

FP 6: A Retrospective Study on the Possible Risk Factors of Failed Otoacoustic Emission Testing Results among Neonates Delivered in a Tertiary Hospital from January to December 2015

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Background:

The importance of early identification of hearing loss has been recognized for many years. Undetected hearing loss present from an early age can impede acquisition of speech, cognitive, and social-emotional development. The incidence of significant hearing loss is ten times greater for infants with one or more maternal and neonatal risk factors than for those with no risk factors. These risk factors were used to identify neonates at higher-than normal risk for hearing loss. However, using these high risk features alone as an indication for hearing testing, would leave at least 50% of infants with congenital hearing loss undiagnosed.

In 2007, the Joint Committee on Infant Hearing was established and recommended hearing screening for all newborns. The goal of newborn hearing screening is to identify those infants who need diagnostic hearing evaluations because they are at risk for significant hearing loss.

Current technology uses automated protocols and pass-refer criteria via the Otoacoustic Emission Testing (OAE). Failures in the Otoacoustic Emission Testing may be associated with several factors. Identifying possible demographic, maternal, neonatal, and perinatal features contributing to the failure of Otoacoustic emission testing results may be necessary in improving detection and screening for neonatal hearing loss.

This study was able to identify possible correlations between the demographic profiles of neonates, significant maternal, perinatal and neonatal histories with the results of the newborn Otoacoustic Emission Testing in a local tertiary hospital.

Method:

The researcher conducted this study by reviewing all medical charts of neonates delivered at Vicente Sotto Memorial Medical Center (VSMMC). The researcher used a Retrospective Study Design and reviewed all noted cases from January 2015 to December 2015 about failed Otoacoustic Emission Testing results.

In this investigation, Total Elimination Sampling Technique was employed. This was based on the overall number of patients who failed the Otoacoustic Emission Testing (74 patients) in the specified time frame. In line with the objective of providing a comparative assessment between those who passed and those who failed the Otoacoustic Emission Testing, the researcher obtained an equal number of seventy four (74) patients who passed the test.

Statistical Package for Social Sciences (SPSS) version 19 was used in this study. Microsoft Excel was used in encoding all data obtained. The researcher coded the data necessary for this study.

Frequency Distribution and Percentage were used to determine the demographic profile of neonates and their respective maternal history.

Chi-square and T-test. These were used to determine association among the identified neonatal and maternal variables and discern significant differences among the aforementioned variable.

Binomial Logistic Regression. This was used to determine the predictors for failed Otoacoustic Emission Testing among neonates admitted at Vicente Sotto memorial Medical Center from January to December 2015.

Result:

Table 1. Clinico-Demographics of Neonates Enrolled in the Investigation

Variables	Newborn Hearing Test		Total	p
	Failed	Passed		
Age				.019 [≠]
2 days old	34(23)	30(20.3)	64(43.2)	
3 days old	24(16.2)	38(25.7)	62(41.9)	
4 days old	16(10.8)	6(4.1)	22(14.9)	
Sex				.205 [≠]
Male	43(29.1)	37(25)	80(54.1)	
Female	31(20.9)	37(25)	68(45.9)	
Birthweight				.058 [≠]
<1000 g	0(0)	0(0)	0(0)	
1000-1500 g	6(4.1)	1(.7)	7(4.7)	
>1500 g	68(45.9)	73(49.3)	141(95.3)	
APGAR 1 min				.004 [∂]
Mean±SD	7.89±1.09	8.01±.634	-	
APGAR 5 mins				.002 [∂]
Mean±SD	9.79±.859	9.95±.198	-	
Craniofacial Anomalies				.500 [≠]
Absent	72(48.6)	73(49.3)	145(98)	
Present	2(1.4)	1(.7)	3(2)	
Hyperbilirubinemia				.058 [≠]
Absent	68(45.9)	73(49.3)	141(95.3)	
Present	6(4.1)	1(.7)	7(4.7)	
Neonatal Sepsis				.065 [≠]
Absent	65(43.9)	71(48)	136(91.9)	
Present	9(6.1)	3(2)	12(8.1)	

Note: The results are presented as Mean±SD, unless otherwise shown.

≠Chi Square Test

∂ t-test for Independent Samples

ΩBinary Logistic Regression

Table 1 presents the clinico-demographics of neonates enrolled in the research investigation. The majority of the study population were in the 2 days old (n=64 or 43.2%). In this group, 34 failed the newborn hearing test (23%). There were 62 patients in the 3 days of age (41.9% where 24 failed the newborn hearing test (16.2%). On the other hand 22 were 4 days old where in this group 16 (10.8%) failed the newborn hearing test. Significant difference was not found between newborn hearing test and sex (p .205 > .05). 141 patients were in the above 1500 gram birthweight (95.3%), in this group 68 (45.9%) failed the newborn hearing test while 73 passed (49.3%). There were only 7 patients in the 1000 to 1500 gram birthweight (4.7%) where 6 failed the newborn hearing test (4.1%) and only 1 (.7%) passed the newborn hearing test. Significant variation was found between birthweight and the results of newborn hearing test (p .058 < .05). The score of APGAR at 1 minute interval was higher among those who passed the newborn hearing test compared to those who failed (8.01±.634 vs. 7.89±1.09; p .004 < .05).

APGAR score taken at 5 minutes disclosed higher score among those who have passed the newborn hearing test ($9.95 \pm .198$ vs. $9.79 \pm .859$; $p .002 < .05$). Most patients had no craniofacial anomalies (145; 95%). In this group 73 failed 49.3% passed the newborn hearing test while 72 (48.6%) failed. There were only 3 patients (2%) who have craniofacial anomalies and 2 of these patients had failed the newborn hearing test ($p .500 > .05$). Hyperbilirubinemia disclosed that most of these patients had none (141; 95.3%) where in this group 68 (45.9%) failed the newborn hearing test. There were only 7 patients (4.7%) with hyperbilirubinemia and 6 of these patients (4.1%) had failed the newborn hearing test ($p .058 < .05$).

Neonatal sepsis was not seen in most patients (136; 91.9%). In this category 65 (43.9%) had failed the newborn hearing test. There were 12 patients who have neonatal sepsis (8.1%). In this category 9 (6.1%) had failed the newborn hearing test ($p .065 < .05$).

Table 2.1. Maternal Clinical and Demographics Characteristics Enrolled in the Investigation

Variables	Newborn Hearing Test		Total	p
	Failed	Passed		
BMI				.318 [§]
Mean \pm SD	23.79 \pm 3.41	23.56 \pm 2.72	-	
Gestational Hypertension				.382 [*]
Absent	67(45.3)	69(46.6)	136(91.9)	
Present	7(4.7)	5(3.4)	12(8.1)	
Chronic Hypertension				.340 [*]
Absent	70(47.3)	72(48.6)	142(95.9)	
Present	4(2.7)	2(1.4)	6(4.1)	
Gestational DM				.058 [*]
Absent	68(45.9)	73(49.3)	141(95.3)	
Present	6(4.1)	1(.7)	7(4.7)	
Chronic DM				.690 [*]
Absent	72(48.6)	72(48.6)	144(97.3)	
Present	2(1.4)	2(1.4)	4(2.7)	
Thyroid Problems				.000 [*]
Absent	60(40.5)	73(49.3)	133(89.9)	
Present	14(9.5)	1(.7)	15(10.1)	
Ototoxic Medications				.009 [*]
Not Taken	65(43.9)	73(49.3)	138(93.2)	
Taken	9(6.1)	1(.7)	10(6.8)	
Alcohol Intake				.031 [*]
Not Taken	62(41.9)	70(47.3)	132(89.2)	
Taken	12(8.1)	4(2.7)	16(10.8)	
Smoking				.310 [*]
Not Taken	71(48)	73(49.3)	144(97.3)	
Taken	3(2)	1(.7)	4(2.7)	
Illicit Drugs				.248 [*]
Not Taken	72(48.6)	74(50)	146(98.6)	
Taken	2(1.4)	0(0)	2(1.4)	

Note: The results are presented as Mean \pm SD, unless otherwise shown.

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Table 2.1 shows the maternal clinico-demographics of patients. The BMI of patients whose neonates have failed the newborn hearing test was higher compared to those whose neonates have passed the newborn hearing test (23.79 ± 3.41 vs. 23.56 ± 2.72). There was no significant difference between body mass index and the results of the newborn hearing test ($p .318 > .05$). Gestational hypertension was absent in the majority (136; 91.9%). In this group 67 (45.3%) had neonates who failed the newborn hearing test. On the other hand, there were 12 patients who had gestational hypertension (8.1%). In this group, 7 (4.7%) had failed the newborn hearing test and 5 (3.4%) had passed the newborn hearing test ($p .382 > .05$). There were 142 patients with no hypertension (95.9%). In this group 70 had neonates who had failed the newborn hearing test (47.3%). There were 6 mothers (4.1%) who had chronic hypertension. In this category 4 (2.7%) had failed the newborn hearing test ($p .340 > .05$).

Cases of gestational diabetes mellitus disclosed that 141 of them had none of it (95.3%). In this group 68 (45.9%) had failed the newborn hearing test. On the other hand, 7 patients had gestational diabetes mellitus (4.7%) and 6 of these (4.1%) had neonates who failed the newborn hearing test ($p .058 < .05$). Chronic cases of diabetes mellitus disclosed that the majority had none (144; 97.3%). In this group 72 (48.6%) had failed the newborn hearing test. There were only 4 patients who had chronic DM and 2 (1.4%) had neonates who failed in the newborn hearing test ($p .690 > .05$).

Thyroid problems of patients revealed that most of them had none (133; 89.9%). In this group, 60 (40.5%) had neonates who failed the newborn hearing test. There were only 15 patients (10.1%) who had thyroid issues and in this group 14 (9.5%) had neonates who failed the newborn hearing test ($p .000 < .05$). With regard to ototoxic medications, 138 patients had not taken it (93.2%) where 65 (43.9%) had neonates who failed the newborn hearing test. There were only 15 patients (10.1%) who had thyroid issues. In this category (9; 6.1%) had neonates who had failed the newborn hearing test ($p .009 < .05$). As for patients who have taken alcoholic beverages, 132 of them declared of not taking it (89.2%). In this group 62 (41.9%) had neonates who had failed the newborn hearing test. There were 16 patients (10.8%) who had taken alcohol. In this group 12 (8.1%) had neonates who failed the newborn hearing test ($p .031 < .05$). The majority of patients were not smoking (144; 97.3%) and in this group 71 (48%) had neonates who failed the newborn hearing test. There were only 4 patients who disclosed that they had smoked (2.7%) and in this group 3 (2%) had neonates who failed the newborn hearing test.

Illicit drugs were not taken by the majority of mothers included in this investigation (146; 98.6%), and in this group 72 (48.6%) had neonates who failed the newborn hearing test. There were only 2 patients who had taken illicit drugs (1.4%) and all of them had neonates who failed the newborn hearing test ($p .248 > .05$).

Table 2.2. Maternal Clinical and Demographics Characteristics Enrolled in the Investigation

Variables	Newborn Hearing Test		Total	p
	Failed	Passed		
Folate				.007 [≠]
Not Taken	22(14.9)	8(5.4)	30(20.3)	
Taken	52(35.1)	66(44.6)	118(79.7)	
Vitamin B Complex				.060 [≠]

Not Taken	4(2.7)	0(0)	4(2.7)	
Taken	70(47.3)	74(50)	144(97.3)	
Vitamin D				.081 [≠]
Not Taken	29(19.6)	20(13.5)	49(33.1)	
Taken	45(30.4)	54(36.5)	99(66.9)	
Congenital Hearing Loss				.002 [≠]
Negative	65(43.9)	74(50)	139(93.9)	
Positive	9(6.1)	0(0)	9(6.1)	
Acquired Hearing Loss				.001 [≠]
Negative	58(39.2)	71(48)	129(87.2)	
Positive	16(10.8)	3(2)	19(12.8)	

Note: The results are presented as Mean±SD, unless otherwise shown.

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The majority of patients had taken folate during pregnancy (118; 79.7%). In this group 52 patients had neonates who failed the newborn hearing test (35.1%). There were only 30 patients who had not taken folate (20.3%) and in this category 22 (14.9%) had neonates who failed the newborn hearing test. The majority of patients had taken vitamin B complex (144; 97.3%) and in this group 70 (47.3%) had neonates who failed the newborn hearing test while there were only 4 patients who had not taken vitamin B complex (2.7%) all their neonates had failed the newborn hearing test ($p .060 < .05$).

Vitamin D of patients were most taken by the majority (99; 66.9%) and in this group 45 (30.4%) had neonates who failed the newborn hearing test while there were only 48 patients who reported of not taking their vitamin D (33.1%). In this group, 29 (19.6%) had neonates who failed the newborn hearing test ($p .081 > .05$). Family history of hearing loss was not found in the majority of the patients in this investigation (139; 93.9%). In this category 65 had neonates who failed the newborn hearing test (43.9%). On the other hand, there were 9 patients who had reported of family members with hearing loss, and all these patients had neonates (6.1%) had neonates who failed the newborn hearing test ($p .002 < .05$). Acquired hearing loss was not observed in the majority of patients (129; 87.2%). In this group 58 (39.2%) had neonates who failed the newborn hearing test. There were 19 mothers who have reported such (12.8%) and 16 (10.8%) of the neonates had failed the newborn hearing test ($p .001 < .05$).

Table 3. Predictors for Failed Otoacoustic Emission Testing among Subjects Enrolled in the Study Program

Variables	p	Conclusion	Decision
Age	.019 ^Ω	Significant	Reject H0
Sex	.247 ^Ω	Not Significant	Accept H0
Birthweight	.749 ^Ω	Not Significant	Accept H0
APGAR 1 minute	.186 ^Ω	Not Significant	Accept H0
APGAR 5 minutes	.952 ^Ω	Not Significant	Accept H0
Craniofacial Anomalies	.312 ^Ω	Not Significant	Accept H0
Hyperbilirubinemia	.206 ^Ω	Not Significant	Accept H0
Neonatal Sepsis	.931 ^Ω	Not Significant	Accept H0
Maternal Body Mass Index	.370 ^Ω	Not Significant	Accept H0
Gestational Diabetes Mellitus	.494 ^Ω	Not Significant	Accept H0
Chronic Hypertension	.569 ^Ω	Not Significant	Accept H0
Chronic Diabetes Mellitus	.888 ^Ω	Not Significant	Accept H0

Ototoxic Medications	.004 ^Ω	Significant	Reject H0
Alcoholic Intake	.003 ^Ω	Significant	Reject H0
Smoking	.787 ^Ω	Not Significant	Accept H0
Illicit Drug Use	.000 ^Ω	Significant	Reject H0
Folate	.030 ^Ω	Significant	Reject H0
Vitamin B Complex	.999 ^Ω	Not Significant	Accept H0
Vitamin D	.056 ^Ω	Significant	Reject H0
Congenital Hearing Loss	.002 ^Ω	Not Significant	Accept H0
Acquired Hearing Loss	.089 ^Ω	Significant	Reject H0

Note: The results are presented as Mean±SD, unless otherwise shown.

≠Chi Square Test

∂ t-test for Independent Samples

^ΩBinary Logistic Regression

Table 3 presents the predictors for failed Otoacoustic Emission Testing among study subjects. In the investigation, predictors for possible newborn hearing loss are age ($p .019 < .05$); the taking of mothers of ototoxic medications ($p .004 < .05$); alcoholic intake ($p .003 < .05$); illicit drug use ($p .000 < .05$); not taking of folate ($p .030 < .05$); vitamin D ($p .056 < .05$); history in the family of hearing loss ($p .008 < .05$).

Conclusion:

Based on the salient findings of this research investigation, the following conclusions are drawn:

1. Most neonates who had undergone newborn hearing test were 4 days of age. Most were males and these occupied the majority of those who failed the newborn hearing test. Most neonates were in the 1500 grams and above. APGAR in 1 and 5 minutes were higher among those who had passed the newborn hearing test. Craniofacial anomalies, hyperbilirubinemia and neonatal sepsis were not observed in the majority of patients but it is important to underscore in the investigation that those who had these conditions were found to have failed the newborn hearing test.

2. Maternal data revealed that most had no gestational and chronic forms of diabetes and hypertension and thyroid problems. On cases of patients with such, most had neonates who failed the newborn hearing test. Although most patients had not taken ototoxic medications, those who had reported of taking it had neonates who failed the newborn hearing test. Drinking and smoking were not observed in the majority, on the other hand those who did it during pregnancy had neonates who failed the newborn hearing test. Lastly, all patients who had taken illicit drugs had neonates who failed the newborn hearing test.

With regard to vitamin supplementations such as folate, vitamin B complex, and vitamin D, it was found that most patients had taken these during pregnancy. Interestingly, only few patients had not taken these supplementations and it was noted that most of these patients had neonates who had failed the newborn hearing test. Family history of hearing loss and even acquired hearing loss were not observed in the majority. It is underscored in this investigation that those mothers who had congenital hearing loss had all neonates who failed the newborn hearing test.

3. It was found that patient's age, taking of ototoxic medications, drinking, illicit drug use, inability to take folate and vitamin D during pregnancy, and family history of hearing loss were considered to be risk factors for failed Otoacoustic Emission Testing. The data indicate that their presence increases the likelihood of newborn hearing loss.

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