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Characteristics of Down Syndrome Children with Delayed Speech and Hearing Loss in Audiology Clinic, Dr. Soetomo Surabaya Hospital

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Abstract

Background: Down syndrome is a pathology related to trisomy 21 chromosome. The incidence of Down syndrome is approximately 1/1000 births in some countries. The syndrome is commonly associated with the risks of developmental delays, difficulties in speech and hearing loss.

Objectives: To determine the prevalence and characteristics of children with Down syndrome suffered from delayed speech and hearing loss in Audiology Clinic, Dr. Soetomo Hospital, Surabaya from January 2013-December 2017. **Method:** This study is an observational analysis with cross-sectional retrospective design on the patient's medical record.

Results: Thirty patients were diagnosed with delayed speech amongst the Down syndrome children; 19 (63.3%) were males; 11 (36.7%) were females. The most frequent was in the age group of >1-2 years [8 patients (26.7%)]; the least was in the age group of 4-6 months [1 patient (3.3%)]. Hearing loss was found in 21 patients (70%) and the rest had normal hearing [9 patients, (30%)]. Amongst the first group, 1 patient (3.3%) had profound hearing loss, 8 patients (26.7%) had severe hearing loss, 11 patients (36.7%) had moderate hearing loss and 1 patient (3.3%) had mild hearing loss. Two patients (6.7%) had prenatal problem, 2 patients (6.7%) had natal problem, 7 patients (23.3%) had post-natal problem. Amongst these, 1 patient (3.3%) had prenatal and natal problems, 5 patients (16.7%) had natal and post-natal problems, 1 patient (3.3%) had prenatal and post-natal problems, 3 patients (10%) had prenatal, natal and post-natal problems, and the rests had no recorded problems.

Conclusion: Hearing loss was prevalent in Down Syndrome children with delayed speech. This might be correlated to the prenatal, natal, post-natal health risk problems. The hearing loss should be considered during treatment of speech delay in Down Syndrome children.

Keywords: Delayed speech, hearing loss, Down syndrome.

Introduction

Down syndrome is correlated to trisomy 21 chromosomes and accepted to be the major cause of Down syndrome, accounting for about 95% of cases.^{1,2,3} The cause of the extra full or partial chromosome is still unknown. This syndrome associated with some phenotypes i.e. disability of learning, cardiac abnormalities, brain development, physical and mental disorder the risk of early Alzheimer's disease,

and leukemia in childhood.⁴ The incidence of Down syndrome has been predicted around 1/1000 live births in some countries. This syndrome is also associated with delayed development, hearing loss, and delayed speech.⁴

Worldwide the number of Down syndrome patients was predicted around 8 million people. This syndrome is the most frequently occurring chromosomal abnormality in humans and affecting between 1 in 400 until 1500 babies born in different populations, depending on

maternal age, and prenatal screening schedules.^{1,5,6} The incidence of Down syndrome is approximately 1 in 1000 births. In USA, 3000 until 5000 births of children in a year is suffered from this condition. Based on the data from Indonesia Center for Biodiversity and Biotechnology (ICBB), there was more than 300,000 of Down syndrome children in Indonesia.⁷

Down syndrome children need specific care from their parents. One of the common health problems are hearing disorder and delayed speech. Children must be able to mumble in the age of 2 until 4 months. However, in Down syndrome children with hearing loss, they could be suffering from delayed speech at the age of 2-5 years. When not detected and treated properly, these may develop into a socioeconomic problem for these children and their parents. Thus controlling children ear hygiene and parental awareness of hearing loss potential play a vital role.⁸ Identification of hearing loss and awareness of its implications in children with Down syndrome is very important⁵ because it will adversely affect cognitive abilities, sentence imitation, language comprehension, speed of word processing, and sensitivity to short acoustics.⁹ However, not every child with Down syndrome has the same problems or associated conditions. Parents of children with Down syndrome should be aware of these possible conditions so they can be diagnosed and treated quickly and appropriately.

¹⁸ To increase public awareness, we conducted a study of the prevalence and characteristics in Down syndrome children with delayed speech and hearing loss in the Audiology clinic at Dr Soetomo General Hospital, Surabaya from January 2013 – December 2017.

Material and Method

²⁰ This was an observational analysis with cross-sectional retrospective design on the patient’s medical record in the Audiology clinic at Dr Soetomo General Hospital, Surabaya from January 2013 until December 2017 which had been ethically legalized before. The assessment was speech development based on the Milestone.¹⁰ All data were analyzed using SPSS 17.

Findings: This study selected 30 data of patient’s medical record which had complete data in the Audiology clinic at Dr Soetomo General Hospital, Surabaya from January 2013 until December 2017.

Table 1. The distribution of gender subject

Gender	n
Male	19 (63.3%)
Female	11 (36.7%)
Total	30

Based on the data table 1, delayed speech in Down syndrome children occur more in male patient 19 patients than female.

Table 2. The distribution age of subject

Age	n
4 – 6 months	1 (3.3%)
>6 – 12 months	3 (10%)
>1 – 2 years	8 (26.7%)
>2 – 3 years	5 (16.7%)
>3 – 4 years	5 (16.7%)
>4 – 5 years	3 (10%)
>5 – 8 years	5 (16.7%)

Based on the data table 2, delayed speech in Down syndrome children occur more in the age group of more than 1 until 2 years, and the least was in the age group of 4 until 6 months.

Table 3. The distribution health risk factor in prenatal and peri-natal period of mother’s subject

Prenatal Period	n
Hypertension	2 (6.7%)
Heart disease	1 (3.3%)
Accident	1 (3.3%)
Pulmonary TB	1 (3.3%)
Drugs user	2 (6.7%)
Normal	23 (76.7%)
Perinatal Period	n
Sectio caesaria	8 (26.7%)
Normal	22 (73.3%)

¹¹ Based on the data table 3 the most frequent health risk factor in prenatal period was hypertension and drugs user. In peri-natal period the most frequent health risk factor was normal labor.

Table 4. The distribution health risk factor in natal period of mother's subject.

Natal Period	n
Premature	3 (10%)
Low birth weight	2 (6.7%)
Placenta calcification	1 (3.3%)
Rupture of membranes	2 (6.7%)
Birth without crying	3 (10%)
Normal	19 (63.3%)

Based on the data table 4 the most frequent health risk factor in natal period was premature and birth without crying.

Table 5. The distribution health risk factor in post-natal period of mother's subject

Post-natal Period	n
Jaundice	3 (10%)
Seizure	4 (13.3%)
Pulmonary infection	4 (13.3%)
High fever	2 (6.7%)
Surgery	1 (3.3%)
Cardiac abnormalities	2 (6.7%)
Normal	14 (46.7%)

Based on the data table 5 the most frequent health risk factor in post-natal period was seizure and pulmonary infection.

Table 6. The distribution hearing threshold level of Down syndrome patients with delayed speech.

Hearing threshold	n
Normal	9 (30%)
Mild hearing loss	1 (3.3%)
Moderate hearing loss	11 (36.7%)
Severe hearing loss	8 (26.7%)
Profound hearing loss	1 (3.3%)
Total	30

Based on the data table 6 the most frequent level of hearing threshold in Down syndrome children with delayed speech was moderate hearing loss.

Discussions

From 34 cases, 4 cases were excluded due to incomplete data. Thirty patients were diagnosed with delayed speech amongst the Down syndrome children; 19 (63.3%) were males; 11(36.7%) were females. In previous study conducted in RSUP Dr. Moh. Hoesin

Hospital, Palembang, Indonesia, delayed speech amongst non-Down syndrome children were found more in males than females (66.9% to 33.1%).¹¹ This is similar with what had been found in the current study: to certain extent this may be associated to the higher prevalence of Down syndrome in males compared to in females (55.8% : 44.2%).¹²

We found the most frequent number of Down syndrome with delayed speech and hearing syndrome was in the age group of >1-2 years [8 patients (26.7%)]; the least was in the age group of 4-6 months [1 patient (3.3%)]. In other study the most frequent delayed speech of Down syndrome children with hearing loss was in the age group of >1-2 years 26.8% whilst the least in age group of 6 months-1 year 6.6%.¹¹ At 4-6 months they cannot babble and dopronunciation speech with many different sounds including p, b, and m, chuckling and giggling, vocalizing vocabulary and displeasure, making a noise when alone and when playing with others. These children could babble at the age of more than 1 year but without meaning and do not understand when ordered; whereas in control group they are able to say more words every month, using several questions with one or two words ("Where is the cat?", "bye-bye", "What is that?"), placing two words together ("More cakes", "No juice", "Mother's book"), using many different consonant sounds from the beginning of the word.¹⁰

In this study, 2 patients (6.7%) had prenatal problem, 2 patients (6.7%) had natal problem, 7 patients (23.3%) had post-natal problem. Amongst these, 1 patient (3,3%) had prenatal and natal problems, 5 patients (16,7%) had natal and post-natal problems, 1 patient (3,3%) had prenatal and post-natal problems, 3 patients (10%) had prenatal, natal and post-natal problems, and the rests had no recorded problems. Patient with premature birth was 17% of total sample, however the etiology was not determined. Previous research reported that hearing loss was found in 53.3% of preterm births (with birth body weight <2500 grams).¹³ The highest risk factors for post-natal period were seizures [4 patients, (13.3%)] and pulmonary infections [4 patients, (13.3%)]. Whereas previous study at Dr Moh. RSUP. Hoesin, Palembang showed that the most frequent risk factors in post-natal period were 20.8% infection and 12.8% head trauma.¹¹ Infections that can cause hearing disorders such as bacterial meningitis, intrauterine infections (CMV, rubella, herpes, syphilis, and toxoplasmosis).¹⁴ The least health risk factors during the prenatal period were hypertension [2 patients (6.7%)] and medications

used [2 patients (6.7%)] in natal period was premature [3 patients, (10%)] and baby born without crying [3 patients, (10%)]. History of the use of herbs or medicines was also reported in Palembang although the type of herbs or medicines taken by patients are not cleared.¹¹

We also found hearing loss based on the hearing threshold level which examined by using BOA (Behavioural Observational Audiometry). In this study, hearing loss was found in 21 patients (70%) and the rest had normal hearing [9 patients, (30%)]. Amongst the first group, 1 patient (3.3%) had profound hearing loss, 8 patients (26.7%) had severe hearing loss, 11 patients (36.7%) had moderate hearing loss, 1 patient (3.3%) had mild hearing loss. In other study, hearing loss was found in patient with delayed speech 6.3%. Lieu *et al*, described that bilateral disorders are more at risk of causing delayed speech in children than unilateral disorder, because in unilateral disorder, growth and development are still running.¹⁵ The previous study reported that Down syndrome children with delayed speech has hearing loss due to the external ear canal being smaller than normal size and has stenosis, chronic ear diseases such as chronic rhinitis which can cause conductive, sensorineural and mixed hearing loss. Subglottic stenosis, vocal cord paralysis, and laryngomalacia are also common in Down Syndrome patients and can cause delayed speech.¹⁶ In another study conducted by Tedeschi *et al.*, in the United States, hearing loss in children with Down syndrome with delayed speech is caused by long-term use of mechanical ventilation.¹⁷

Conclusion

From the current study, hearing loss was prevalent in Down Syndrome children with delayed speech. This might be correlated to the prenatal, natal, post-natal health risk problems. The hearing loss should be considered during treatment of speech delay in Down Syndrome children.

¹⁶**Conflict of Interest:** There was no conflict of interest in this study.

Ethical Clearance: The ethical clearance is granted from KEPK, Dr Soetomo General Hospital, Surabaya no. 0925/KEPK/II/2019.

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