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Original Research Article

Association of sensorineural hearing loss in pediatric patients with CMV and Rubella infection

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ABSTRACT

Background: Sensorineural hearing loss handicaps a child and delays emotional, speech, behavioural and social development, if not diagnosed early. Among manifold causes of SNHL, CMV and Rubella infections are important for a significant prognostic and future planning for the child. Aim to find out the association of paediatric SNHL with Cytomegalovirus and Rubella infection. To evaluate other risk factors for paediatric sensorineural hearing loss.
Methods: This is a case-control study of one year with 74 Patients from birth to 12 years of age attending ENT department for audiological assessment. Sample was divided into 2 groups (37 with SNHL, 37 with normal hearing) based on relevant tests like Oto Acoustic Emission (OAE) and Brainstem Evoked Response Audiometry (BERA). History of CMV and Rubella infection and also prematurity, low birth weight, birth asphyxia was recorded followed by analyses of their association with SNHL.
Results: There is a strong and significant association of CMV (OR=11.93) and Rubella (OR=28.75) with paediatric SNHL. Around 56.5% cases of Rubella infected kids had Profound SNHL and 40% of CMV infected kids had moderately severe SNHL. There is mild to moderate association of low birth weight (OR=1.81), prematurity (OR=1.44) and neonatal asphyxia (OR=3.08) with paediatric SNHL.
Conclusions: Based on the analysis, CMV and Rubella infection has statistically significant and strong association with SNHL in children. Cochlear implantation can be planned in Children with severe to profound SNHL if diagnosed timely preventing the child from being handicapped. Early screening for CMV and rubella infection with audiological evaluation is thus highly recommended.

Keywords: Brainstem evoked response audiometry, Cytomegalovirus, Low birth weight, Oto acoustic emission, Sensorineural hearing loss

INTRODUCTION

Sensorineural hearing loss from damage to cochlea, Eighth cranial nerve and neural pathway is responsible for a major cause of hearing disability. Its prevalence is around 1 in 1000 neonates, 6 in 1000 children by 18 years of age.[1] Although with high prevalence, paediatric sensorineural hearing loss are generally diagnosed when the child undergoes the first audiometric evaluation at school.[3] A delayed diagnosis and inadequate treatment hampers the speech, language, social and emotional development of the child.[2] Among manifold aetiologies of paediatric SNHL, infectious causes like CMV and Rubella are of prime concern. Delayed diagnosis of Cytomegalovirus and Rubella infection in paediatric SNHL does not help in medically treating the cause. Screening for Cytomegalovirus and Rubella as early as possible and timely audiological assessment is crucial.

Thus through this study we try to disclose the importance of prompt audiological screening for children to ensure good hearing health.

Aims and objectives

To evaluate the association of pediatric sensorineural hearing loss with CMV and Rubella infection. To evaluate other risk factors for pediatric sensorineural hearing loss.

METHODS

This is a case-control observational study of 1 year duration from December 2023 to November 2024. It includes 74 patients from birth till 12years attending Department of ENT, SMCH for audiological assessment. Patients of severe mental retardation, active middle ear disease, psychosis, cerebral palsy, conductive or mixed hearing loss, inadequate history and guardian of the patient not consenting for the study were excluded from the study.

With informed consent from guardian, detailed history and physical examination was recorded as per proforma. Sample was divided into 2 groups (Group A: 37patients with SNHL & Group B: 37 patients with normal hearing) based on relevant tests like OAE, BERA. History of CMV & Rubella infection was recorded as well as tested with ELISA for Serum IgG as when required. Analysis of the association and pattern of CMV, Rubella with SNHL was done thereafter. History of other risk factors like prematurity, low birth weight, birth asphyxia was also recorded as per proforma. Further detailed analysis with all the risk factors and their association and significance with SNHL was done.

Ethical clearance from Institutional Ethics Committee of Silchar Medical College and Hospital Silchar was obtained.

RESULTS

Following distribution (Table 1) was obtained with 74 patients divided into two groups, group A of 37 patients with SNHL and group B of 37 patients with normal hearing. In the group A with 37 patients of SNHL, Rubella was found more in the age group of 6-18 months, whereas, 6-9 years children were found more with CMV (Figure 1). The study reveals that, Females were more affected by CMV (F: M=2.5:1) whereas males were more affected with Rubella (M: F= 2:1). But both Rubella and CMV infection was found more in Females (F: M=3:1) (Table 2).

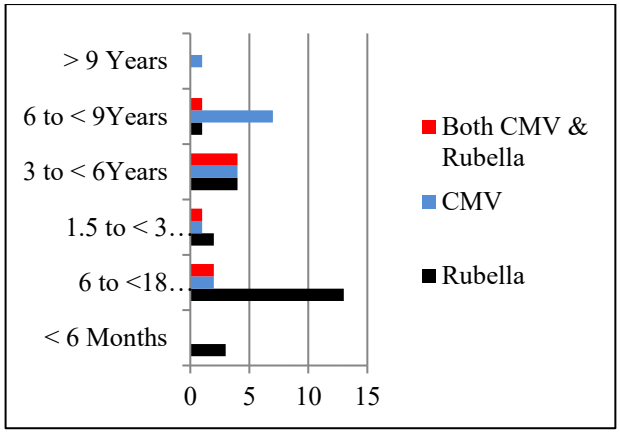

Figure 1: Relation of disease with presenting age for audiology check-up in Group A.

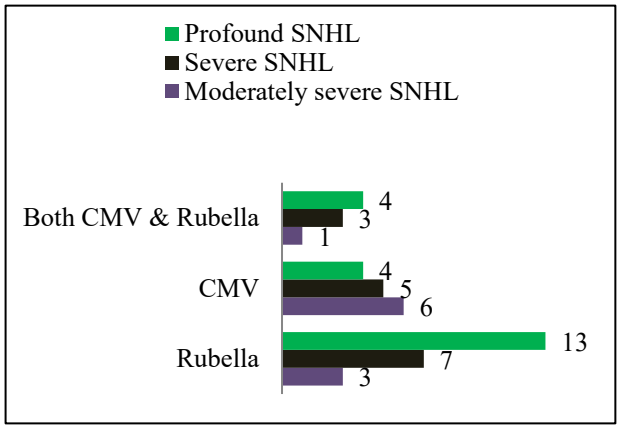

Figure 2: Distribution of Degree of SNHL with CMV and Rubella in Group A.

Rubella infection presented with more of Profound SNHL (13 cases, 56.52%). CMV infections presented more with moderately severe SNHL (6 cases, 40%). Profound SNHL (4 cases, 50%) was found in patients affected with both CMV and Rubella (Figure 2). Based on the statistical analysis, it is found that, both Rubella and Cytomegalovirus has the strong association with SNHL and are highly statistically significant. Neonatal birth asphyxia is moderately associated with SNHL and is statistically significant. But prematurity and low birth weight have mild association with SNHL but is statistically insignificant (Table 3).

Table 1: Comparative distribution of demography.

		Group A SNHL (n=37)	Group B normal hearing (n=37)
Gender	Males	14	24
	Females	23	13
Cytomegalovirus infection only		7	2
Rubella infection only		15	2
Both CMV & Rubella infection		8	0
Other risk factors		7	25

Table 2: Gender distribution with CMV and rubella in group A.

	Male	Female	Ratio (M:F)
CMV	2	5	0.4:1
Rubella	10	5	2:1
Both CMV and Rubella	2	6	0.3:1

Table 3: Statistical analysis of association and significance of various risk factors with pediatric SNHL compared among group A and B.

S. no.	Variables	OR	95% CI	P value
1	Rubella	28.75	5.96-138.5	0.001
2	CMV	11.93	2.48-57.28	0.001
3	Prematurity	1.81	0.61-5.35	0.278
4	Low birth weight	1.44	0.52-3.98	0.476
5	Neonatal asphyxia	3.08	1.11-8.50	0.027

DISCUSSION

SNHL in children diagnosed late handicaps them and delays their speech, behavioural, social and emotional development. Thus adequate and timely screening is of utmost importance to increase outcome and better future for newcomers.

There are manifold causes of sensorineural hearing loss in kids, but infection with rubella and cytomegalovirus is of utmost priority. Though due to development of vaccines, the incidence of viral infections has declined but Northeast region of India still witness kids infected with rubella, cytomegalovirus, toxoplasma etc. Prompt diagnosis of serum IgG, IgM with ELISA or viral isolation with PCR from urine/pharyngeal swab/blood can prevent lifelong morbidity in these children. In this study, it is found that till now Rubella and CMV infections are prevalent in the North East region of India causing significant hearing loss in the children. This study conveys that, Male are more affected with Rubella whereas females are more affected with CMV, which corresponds to a study by Nazme et al, who reported that SNHL in rubella infected patients are dominated by male in Bangladesh.[9] A study by Chalkiadakis et al, reported that TORCH infection was found to be a significant contributor in causing hearing loss.[10]

Our study concludes that children infected with Rubella developed profound SNHL and presented mostly around 6-18 months of age as compared with a study in Yogyakarta showing severe SNHL in Congenital Rubella Syndrome patients were found in 36% children with mostly aged 2-6 months old.[8] In CMV infection, type of hearing loss is late in onset and progressive in nature and the hearing loss progresses through adolescence according to Garima Singh et al, 2022.[11] Which might be a reason for delayed CMV infected children presentation around 6-9 years with moderately severe SNHL, similar to long-term studies by Fowler et al, Rosenthal et al whose study confirm fluctuating or progressive SNHL in children with congenital CMV infection.[12,13]

The pathogenesis of hearing loss in CMV and Rubella is thought to result from strial atrophy, disruption of Reissner's membrane and limbus spiralis damage, with additional involvement of vestibular structures, these histopathological changes, as cited by Kenna MA et al, underlie the profound and often irreversible SNHL seen in such infections.[14] A multidisciplinary treatment with timely audiology tests like otoacoustic emission (OAE) which can be performed post-delivery, Brain evoked response audiometry (BERA) that can be initiated since 3 months of age can help plan the future requirement for cochlear implant in these suffering kids. As mentioned, and emphasized by other studies too about the importance of early screening for congenital infections like Rubella, as they continue to be an important preventable cause of childhood deafness.[15]

Similarly, CMV remains the leading non-genetic cause of congenital hearing loss worldwide, with delayed-onset presentations often being missed without structured screening programmes.[16] AlSabellha et al, have similarly emphasized the value of early identification of hearing loss through automated otoacoustic emissions (AOAE) and auditory brainstem response (ABR) testing, highlighting their role in facilitating timely intervention and appropriate management for affected children.[17] Other risk factors associated with SNHL includes prematurity, neonatal asphyxia, low birth weight but are not statistically significant with hearing development of the child in this study similar to study by Bondan Herwindo et al.[7] However, other factors such as genetic predisposition, ototoxic medications and meningitis, as highlighted by Korver et al, were not fully evaluated in the present study.[18]

The present study has few limitations as this being a single-centre investigation with a modest sample size, the

findings may not be fully generalizable to a larger population. The diagnosis of CMV and Rubella relied partly on clinical history with limited serological confirmation, carrying a risk of recall bias. In addition, other important contributors to paediatric SNHL, such as non-syndromic genetic predisposition, ototoxic medications or environmental exposures were not comprehensively assessed.

CONCLUSION

Thus, through this study, it is concluded that, Rubella and CMV infections have strong association and statistically significant with high risk for causing severe to profound SNHL in the children. Prematurity, neonatal asphyxia, low birth weight are some of the other risk factors causing mild to moderate SNHL in children but not significant.

These infections if diagnosed timely and treated accordingly can cure the child and prevent progression to hearing disability thus audiological assessment is highly advisable for all of them as early as possible. Further cochlear implants can be planned as early as possible if diagnosed timely for these children for a better quality of life.

In conclusion, compliance to the Universal Neonatal Hearing Screening protocol, heightened awareness among underserved areas, intensified surveillance for the prevention of CMV and Rubella infections, with expansion of facilities and equipment for Cochlear and Brainstem implants can significantly impact the indigent segments of society for a promising future of the budding generation.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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