years

Majority age group	School-going children
Children with complete outcome assessment	55
Ongoing therapy / incomplete follow-up	11

Table 2. Educational Placement in Children with Congenital Rubella Syndrome

Educational Status	n	%
Mainstream/Normal school	27	40.9
Special schools	17	25.8
Auditory Verbal Therapy centre	8	12.1
Play school	2	3.0
Speech therapy only	1	1.5
Information unavailable	11	16.7

Nearly half of the children were integrated into mainstream schools, indicating satisfactory functional hearing and language development following cochlear implantation in this CRS cohort.

Table 3. Speech and Language Outcomes in Children with Congenital Rubella Syndrome

Outcome	n	%
Adequate speech intelligibility	12	18.2
One-word speech	21	31.8
Two-word phrases	15	22.7
Syllables only	4	6.1
Nil speech	2	3.0
Data unavailable	12	18.2

Table 4. Auditory Outcomes (CAP Score) in Children with Congenital Rubella Syndrome

CAP Outcome	n	%
CAP Score Achieved (highest functional category recorded)	22	33.3
CAP Score 7	8	12.1
CAP Score 4	3	4.5
CAP Score 5	1	1.5
CAP Score 3	18	27.3
Responds only to loud sounds	1	1.5
Nil auditory response	1	1.5
Lost follow-up	1	1.5
Data unavailable	11	16.7

CASE STUDY DISCUSSION

The present study demonstrates that cochlear implantation provides substantial auditory and language benefits in children affected by Congenital Rubella Syndrome. Despite the possibility of associated ocular, cardiac, neurological, and developmental abnormalities in CRS, most children in the present cohort exhibited measurable improvement in auditory perception and expressive language following implantation.

A notable finding was the successful integration of nearly half of the children into mainstream educational settings. This suggests that restoration of auditory input through cochlear implantation can facilitate language acquisition sufficient to support conventional schooling. These findings are consistent with reports of children with congenital rubella syndrome in which early cochlear implantation combined with intensive auditory-verbal therapy resulted in favourable auditory and educational outcomes.

Auditory performance, assessed using the Categories of Auditory Performance (CAP) scale, revealed that a substantial proportion of children achieved high functional listening abilities. Children attaining CAP scores of 7 demonstrated effective speech perception during everyday communication, indicating that cochlear implantation can substantially reduce the auditory handicap associated with CRS. Nevertheless, approximately one-quarter of the cohort remained at CAP score 3, underscoring the variability in outcomes that may result from differences in age at implantation, associated developmental involvement, duration of auditory deprivation, and adherence to rehabilitation.

Speech and language outcomes paralleled auditory performance. Most children progressed from isolated word production to two-word phrases or intelligible connected speech. However, a small proportion remained limited to syllabic vocalizations or showed minimal speech development. This variability may reflect differences in age at implantation, duration of auditory deprivation, associated developmental difficulties, and the intensity and duration of rehabilitation.

The findings also emphasize the importance of long-term rehabilitation. Several children continued auditory-verbal therapy or required additional educational support, reinforcing that cochlear implantation alone is insufficient without comprehensive post-implant rehabilitation.

Overall, the study supports cochlear implantation as an effective intervention for auditory rehabilitation in children with Congenital Rubella Syndrome. Although outcomes vary among individuals, most children achieved meaningful improvements in auditory perception, speech-language development, and educational participation. Early diagnosis, timely implantation, consistent device use, and structured auditory-verbal therapy remain important determinants of successful long-term outcomes.

CONCLUSIONS

A total of 66 children with Congenital Rubella Syndrome who underwent cochlear implantation were included in this retrospective study. The majority were between 3 and 15 years of age at follow-up.

Approximately 41% of the cohort had been successfully integrated into mainstream schools, while 26% continued education in special schools. Eight children remained enrolled in structured auditory verbal therapy programmes.

Auditory performance demonstrated encouraging outcomes. Nearly one-third of children achieved the highest documented CAP category, while additional children attained CAP score 7, indicating the ability to communicate effectively in everyday situations. Approximately one-quarter remained at CAP score 3, reflecting ongoing dependence on structured auditory rehabilitation.

Language outcomes also showed progressive improvement. Around one-third of children developed single-word expressive speech, whereas almost one-quarter progressed to two-word combinations. Nearly one-fifth achieved speech intelligibility adequate for routine communication, highlighting the beneficial role of cochlear implantation combined with sustained auditory-verbal rehabilitation in children with Congenital Rubella Syndrome.

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