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# NEWBORN HEARING SCREENING IN BORNEO INTERIOR ZONE: PRIME CASE IN KENINGAU

Doh Jeing Yong[1], Ridwan Hashim[2], Hui Lian Ho[3*]

## Abstract

Borneo Sabah being part of the country of Malaysia, is constituted by huge land area. Healthcare development in rural area of interior always lags behind the city area. Wise distribution of healthcare personnel and equipment are possible and should be looked in as an important step to escalate heath care accessibility of the under privileged folks. Neonatal hearing screening is not available in the interior of Sabah. This study describes the first case of newborn hearing screening conducted at Keningau Hospital, an interior zone of Northern Borneo, Malaysia. New service of high-risk neonatal hearing screening was launched and protocol of neonatal Otoacoustic Emission (OAE) screening was established.

**Keywords:** Neonatal hearing screening, Otoacoustic Emission, Deafness, Borneo Interior, Keningau

*Correspondence Email: hnorlking.au@gmail.com

[1] *Head and Neck Division, Department of Otorhinolaryngology, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Jalan UMS, Kota Kinabalu 88400, Malaysia.*

[2] *Department of Administration, Keningau Hospital, Keningau 89007, Sabah, Malaysia*

[3] *Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Jalan UMS, Kota Kinabalu 88400, Malaysia.*

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## INTRODUCTION

Borneo of Malaysia constitutes of Sabah and Sarawak. Since the inception of Malaysia, Northern Borneo has formally joined Malaya in 1963 to form a strong union and remain strong for the past 62 years. Sabah, being part of the island of a huge Borneo landscape, are rich with terrains of biodiversity and long mountainous ranges. Reserves land occupied half of its massive 7.32 million hectares in this land below the winds (Kodoh et al., 2009).

Interior of Sabah strives to develop at a pace much slower than bigger city of waterfront. Keningau district is in the deep interior of Sabah state. The only health facility in this domain is Keningau Hospital which is located 120 km away from the coastal city and separated by the Crooker range. Newborn here are not privileged to be screened for hearing loss as to what baby born in the city usually do. Baby with high risk of hearing loss needs to be referred to the state hospital for mere preliminary screening. Due to logistic hindrance, some mothers of newborn has opted to default referral and thus deprived their baby of possible earliest detection of hearing impairment as well as rehabilitation. We strive to break this logistic healthcare accessibility barrier by provision of prime in-house hearing screening facility. This paper aims to report the implementation of the first newborn hearing screening using Otoacoustic Emission (OAE) at Keningau Hospital.

## METHODS

Neonatal hearing screening is inherently aimed at all newborns at our centre in postnatal ward. Babies who were admitted to neonatal intensive care unit are not considered. Existing screening team were formed from trained Assistant Medical Officer and Nurse in the centre. The selection of baby for our first case of screening was based entirely upon on the first parental consent obtained in the postnatal ward.

Our prime case of hearing screening was a baby girl 12 hours of life, born at term via spontaneous vaginal delivery in the labour room of Keningau Hospital. The birth weight was 3060 grams. The baby was noted to have APGAR score of 9 and 9 at 1 and 5 minutes after birth, respectively. Perinatal periods were uneventful. Prenatal history was unremarkable. There was no risk of hearing loss in the family history. Mother was a healthy 28-year-old lady with no comorbidities. On examination, the neonate was active and normal in appearance. No syndromic features were noticeable. Oral, nasal and aural examination were normal. The pinna and ear canals normal and intact on both sides.

Our screening began with transporting the neonate to an examination baby cot in the postnasal ward with the company of the mother. Consent was obtained after the intended procedure of hearing screening was explained thoroughly to the mother.

Baby was positioned supine on the examining baby cord in the postnatal ward at a chosen location of corner with less sound interference (Figure 1). The baby was calmed before conducting the screening assessment. We used the Grason Stadler GSI Corti OAE machine with

Distorted Product Otoacoustic Emission (DPOAE) mode and tested the baby in a quiet corner of the postnatal ward.

**Figure 1:** OAE assessment of our prime case in postnatal ward on baby cot in open ward environment.

Grason Stadler GSI Corti OAE machines have been distributed to all state hospital by Ministry of Health for the purpose of nationwide neonatal hearing screening program. This basic model has preset module with single mode of DPOAE only and option of signal transduction two and four seconds during the screening. The machine has a test probe fitted with a silicon seal (Figure 2) that would be inserted into the ear canal of the baby to initiate the test.


**Figure 2:** Site of test probe (1) of the OAE machine fitted with a red silicone soft seal with the outer ear canal.

## RESULTS AND DISCUSSION

The left ear showed a 'REFER' result in the first test, but after calming the baby and repositioning the probe, the second test showed a 'PASS' (Table 1).

**Table 1:** Otoacoustic Emission test result

| OAE Site | First Test | Second Test | Time Taken (Min) |
|---|---|---|---|
| **Right Ear** | PASS | - | 5 |
| **Left Ear** | REFER | PASS | 10 |

Hearing screening for newborns is utmost important to prevent missed early detection of hearing loss that could hamper the speech development. The earlier the detection, the better the outcome of hearing rehabilitation that could make a significant different in speech development of the newborn.

Vital preparations were conducted to enable the establishment of neonatal hearing screening programme in the interior of Sabah. Firstly, a suitable machine is needed to perform such test. OAE test is the recommended evaluation tool for all neonatal hearing screening in our country (Ministry of Health, Malaysia, 2021) . An OAE machine (Grason Stadler GSI Corti) sourced from the state hospital was used in this launching of services. Intensive training sessions were conducted to ORL staff in the facility to ensure the proper conduct of the test and handling of the machines. Meetings dan workshop was conducted in line with this intention (Figure 3).


**Figure 3:** Workshop to strengthen and credential staff of interior hospital in neonatal hearing programme.

Selection of our baby for our first screening case was random as she was the only baby admitted to postnatal ward at the time of the official launching of our screening program. The result has shown that the OAE test is a fast and simple procedure that is not time consuming. The venue limitations of noisy ambience were unavoidable as the existing venue was not soundproof. Nonetheless, the machine was able to produce reliable test result in the background noise level below 55 decibel sound pressure level (dbSPL) (Kemp, D. T., 2002).

Time taken to conduct the left ear was prolonged due to repeated testing. The test generates two spectrums of result: PASS or REFER. REFER means the testing probe failed to detect any cochlear microphonic response, indicating possible positive in hearing loss of cochlear origin. Immediate redo testing is performed to verify the findings as false positive result in hearing loss could happen. Studies have shown that the REFER result rates drops with repetitive testing in the same setting (Joint Committee on Infant Hearing, 1994). Hence 3rd attempts of repetitive screening is not performed in the same setting should the 2nd result persistently show the result of REFER (Figure 4).

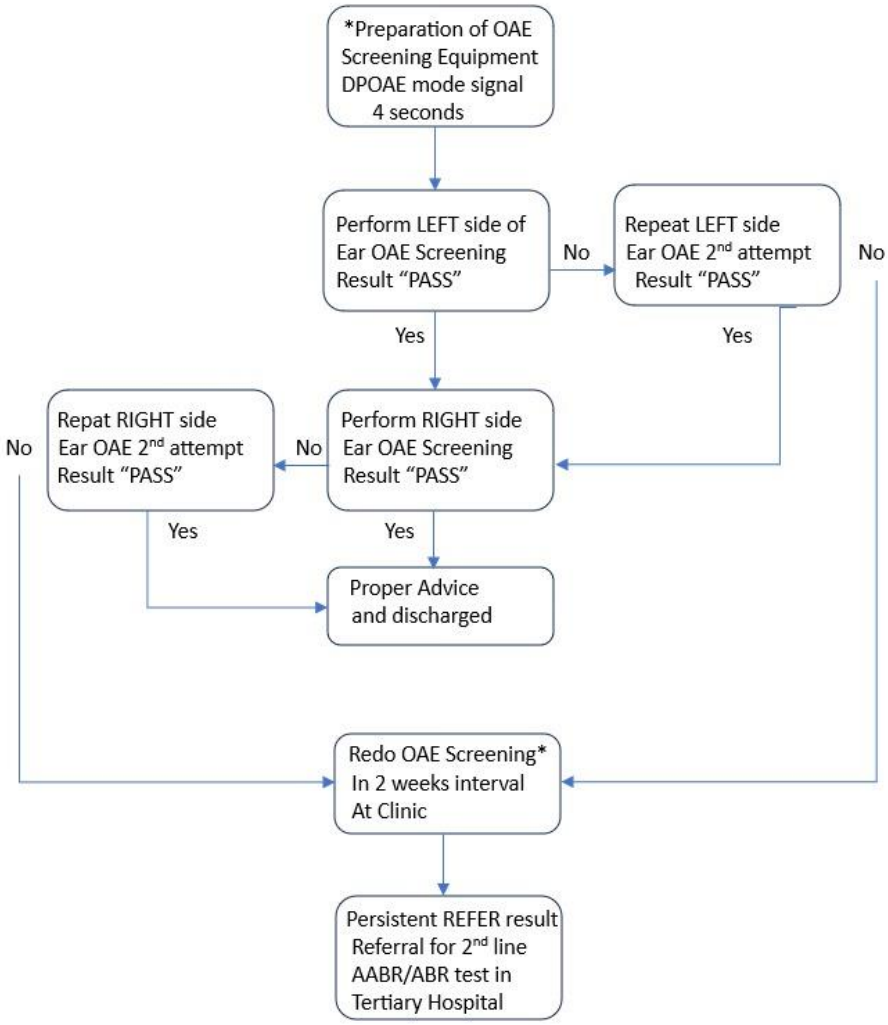


**Figure 4:** Flowchart of OAE Testing Protocol in Borneo Interior (AABR: Automatic auditory brainstem reflex).

The interior Keningau Hospital is a small healthcare facility that capable of providing 261 beds admission. The census over the last three years shows an average 4000 deliveries per annum. Moreover, figures have shown that almost one in 1000 newborn was born with one or both side of hearing loss (Joint Committee on Infant Hearing, 2007; Thompson, D. C et al., 2001). The availability of neonatal screening in the interior hospital obviates the need to refer the patients to state hospital. Shortest route to the state hospital in the city centre traverses the Crook Range Kimanis road which spans across 120 km distance and consumes three hours journey. Public transport shuttle and chartered taxis services are costly to many families.

Nonetheless, with the current sizing of the Otorhinolaryngology (ORL) unit and limited manpower as well as resources, the hearing screening test can only be considered for the high-risk group (Davis, A. et al., 1997). Future plan of development includes recruiting a permanent audiologist staff to serve the interior hospital, acquisition of more OAE test machines as well as assignment of more staff to the screening team. Universal screening will be the next agenda in line for Keningau Hospital.

Our first case of OAE screening for newborn has proven that the interior hospital has the capability to perform this audiological assessment by minimal staff with proper training of OAE tool. The launching of OAE screening in interior Borneo (Figure 5) was a laudable move in escalating health care provision to the interior and underprivileged folks. Although current neonatal screening is limited for high-risk group, future plan for universal screening expansion will surely benefit more newborns.

**Figure 5:** Prime case of hearing screening and official launching of the Neonatal Hearing Screening Programme in Keningau on 12th November 2024. Chief author (White coat).

## CONCLUSION

This meaningful project was undertaken by the initiation of a Head and Neck subspeciality trained surgeon in the field of laser, robotic and reconstructive surgery that has embarked on a journey to explore the establishment of an ORL unit in the interior of Sabah. The unorthodox order of this subspecialist placement has enabled the serendipitous initiation of a historical launching of prime hearing screening programme in Keningau district. Furthermore, OAE neonatal screening protocol for interior Keningau Hospital was established. The centre handles more than a handful of deliveries per day. With proper training, the time required for each hearing screening remains reasonable. Even with a limited number of trained personnel, the implementation of universal newborn hearing screening is feasible and holds promise for future service expansion.

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