Risk Factors with Otoacoustic Emission and Automated Auditory Brainstem Response examinations in Infant

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Abstract

Hearing loss in children can be caused by various risk factors and sometimes they overlap. These risk factors include a family history of hearing loss, TORCH infection (Toxoplasmosis, Rubella, Cytomegalovirus, and Herpes Simplex). Purpose: To describe an overview of risk factors in infants by OAE and AABR examination. Methods: This study is a retrospective observational analytic study with a cross-sectional approach. This study uses a secondary data source in the form of medical records of infants with hearing loss. The research was conducted at Dr.Soetomo Surabaya Hospital. Results: The most common risk factor was premature birth, 287 (79.1%). The least risk factors are toxoplasma, pneumonia, speech delay and Aminoglycosides 4 days as much as 1 (0.3%). Conclusion: risk factors for babies with hearing loss include: premature, LBW, hyperbilirubinemia, asphyxia, NICU>5 days, mechanical ventilator>5 days, Toxoplasma, rubella, CMV, meningitis, pneumonia, sepsis, family history, microcephaly, hydrocephalus, congenital syndrome , craniofacial malformations, global development delay, speech delay, respiratory distress syndrome, aminoglycosides.

Keywords : Risk Factor, Infant, OAE, AABR

1. Introduction

The auditory system plays an important role in helping children learn the language around them. Through understanding language, children can learn to speak, socialize, and hone their cognitive abilities [1]. Hearing loss in children can occur at any age from newborn to childhood. However, children with hearing loss from birth (congenital) that are not detected and left untreated will increase the incidence of impacts such as speech delays accompanied by psychological disorders and behavioral disorders which will also affect the child's socialization abilities and academic achievement [1] [2]. In addition, if hearing loss persists and is left until adulthood, the number of unemployed people in the country will increase. This is because sufferers have difficulty communicating and understanding lessons [3].

In terms of prevalence in 2019, the loss due to untreated hearing loss is around 1 trillion international dollars. If it is not addressed immediately, the number of sufferers will continue to increase. The prevalence of hearing loss in the world in 2019 is around 1.5 billion people, with 430 of them experiencing moderate to severe impairment [4]. Children suffer from 34 million people [5].

The most common type of hearing loss from birth is the bilateral sensorineural type, but conductive disorders can be found if there are anatomical abnormalities [6]. Hearing loss in children can be caused by various risk factors and sometimes overlap [7]. These risk factors include a family history of hearing loss, intrauterine TORCH infection (Toxoplasmosis, Rubella Cytomegalovirus, and Herpes Simplex), undergoing treatment in the Neonatal Intensive Care Unit (NICU) > 5 days, administration of aminoglycoside drugs > 5 days, use of mechanical ventilation > 5 days, use of extracorporeal membrane oxygenation (ECMO), hyperbilirubinemia (kernicterus), perinatal asphyxia or hypoxic ischemic encephalopathy (HIE), prematurity, low birth weight (LBW), craniofacial malformations, microcephaly, hydrocephalus, syndromes associated with hearing loss, and meningitis or encephalitis [8] [9] [10] [11] [12].

This study aims to determine and analyze the distribution of the characteristics of infants with and without risk factors who were examined with OAE and AABR at the Audiology Outpatient Unit at RSUD Dr. Soetomo for the 2016-2020 period.

2. Method

Our study used a observational analitik method, with the types of dengan studi retrospektif. We used secondary data, namely reading the data related to gender, age, family history of risk factor patients at the clinic of Audiology, Soetomo General Hospital in November 2016 until June 2020. The sampling technique used purposive non-probability sampling dengan metode total sampling that met the inclusion criteria. Variables will be collected in the Microsoft Excel application, processed using Statistical Package for the Social Sciences application, and presented in a table.

3. Result

Table 1.1 Distribution of Risk Factors for Infants Examined with OAE and AABR

No	Risk Factor	n	
		Frequency	Percentage
1	Prematur	287	79,1
2	BBLR	258	71,1
3	Hiperbilirubinemia	70	19,3
4	Asfiksia	58	16
5	NICU>5hari	79	21,8
6	Ventilator mekanik > 5 hari	10	2,8
7	Toxoplasma	1	0,3

8	Rubella	4	1,1
9	CMV	4	1,1
10	Meningitis/Ensefalitis	2	0,5
11	Pneumonia	1	0,3
12	Sepsis	2	0,5
13	Riwayat Keluarga Tuli	2	0,5
14	Mikrosefali	6	1,7
15	Hidrosefalus	3	0,8
16	Sindrom Kongenital	4	1,1
17	Malformasi kraniofasial	2	0,5
18	Global Developmental Delay	4	1,1
19	Speech Delay	1	0,3
20	Respiratory Distress Syndrome	2	0,5
21	Aminoglikosida 4 hari	1	0,3

Table 1.1 shows the distribution of risk factors for babies who were examined with OAE and AABR at the Audiology Outpatient Unit at RSUD Dr. Soetomo for the 2016-2020 period. The most common risk factor for hearing loss was premature birth, in 287 (71.9%) patients, counted from a total of 363 babies, followed by LBW (71.1%). The number of babies with a combination of premature and LBW risk factors was 88 (24.2%) babies.

4. Discussions

Hearing screening is an important program used to reduce the number of hearing loss in children. This screening uses acoustic emission devices, OAE, and ABR [13][14]. Early intervention programs and newborn hearing screening programs (based on physiological methods) that focus on early intervention, ideally starting before 6 months of age; family support, including parental guidance and counseling; hearing rehabilitation through hearing aids and cochlear implants; appropriate therapeutic and communication options [15].

Premature is a risk factor that is often found in this study, which is 79.1%. Prematurity is often not a single risk factor, but overlaps especially with LBW [16]. In this study, 88 (24.2%) infants had both of these risk factors. Meanwhile, research at the Assiut University Hospital in Egypt showed that the combination of these two risk factors had the highest prevalence, namely 57% [17].

The results in this study indicate that both premature and LBW babies both show more referrals to OAE than those with AABR. This indicates a disturbance in the outer, middle ear, or cochlea. The relationship between pure prematurity and hearing loss is still unclear [18] [19]. According to Wroblewska et al, prematurity often overlaps with other risk factors because prematurity itself is the cause of other risk factors such as asphyxia, hyperbilirubinemia, and stay in the NICU > 5 days [7][20]. This is consistent with the study of Moore et al, which stated that cochlear maturity has an effect on DPOAE examination [21]. However, according to Hof et al, it is suspected that delayed maturation of the auditory nerve pathways causes hearing loss [22]. Meanwhile, in cases of LBW infants, screening failures are caused by accumulation of fluid in the middle ear, but this fluid will disappear on its own within a few days or weeks [23]. In contrast to this opinion, Barker stated that there were changes in microcirculation in the cochlea of LBW babies which caused sensorineural disturbances [24].

Prematurity and LBW are not included in the category of risk factors in JCIH, but prematurity and LBW are included as risk factors for hyperbilirubinemia which causes sensorineural disturbances. According to research in Surabaya, prematurity and LBW are not related to congenital hearing loss [25]. Supporting this research, Swaiman et. al stated that prematurity is rarely categorized as a risk factor because ear formation is complete during the second trimester [9]. Nonetheless, there are reports that babies born <32 weeks must be monitored intensively until the baby is 3-4 years old [26]. Infants with LBW are also reported to have a risk of hearing loss both early and late onset, so their speech and language development must be monitored [23] [25].

Risk factors for babies with hearing loss include: premature, low birth weight, hyperbilirubinemia, asphyxia, NICU> 5 days, mechanical ventilation > 5 days, Toxoplasma, rubella, CMV, meningitis, pneumonia, sepsis, family history, microcephaly, hydrocephalus, congenital syndromes, malformations craniofacial, global development delay, speech delay, respiratory distress syndrome, aminoglycosides

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