Research Report

ABR profile in children with congenital rubella syndrome at Hasan Sadikin General Hospital

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ABSTRACT

Background: Congenital Rubella Syndrome (CRS) refer to a condition of variable birth defects, such as hearing impairment, congenital heart defects, cataract or congenital glaucoma, and others. In Indonesia, the incidence rate of rubella infection in 2015 was 3.2 per 100.000 live birth and increasing to 5.6 per 100.000 live birth in 2017. Rubella vaccination can decrease the incidence of CRS, however it has not been implemented in many developing country. Hearing impairment is the most common clinical manifestation among CRS cases. **Purpose:** This study was performed to know the hearing profile on CRS from January until December 2018, at Hasan Sadikin Hospital. **Methods:** A retrospective descriptive study design was conducted. Data was obtained from medical records and Auditory Brainstem Response (ABR) results, between January until December 2018, at Dr. Hasan Sadikin General Hospital, Bandung. **Results:** There were 60 CRS patients, 53 of them (88%) had hearing loss. Profound Sensorineural Hearing Loss (SNHL) in 27 patients (45%), severe SNHL in 18 patients (30%), 3 of them were unilateral, moderate unilateral SNHL in 3 patients (5%), mild SNHL in 5 patients (8%) consisted of 2 unilateral SNHL and 3 bilateral SNHL. Normal hearing in 7 patients (12%). **Conclusion:** Eighty eight percent of CRS patients had hearing loss, 75% with bilateral SNHL. Follow-up and management for these patients required multidisciplinary approach such as paediatrics, ophthalmologic, physical medicine and rehabilitation, and parental support.

Keywords: congenital rubella syndrome, auditory brainstem response, sensorineural hearing loss

ABSTRAK

Latar belakang: *Sindrom Rubella Kongenital (SRK) mengacu pada berbagai kondisi cacat lahir, seperti gangguan pendengaran, cacat jantung kongenital, katarak atau glaukoma kongenital, dan lain-lain. Di Indonesia, tingkat kejadian infeksi rubella pada tahun 2015 adalah 3,2 per 100,000 kelahiran hidup dan meningkat menjadi 5,6 per 100,000 kelahiran hidup pada tahun 2017. Vaksinasi rubella dapat mengurangi kejadian SRK, namun belum diterapkan di banyak negara berkembang. Gangguan pendengaran adalah manifestasi klinis paling umum di antara kasus SRK.* ***Tujuan:*** *Penelitian ini dilakukan untuk mengetahui profil pendengaran pada SRK, dari Januari sampai dengan Desember 2018, di Rumah Sakit Hasan Sadikin.* ***Metode:*** *Penelitian ini adalah deskriptif retrospektif. Data diperoleh dari rekam medis dan hasil Auditory Brainstem Response (ABR) antara Januari hingga Desember 2018 di Rumah Sakit Umum Dr. Hasan Sadikin, Bandung.* ***Hasil:*** *Didapatkan 60 pasien SRK, 53 pasien (88%) mengalami gangguan pendengaran. Gangguan pendengaran sensorineural (GPSN) sangat berat terdapat pada 27 pasien (45%), GPSN berat pada 18 pasien (30%), 3 di antaranya adalah GPSN unilateral. GPSN unilateral sedang pada 3 pasien (5%), GPSN ringan pada 5 pasien (8%) terdiri dari 2 gangguan pendengaran unilateral dan 3 GPSN bilateral. Pendengaran normal pada 7 pasien (12%).* ***Kesimpulan:*** *Delapan puluh delapan persen pasien SRK mengalami gangguan pendengaran, 75% dengan GPSN bilateral. Tindak lanjut dan penatalaksanaan untuk pasien ini memerlukan pendekatan multidisiplin: spesialis THT, spesialis anak, spesialis mata, spesialis kedokteran fisik dan rehabilitasi, serta dukungan orang tua.*

Kata kunci: *sindrom rubella kongenital, auditory brainstem response, gangguan pendengaran sensorineural*

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INTRODUCTION

Rubella is an infection caused by rubella virus which spread in airborne droplet through cough or sneeze.[1] Congenital rubella is transmitted through maternal-fetal placental circulation, usually five to seven days after maternal infection.[2] The terminology could be split up into two types of manifestation, congenital rubella infection (CRI) and congenital rubella syndrome (CRS). CRI is all outcomes that associated with rubella infection such as miscarriage, stillbirth, birth defects, or asymptomatic infection. Rubella infection can affect several organs and cause birth defects that are responsible for CRS. CRS refers to a condition of variable birth defects, such as hearing impairment, congenital heart defects, cataract or congenital glaucoma, and others.[2]

Each year, it is estimated that more than 100.000 infant born with CRS worldwide. Some country reported that rubella continues to be endemic, even though it has been eliminated in the United States, still the number of CRS cases from 2005 until 2015 decreased less than one percent per year. From 2012 until 2013 estimated 2.3 per 1000 live birth incidence of CRS cases in South East Asia.[3] In Indonesia, the incidence rate of rubella infection in 2015 was 3.2 per 100.000 live birth, and had increased to become 5.6 in 2017.[4] Based on Herini et al.[5] study, the number of CRS among Indonesian infants is still high. Rubella vaccination can decrease the incidence of CRS in developed country, but it has not been implemented in some developing countries including Indonesia. Even in countries with rubella vaccination programs, it was reported that 78 countries which had a national vaccination policy, only 9% performed it as selective strategy (i.e. protection to women or schoolgirls), and 31% reported that it was only children immunization.[6] Vaccination of two doses of Rubella Containing Vaccine (RCV) before pregnancy is necessary in prevention of CRS.[7]

Manifestation of birth defects of CRS are hearing impairment, congenital heart defects, cataract or congenital glaucoma, and deafness which are the most common among others.[1] One study in Indonesia reported that hearing impairment was the most common clinical manifestation in CRS cases, counted 100% from all subjects, followed by congenital cataracts (72.7%), microcephaly (72.7%), congenital heart defects (45.5%), hepatosplenomegaly (18.2%) and global development delay (9.1%).[5] Permanent hearing loss can occur in 80% of patients, and it can be sensorineural and bilateral with severity ranges.[2]

The aim of this study is to find out the hearing profile, such as the severity and types of hearing impairment of CRS patients at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia, in the year 2018.

METHOD

A descriptive study was carried out at the Audiology Clinic of Hasan Sadikin General Hospital. A retrospective descriptive study design was used in this research. The data was taken from paper based and computer-based medical records. Data were taken from patients whom diagnosed with CRS between January 2018 and December 2018. The sampling technique was total sampling.

The diagnosis of CRS was based on patients' history, physical examination, serologic examination of IgG and IgM anti-rubella from mother and child. Auditory Brainstem Response (ABR) results from the medical record were collected to find out the patient's hearing profile, including hearing impairment types and severity in every CRS patients. The ABR examination was performed after the patient had been diagnosed with clinical CRS. Subjects with incomplete medical records were excluded.

The results from click-evoked ABR with single channel recording method were collected from the medical records. The ABR employed a non-inverting electrode. The electrode was placed on upper forehead (Fz electrode); the inverting electrode was placed on mastoid of tested ear, and ground electrode was placed on mastoid of non-tested ear.

RESULTS

In total, 60 CRS cases were reported between January 2018 and December 2018 at Hasan Sadikin Hospital. Sixty CRS patients underwent ABR examination at the Audiology Center, and the data were processed for this research. Amongst 60 CRS patients, there were 53 (88%) patients with hearing loss. Based on WHO classification, the age range was divided to 2-14 months, 15-36 months, and 37-72 months. The mean age of patients with hearing loss was 15 months of age. The

Table 1. Characteristic of CRS patients at RS Dr.Hasan Sadikin in 2018

NO	Characteristic		Total	%
1	Age	2-14 mo	31	52
		15-36 mo	26	43
		37-72 mo	3	3
		TOTAL	**60**	**100**
2	Sex	Male	27	45
		Female	33	55
		TOTAL	**60**	**100**

Table 2. Hearing profile of CRS patients

		Hearing Level (n)						
		Normal	**Mild SNHL**	**Moderate SNHL**	**Severe SNHL**	**Profound SNHL**	**Conductive HL**	**TOTAL**
		n(%)	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**
Sex	Male	4(7)	3(5)	2(3)	10(17)	8(13)	0(0)	**27(45)**
	Female	3(5)	2(2)	1(2)	8(13)	19(32)	0(0)	**33(55)**
Age (mo)	2-14	6(10)	5(8)	1(2)	6(10)	13(22)	0(0)	**31(52)**
	15-36	1(2)	0(0)	2(3)	11(18)	12(20)	0(0)	**26(43)**
	37-72	0(0)	0(0)	0(0)	0(0)	3(3)	0(0)	**3(3)**

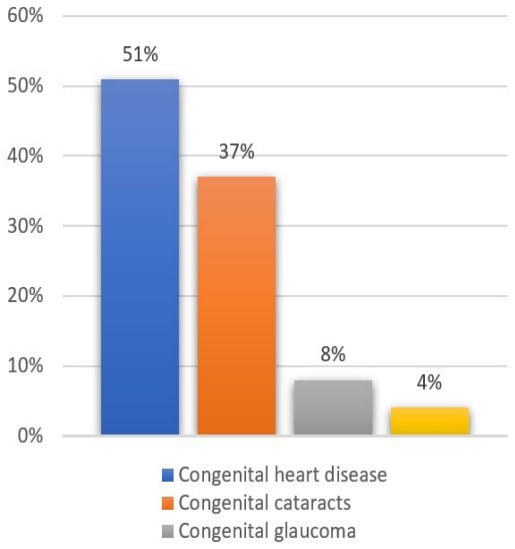

Figure 1. Major Complication of CRS

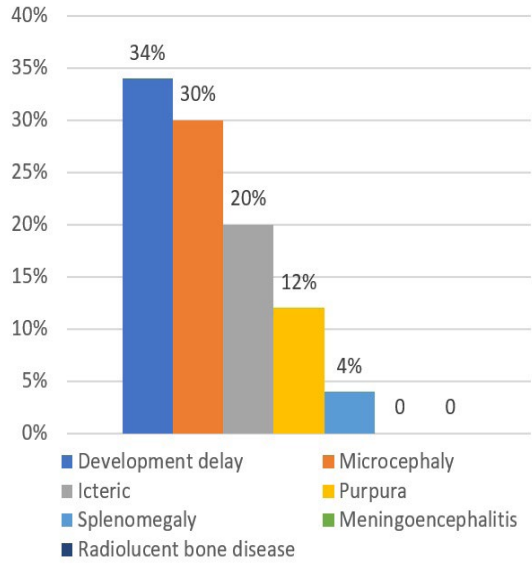

Figure2. Minor Complication of CRS

majority of patients with positive result were between 2-14 months, i.e. 31 (52%) cases. By gender, the prevalence rate was 27 (45%) male and 33 (55%) female. All characteristics of CRS patients were shown in Table 1.

This study also determined the degree of hearing level based on ABR examination with click and tone burst stimulation (500 Hz and 1000 Hz). The degree of hearing loss could be classified based on ABR waveform response. Table 2 showed that the incidence of SNHL was higher in female group than male, namely 33 (55%) and 27 (45%). Most of the patients were 2-14 months of age, i.e. 31 (52%) cases. The most common degree of SNHL was profound. Conductive hearing loss was not found in CRS patient.

Figure 1 presented the major complication of CRS besides hearing impairment which was congenital heart disease found in 51% of cases, and followed by eye problem such as congenital cataracts in 37% cases. Meanwhile, Figure 2 showed many minor complications of CRS and the most common was development delay in 34% patients, followed by microcephaly in 30% patients.

DISCUSSION

CRS caused hearing impairment on 53 (88%) patients, with the majority of cases were profound SNHL (45%). CRS can be found worldwide and considered as harmless viral childhood disease. Nevertheless, infection during early pregnancy may cause fetal death or CRS.[8] CRS is a major contributor to global burden of preventable blindness and deafness.[9] Congenital defects commonly found as classic triad: congenital cataract that cause blindness, congenital heart disease, and sensorineural hearing loss.[10] It happens when the fetus is growing, the most rapid heart muscle development occurs along with the development of the inner ear and lens. Therefore, the damage of the ears and eyes are often accompanied by a variety of heart defects. Several cases only have one symptom, and hearing impairment is the most common manifestation found in infants with CRS.[10] According to WHO, hearing loss means limited hearing ability ≥26 dB, which is incurable and permanent. In our study, 88% subjects with CRS from January to December 2018, had suffered hearing loss. The majority of subjects (52%) were in the range 2-14

months of age, which was in accord with the research conducted by Sugishita et al.[11] (51.5%).Our study did not show striking difference between the gender of patients as reported by Sugishita et al.[11] who also did not find statistical significance for sex. Another research by Rahman et al.[8] also showed the same prevalence between men and women. In the contrary, a study by Nazme et al.[10] found the subjects were dominated by male patients (68%).

Steps to diagnose CRS usually performed by Behavioral Observation Audiometry (BOA) after otoscopic examination, by evaluating in detail the response of the patient's behavior to the sound stimulus with several parameters such as eye shifting, provocation from sleep, and eye blinking behavior.[12] However, some studies reported that BOA had poor sensitivity (66.7%), and specificity (86.9%), and this behavioural technique is unreliable for unilateral hearing loss, delayed cognitive, speech and language development, motoric development in infants, and immature neurodevelopment process in high-risk new born. To overcome the limitations of the evaluations based on BOA responses, objective assessment of hearing procedure was adapted. Our current study applied method of auditory brainstem response (ABR) to evaluate the infants' hearing based on objective measures.

ABR testing was performed for threshold estimation.[12] It was also used to check the reliability of hearing thresholds by comparing with pure tone behaviour threshold. Our study showed almost half of the subjects suffered from profound SNHL, as many as 45% patients with different prevalence in males (13%) and females (32%). In other study, it was found that abnormal ABR obtained in children with a history of gestational rubella infection in which profound hearing loss were more evident than lesser degree of hearing loss.[12] Our study presented subjects with profound SNHL was in age group of 2-14 months (22%). Meanwhile, the study conducted by Siti Herini et al.[5] showed subjects with profound SNHL in 17 patients (36%), and mostly 2-6 months of age, which 53% subjects were males.

Our study showed other major complications of CRS are congenital heart disease (51%). Meanwhile minor complications that also accompanying were development delay (34%). This was in accord with other study by Sugishita et al.[11] that showed subjects with congenital heart disease were most dominant (75%), followed by pigmentary retinopathy (12,5%), and cataract (6,3%). Cardiac abnormalities occur in half of the children infected during the first 8 weeks of gestation. Although rubella virus infection usually causes a mild fever and rash illness in children and adults, infection during pregnancy, especially during the first trimester, can result in miscarriage, fetal death, stillbirth, or infants with a constellation of congenital malformations known as congenital rubella syndrome.[13]

Congenital rubella syndrome is a major contributor to the global burden of preventable blindness, deafness, cardiovascular defects and mental retardation. One study by the Oman surveillance system described early clinical manifestations after a median of 30 years follow-up of all evaluable CRS patients from 1980 to 2015 who received comprehensive general and specialty clinical assessments in the Middle East. Early CRS manifestations recorded by the study included ocular, auditory, neurologic, and cardiovascular manifestations, low birth weight and hepatosplenomegaly. Similar studies and findings were also observed in Australia, Canada, Israel and the United Kingdom.[14]

The strongly suggested prevention is vaccination. Rubella vaccination protects effectively against subsequent infection and is the best strategy to eliminate CRS cases. It is a live vaccine type and it can penetrate

the placenta. Theoretically it infects the fetus; thus, it is contraindicated during pregnancy, and women are advised to delay pregnancy for one month after vaccination. The immunization should be executed prior to child-bearing age. The goal of rubella vaccination is to prevent congenitally acquired rubella. Immunization of all young children is required to reduce rates of CRS.[6,10,13]

In our study, it was found that 88% of CRS patients had hearing loss with or without other major and/or minor complications. Most subjects with hearing impairment had profound SNHL type. Follow-up and management for these patients required multidisciplinary approach such as pediatry, ophthalmology, physical medicine and rehabilitation, pediatric cardiology, and also parental support.

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