

## Oto-Acoustic Emission and Auditory Brainstem Response Profile in Children with Speech Delay at Dr. Hasan Sadikin General Hospital Bandung

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### Abstract

**Background:** Language and speech delay are the most common developmental disorders found in children. Hearing loss is the most common cause of speech delay among children. Hearing loss can be detected by subjective and objective examinations. Oto-acoustic emission (OAE) and auditory brainstem response (ABR) are objective electrophysiological examination with 100% sensitivity and 99% specificity. This study was aimed to describe OAE and ABR profile in children with speech delay at Dr. Hasan Sadikin General Hospital Bandung

**Methods:** This study was conducted in 2014 used the descriptive cross-sectional design with a total sampling of 333 medical records of children diagnosed with speech delay with inclusion criteria patients aged 1–5 years at the Hearing Disorders Clinic of Otorhinolaryngology-Head and Neck Surgery Polyclinic at Dr. Hasan Sadikin General Hospital Bandung during the period of 2011–2012.

**Results:** Out of all of the samples, there were 176 boys (52.9%) and 157 girls (47.1%). Most of children aged 24–35 months. Eighty children (24%) with normal hearing and 253 children (76%) with hearing loss. Hearing loss with Sensorineural hearing loss (SNHL) type most occurred at the profound degree with 244 cases.

**Conclusions:** Hearing loss is the most common cause of speech delay in children. Speech delay can be prevented by conducting the OAE and ABR examinations as early as possible. [AMJ.2016;3(2):265–8]

**Keywords:** Auditory brainstem response examination, hearing loss, oto-acoustic emission examination, speech delay

### Introduction

Language and speech delay are the most common developmental disorders found in children.<sup>1,2</sup> Speech and language in children can give negative impacts to the socialisation, personality, behaviour and school attainment. These disorders are experienced by 5–8% pre-school age children. In Indonesia prevalence of speech delay in children is between 5–10% in school age children.<sup>3-5</sup>

Speech and language disorders are disorders or delay in children in speaking or using language in the daily life. Hearing loss is one of the most common causes of the speech delay.<sup>6,7</sup> The Joint Committee on Infant Hearing (JCIH) decided that hearing loss in children should have been detected at the age of three months and the proper intervention is started before six months or less.<sup>8</sup> This priority is

in concert with the national initiative. It is shown in the result of a study conducted by Yoshinaga-Itano et al.<sup>9</sup>

Hearing loss can be detected by subjective and objective examinations. Oto-acoustic emission (OAE) and auditory brainstem response (ABR) are objective electrophysiological examinations with 100% sensitivity and 99% specificity. For children, OAE is an ideal screening from the ear to the cochlea, since it can examine babies from the age of one day in a fast, easy, and unpainful way. The ABR examination measures the brainstem auditory pathway and can estimate the threshold of hearing and the type of hearing loss (conductive, sensorineural, or mixed).<sup>1,6</sup> This study was aimed to describe OAE and ABR profile in children with speech delay at Dr. Hasan Sadikin General Hospital Bandung.

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**Table 1 Incidence of Hearing Loss.**

Age (months)	Normal			Hearing Loss		
	Boy(s)	Girl(s)	Total	Boy(s)	Girl(s)	Total
12-23	2	0	2	12	10	22
24-35	25	8	33	56	45	101
36-47	16	9	25	27	45	72
48-59	12	2	14	12	22	34
> 60	2	4	6	12	12	24
Total	57	23	80	119	134	253

**Table 2 Results of Oto-Acoustic Emission (OAE) Examination .**

Result	Number	%
Pass	80	24
Refer	253	76
Total	333	100

## Methods

This study was conducted in 2014 using a descriptive cross-sectional design to 333 medical records of children diagnosed with speech delay at the Hearing Disorders Clinic of Otorhinolaryngology-Head and Neck Surgery

Policlinic at Dr. Hasan Sadikin General Hospital Bandung during the period of 2011-2012. The inclusion criteria were medical record data of speech delay patients aged 1-5 years and exclusion criteria were patients with craniofacial, congenital anomaly and other problems.

**Table 3 Results of Auditory Brainstem Response (ABR) Examination**

Type of Hearing	Degree of Hearing	Threshold of Hearing (dB)	Right Ear		Left Ear	
			n	%	n	%
Normal	Normal	0-25	80	24	80	24
SNHL	Mild	26-40	10	3	10	3
	Moderate	41-60	7	2.1	13	3.9
	Severe	61-80	72	21.6	75	22.5
	Profound	81 or >	155	46.6	146	43.9
CHL	Mild	26-40	4	1.2	3	0.9
	Moderate	41-60	0	0	0	0
	Severe	61-80	2	0.6	1	0.3
	Profound	81 or >	3	0.9	5	1.5
MHL	Mild	26-40	0	0	0	0
	Moderate	41-60	0	0	0	0
	Severe	61-80	0	0	0	0
	Profound	81 or >	0	0	0	0
Total			333	100%	333	100%

Note: SNHL = Sensorineural hearing loss; CHL = Conductive hearing loss; MHL = Mixed hearing loss

## Results

Out of all of the samples, there were 176 boys (52.9%) and 157 girls (47.1%). Most of children aged 24-35 months. Based on the result of OAE examination there were 80 children (24%) with normal hearing (pass in examination) and 253 children (76%) with hearing loss (refer in examination).

Based on the result of ABR examination, hearing loss with Sensorineural hearing loss (SNHL) type most occurred at the profound degree with 244 cases.

## Discussion

It is shown that the least number of patients were the one-year-old patients, meaning that the parents had not realized the hearing loss of their children (Table 1). This might be caused by the lack of awareness and knowledge of the parents regarding the children's reaction to sound and the impact of hearing in children. If the children were diagnosed with hearing loss before the age of 6 months, those children would still have bigger chances to be able to speak and communicate optimally, since they would obtain earlier managements. This is shown in the result of a study conducted by Yoshinaga-Itano et al.<sup>9</sup> which stated that earlier identification and management of permanent childhood hearing loss is known to result in improved developmental outcomes, children with hearing loss who got intervention before six months of age got improved results in language at 3 years of age.

From the results of OAE and ABR examinations, the ratio of children with hearing loss and normal children is 3:1. There were 253 children (75.98%) with speech delay who got "refer" or "not pass" in their OAE examination, which means that hearing loss is the most common cause. The results of ABR examination is categorized based on the degree of hearing loss and location of the disorder, whether at the left or right ear.<sup>10</sup> The most frequently found hearing loss was the profound hearing loss, in which the children were not able to hear a loud sound from a nearby place.

The hearing loss which most commonly occurred was the SNHL i.e. 244 cases and Conductive hearing loss (CHL) i.e 9 cases. The SNHL is the sensorineural hearing loss, i.e. a disorder at the cochlea or the inner ear. Children are indeed identified with SNHL, a variety of diagnostic tests can be

recommended depending on the patient's history and physical examination.<sup>11</sup> For infants/children with profound hearing loss, probability exists by use of hearing aids or cochlear implantation (CI) and speech therapy. Children with mild hearing loss should also be monitored for developmental and behavioral problems (attention deficit/hyperactivity disorder, autism, and learning disabilities), speech therapy and use of hearing aids. Speech and language disorders seem to have more impact on motor performance than only language disorders, and it seems that when speech production is affected, motor problems are more pronounced. The results support the need to give early and more attention to motor development. Moreover, special attention should be given to children with speech and language disorders.<sup>12</sup>

As a conclusion, this study found that hearing loss is the most common cause of speech delay in children (76%). Speech delay can be prevented by conducting the OAE and ABR examinations as early as possible.

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