HEARING OUTCOME IN NEONATES OF PRE-ECLAMPTIC AND DIABETIC MOTHERS

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ORIGINAL ARTICLE

ABSTRACT

Background Both pre-eclampsia and diabetes can have significant effects on fetal development, including the auditory system. Therefore, understanding the potential impact of these maternal conditions on neonatal hearing can help healthcare providers identify at-risk neonates and provide appropriate follow-up care.

Objective: To find the hearing outcome in neonates of pre-eclamptic and diabetic mothers.

Methodology: Cross-sectional descriptive study was conducted at University of Lahore Teaching Hospital. Duration was 9 months (July 2022 to March 2023). Sample size was 95 neonates. Non-probability purposive sampling technique was used. Participants was selected based on inclusion and exclusion criteria. Distortion product otoacoustic emission (DPOAE) was used for hearing evaluation. The hearing evaluation was done within the first 48 hours. The neonates who failed the first screening were recalled for 2nd after 2 weeks and those who failed the 2nd trial of DPOAE underwent 3rd trial DPOAE after 1 month. Data was analyzed through SPSS version 23.0 package.

Results: On 1st trial, DPOAE test showed bilateral refer results 17 (56.7%), 13 (52%) and 10 (25%) among pre-eclamptic mothers, diabetic mothers and healthy mothers respectively. On 2nd trial absent DPOAE rates were 15 (50%), 8 (32%) and 5 (12.5%) neonates from pre-eclamptic mothers, diabetic mothers and healthy mothers. On 3rd trial, DPOAE rates were 5 (16.7%), 4 (16%) and 1 (2.5%) absent among pre-eclamptic mothers, diabetic mothers and healthy mothers respectively.

Conclusion: The result of this study concluded that diabetes during pregnancy and pre-eclampsia has negative effect on neonatal hearing. Both are considered the risk factors for hearing loss in the neonates.

INTRODUCTION

Diabetes during pregnancy is becoming common across the world. Gestational Diabetes Mellitus (GDM) is characterized by glucose intolerance that manifests itself during pregnancy[1] Diabetes has become more common among women of childbearing age. Diabetes mellitus complicates 1 to 14 percent of all pregnancies, and 90 percent of them have GDM.[2] Most common conditions linked with elevated-risk pregnancy are preeclampsia and GDM, which contribute the difficulties of pregnancy, delivery, and puerperium. Globally, hyperglycemia affects (16.9 percent) 21.4 million of 127.1 million newborns, children of mothers aged 20-49 years old. In terms of hypertension, 5 -10 percent of pregnancies are affected by hypertensive disorders, whereas preeclampsia affects roughly 3 percent[3]

Diabetes negatively affects fetus in the womb

which may result in congenital malformation during first trimester of pregnancy, which increases likelihood of sudden abortion.[4] Insufficient development and even foetal mortality can be noted throughout the second and third trimesters.[5] Diabetes mellitus during pregnancy is considered a risk factor for hypoglycemia, polyhydromnia in the infant, seizures, imbalances in electrolytes, and Neonatal Intensive Care Unit (NICU) hospitalization. Because the inner ear is vulnerable to abnormal glucose metabolism in GDM, cochlear impairment may be a result.[6]

Preeclampsia, also known as pregnancy induced hypertension (PIH), is a condition characterized by excessive amounts of protein in urine and mother's blood pressure more than 140/90 mm Hg after twenty weeks of pregnancy. It happens in 2 to 7 percent of pregnancies. Proteinuria and hypertension are the primary symptoms, which may indicate dysfunction of organs.[7] The pathological alterations consist of a reduction in the blood flow to all organs due to arteriolar spasm, ischemia, and tissue hypoxia, along with an increase in vascular permeability. Acute atherosclerosis of the uterine placental vessel causing intrauterine development restriction and foetal distress.[8] This affect various organs and central nervous system. The inner ear is particularly vulnerable to ischemia and immunologic destruction, and vascular blockage can result in hearing impairment.[9] Preeclampsia can harm the inner ear and induce sensorineural hearing loss (SNHL) in both the mother and the infant due to its effects on microcirculation and possibly immunologic aetiology. It is conceivable to believe that if the mother suffers, the foetus or infant will be as well.[10]

According to WHO, approximately 0.5 to 5 out of every 1000 newborns and babies have SNHL or severe to profound degree hearing loss that is either congenital or occurs in early stages of childhood.[11] Genetic factors are responsible for 50% of cases and may go undetected in the general neonatal population. NICU newborns are at high prevalence of risk factors for hearing impairment. The Joint Commission on Infant Hearing (JCIH) recommended various prenatal risk factors in the 2000 year, which raised the prevalence of hearing loss by up to fourteen percent.[12] Early detection and treatment is essential for ensuring the growth of neonatal hearing abilities and preservation of cognitive functioning.[13] For a long time, the JCIH has emphasized the necessity of neonatal hearing screening (NHS). Kemp used transient evoked otoacoustic emissions (TEOAE) as a means of assessing the hearing status of newborns in 1978. Following early research on NHS, proposed that these tests may be used to diagnose hearing impairment.[14] NHS has proven to be highly effective in early diagnosis and was initially implemented as a national program in the UK, and Later on, it was approved in Europe and started to be performed on all babies in several nations. TEOAE and auditory brainstem response (ABR) are well-known fundamental instruments for the Newborn hearing screening.[15] In underdeveloped nations, particularly Pakistan, there is a dearth of information about the hearing result in neonates of pre-eclamptic and diabetic mothers.

MATERIALS AND METHODS

Study Design: Cross-sectional descriptive

Sampling Techniques: Non-probability purposive sampling technique was used.

Setting: The study was performed at University of Lahore Teaching Hospital.

Duration: Duration of study was 9 months (July 2022 to March 2023).

Sample size: There was Sample size of 95 neonates. Sample size was calculated on the

basis of Hearing Impairment 12.93% by using 95% confidence level and 5% confidence interval.16

Sample selection criteria

Inclusion criteria:

Gestational age of neonates that were enrolled in the study whether they born from mother with preeclampsia, mother with gestational diabetes mellitus, or healthy mother with more than 32 weeks.

Exclusion criteria

Mother with any other complications and comorbidities (diabetes type 1, jaundice and goiter) were also excluded. Neonates with microtia, cleft palate, microtia, and other congenital anomalies/syndromes or who are born to mothers with hearing loss were also excluded.

Data collection procedure

DPOAE (distortion product otoacoustic emission) was used to accumulate the data. After taking the written consent from the mothers, their neonates hearing was assessed. The neonates left to be by the mother's sides were inspected in the postnatal ward, whereas newborns who were referred to the newborn intensive care unit (NICU) were screened in the newborn intensive care unit. A flexible probe tip large enough to create a seal was placed into the infant's external auditory canal, and distortion product otoacoustic emissions was recorded independently for both ears. The hearing evaluation was done within the first 48 hours, No further testing was done for those neonates who "pass" the test. The neonates who failed the first screening were recalled for 2nd trial of DPOAE after 2 weeks, and those who failed the 2nd trial of DPOAE underwent 3rd trial DPOAE after 1 month.

Data analysis

Data was analyzed through SPSS version 23.0 package. Data was analyzed through frequency and percentage.

RESULTS

Table 1 shows that out of 95 neonates, most mothers of those neonates are in the age group 41-50 years are 44 (46.3%). 25 (26.3%) women have diabetes during pregnancy. 30 (31.6%) have pre-eclampsia. There are 30 (31.6%) neonates are from pre-eclamptic mothers, 25 (26.3%) are from diabetic mothers and 40 (42.1%) mother are from healthy mothers. There are 40 (52.2%) male neonates and 55 (57.9%) female neonates. In 39 (41.1%) neonates screening is done on 1st day (within first 24 hours) after delivery and in 56 (58.9%) neonates screening is done on 2nd day (within first 48 hours). 32 (33.7%) neonates has 7 to 8 ASPGAR score and 63 (66.3%) neonates has 9 to 10 ASPGAR score. Most neonates are from gestational age 35 to 37 weeks 45 (47.4%).

Table 2 shows that 95 neonates are evaluated by DOPAE (distortion product otoacoustic emission) testing soon after birth from which 30 neonates from pre-eclamptic mother, 25 neonates are from diabetic mothers and 40 neonates are from healthy mothers. On 1st trial testing within first 48 hours after delivery 17 (56.7%) neonates from pre-eclamptic mothers, 13 (52%) neonates from diabetic mothers and 10 (25%) neonates from healthy mothers shows refer in testing. On 2nd trial after 2 weeks 15 (50%) neonates from pre-eclamptic mothers, 8 (32%) neonates from diabetic mothers and 5 (12.5%) neonates from healthy mothers shows refer in testing. On 3rd trial after 1 month DPOAE are refer in 5 (16.7%) neonates from pre-eclamptic mothers, 4 (16%) neonates from diabetic mothers and 1 (2.5%) neonates from healthy mothers.

Table 1: Descriptive statistics of different Demographic and clinical parameters

Variables	Sub Variables	Frequency (Percentage %)
Mother age	25-30	**20 (21.1%)**
	31-35	**44 (46.3%)**
	36-40	**31 (32.6%)**
Do you have diabetes?	Yes	**25 (26.3%)**
	No	**70 (73.7%)**
Do you have pre-eclampsia?	Yes	**30 (31.6%)**
	No	**65 (68.4%)**
Group	Pre-eclamptic	**30 (31.6%)**
	Diabetic	**25 (26.3%)**
	Healthy	**40 (42.1%)**
Gender of Neonate	Male	**40 (52.1%)**
	Female	**55 (57.9%)**
Age at which test was done (in days)	1st day	**39 (41.1%)**
	2nd day	**56 (58.9%)**
ASPGAR score	7-8	**32 (33.7%)**
	9-10	**63 (66.3%)**
Gestational age (weeks)	32 -34	**20 (21.1%)**
	35-37	**45 (47.4%)**
	38-40	**30 (31.6%)**

Table 2 DPOAE testing in neonates of pre-eclamptic mothers, neonates of diabetic mothers and neonates of healthy mothers within first 48 hours after delivery, after 2 weeks and after 1 month

Variables	Neonates of pre-eclamptic mothers (Total 30)		Neonates of diabetic mothers (Total 25)		Neonates of healthy mothers (Total 40)	
1st Trial within first 48 Hours	Pass n (%)	Refer n (%)	Pass n (%)	Refer n (%)	Pass n (%)	Refer n (%)
	13 (43.3%)	17(56.7%)	12 (48%)	13 (52%)	30 (75%)	10 (25%)
2nd Trial After 2 Weeks	15 (50%)	15 (50%)	17 (68%)	8 (32%)	35 (87.5%)	5 (12.5%)
3rd Trial	25 (83.3%)	5 (16.7%)	21 (84%)	4 (16%)	39 (97.5%)	1 (2.5%)

DISCUSSION

Results of the current study shows that on 1st trial testing within first 48 hours after delivery 56.7% neonates from pre-eclamptic mothers, 52% neonates from diabetic mothers and 25% neonates from healthy mothers shows initial refer in testing. In contrast a previous study conducted by Rakshitha Samanth with his coworkers, examine the Influence of preeclampsia and gestational diabetes mellitus on newborn DPOAE. According to their findings of absent Distortion Product Otoacoustic Emissions rates were 19.5%, 15.8%, and 3.5% among preeclampsia, GDM, healthy group respectively.17 Another previous study conducted by Angeli C. Carlos-Hicetato, investigate the maternal diabetes as a potential risk factor for congenital hearing loss. According to their findings among the one fifty neonates, 10 were born to diabetic mothers, age range of 2-8 days old. An 'initial refer' result was obtained by 40% of diabetes mothers' newborns and 7.9% of non-diabetic mothers' neonates.18

In present study the results shows that 2nd trial after two weeks absent DPOAE rates are 50%, 32% 12.5% neonates from pre-eclamptic mothers, diabetic mothers and healthy mothers respectively. On 3rd trial after one month DPOAE rates are absent in 16.7%, 16% and 2.5% among pre-eclamptic mothers, diabetic mothers and healthy mother respectively. In contrast a previous study conducted by Esra Gulen yildiz and his coworkers, to investigate whether gestational diabetic pregnancies (GDM) is linked to presumed hearing loss in neonates. Their findings showed that 40.8% neonates from diabetic mothers group and 7.7% newborns from healthy mothers group failed the first hearing screening test. The number of newborns with bilateral failed hearing screening tests was higher from diabetic mothers group at the first screening. 75.0% newborn from diabetic mothers group and 20.0% newborns from healthy mothers group failed the second TEOAE hearing screening test.19 Another research conducted by Hend Abdelfattah, to assess the potential effects of pre-eclampsia on the hearing of the neonate and to decide the ideal time to do the screening. According to their result 73.8% passed their TEOAE test from the first time, but only 41.7% of the pre-eclamptic had passed. Also 17.5% control ear passed from second time and 41.7% of the pre-eclamptic group, there was high failure rate in first TEOAEs test in pre-eclamptic study group. Two neonates failed their third TEOAEs test from the control group and four from the pre-eclamptic group.

Preeclampsia has some temporary effect on hearing in the newborns of pre-eclamptic mothers.20 The current investigation had the drawback of requiring several hospital visits.

CONCLUSION

The result of this study concluded that diabetes during pregnancy and pre-eclampsia has negative effect on neonatal hearing. Diabetes during pregnancy and pre-eclampsia considered the risk factors for hearing loss in the neonates.

RECOMMENDATIONS

As a result, it is preferable to delay the initial infant hearing examination for these infants until two weeks following birth. More large-scale study is needed to offer better clarity on the link.

AUTHORS CONTRIBUTION

MS: Article writeup,

SAB: Data analysis,

MJ: Data collection,

M: Data collection,

AC: Final reading and correction

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