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Original Research Article

A prospective study on the impact of gestational diabetes mellitus on auditory function in newborn

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ABSTRACT

Background: Gestational diabetes is a potential risk factor for neonatal hearing loss. Increased circulating sugars in mothers during pregnancy can impair the micro circulation and can cause congenital anomalies of the inner ear resulting in congenital hearing loss. Prevalence of deafness in neonates of mothers with diabetes mellitus is 4.16%. Otoacoustic emissions (OAE) and brainstem evoked response audiometry (BERA), are used to evaluate hearing impairment.
Methods: This prospective case-control study was conducted by the Department of Obstetrics and Gynecology, among 92 antenatal mothers between the age of 21 to 35 years, who were classified into two groups, based on their gestational diabetes status. All these newborns were screened for hearing as per universal protocol using OAE within 72 hours of birth and on the 10th day. The aim of the study is to ascertain the effects of gestational diabetes mellitus on auditory function in newborns.
Results: In this study a total of 92 pregnant women were selected and divided into two groups, A and B. The mean age was observed as 27.8±5.4 year. On assessment done within 72 hours after birth, 39.1% (18) of the neonates in group A failed in OAE, whereas only 8.7% (4) of the neonates in group B failed in OAE. Children born to mother with gestational diabetes mellitus are at a 6.7 times higher risk to develop congenital hearing loss.
Conclusions: This present study shows a significant association between gestational diabetes mellitus and neonatal hearing impairment. Neonates born to GDM mothers had higher failure rate in OAE screening compared to neonates born to non-GDM mothers.

Keywords: Gestational diabetes, Neonates, Hearing, OAE

INTRODUCTION

Gestational diabetes mellitus (GDM) is typically defined as hyperglycaemia that is diagnosed or develops during pregnancy.[1] Gestational diabetes is a potential risk factor for neonatal hearing loss. Increased circulating sugars in mothers during pregnancy can impair the micro circulation and can cause congenital anomalies of the inner ear resulting in congenital hearing loss.[2] Hearing plays an important role in a child's language development, cognitive skills and speech, which makes it important for early detection and timely intervention for better outcomes. Congenital hearing loss is one of the commonest chronic conditions seen in children. Congenital hearing loss is mainly thought to be multifactorial in aetiology with both genetic (autosomal and X-linked) and acquired causes (such as maternal infections, drug intake, trauma). GDM is a relatively

common condition found in pregnant females but is rather an understudied risk factor in terms of congenital hearing loss. GDM is easily treatable which makes the hearing loss due to it easily preventable.

According to World Health Organization (WHO), over 5% of the world's population (430 million people) require rehabilitation for their 'disabling' hearing loss (432 million adults and 34 million children). WHO estimates that by 2050 over 700 million people will have disabling hearing loss. 'Disabling' hearing loss refers to hearing loss greater than 35 decibels (dB) in the better hearing ear.[3] GDM has become one of the most common comorbidities during pregnancy in India with reported prevalence being as high as 1.3%. It seems to increase with age, from 1.0% among women aged 15–19 years to 2.4% among women aged 35 years and older.[4] Prevalence of deafness in neonates of mothers with diabetes mellitus is 4.16% and they are more likely to have bilateral hearing loss with 81% sensorineural hearing loss, with 8% relative to children of non- diabetic pregnancies.[5,6]

Otoacoustic emissions (OAE) are frequently used in neonatal hearing screening to identify cochlear (outer hair cell) function. Infants who fail OAE screening can be further assessed through brainstem evoked response audiometry (BERA), which evaluates auditory nerve and brainstem pathways.[8] Given the potential risks associated with GDM, it is essential to assess the impact of maternal glucose intolerance on newborn hearing outcomes. These findings raise major concerns as congenital hearing loss is often associated with children's affected quality of life, limited social and cognitive development.[7] Importantly, the impact of untreated hearing loss affects self-esteem, less academic achievements followed by limited employment opportunities.[9] This study is intended to identify the gap by evaluating the hearing outcomes of newborns born to mothers with GDM and comparing them with non-GDM mothers, by using well established methods for neonatal screening like OAE and BERA and to provide evidence, whether GDM poses an additional risk.

METHODS

The aim of the study is to identify the effects of GDM on auditory function in newborns. This prospective case-control study was conducted by the Department of Obstetrics and Gynecology, at Sri Muthukumaran Medical College and Research institute for a period of 6 months from January to June 2024. A total of 46 antenatal mothers between the age of 21 to 35 years who were diagnosed with gestational diabetes mellitus were selected as study participants, 46 age-matched participants without GDM were selected and they were classified into two groups, group A included newborn children born to mothers diagnosed with GDM and group B included new born children born to mother without gestational diabetes.

All neonates, male and female, born to mothers with and without GDM (exposed and non-exposed groups), delivered by vaginal and cesarean section willing to participate were included in the study.

Mothers with history of infections like toxoplasmosis, rubella cytomegalovirus, history of drug and alcohol usage were excluded. Neonates with family history of early childhood deafness, birth trauma and neonatal intensive care unit (NICU) treatment were excluded.

All these newborns were screened for hearing as per universal protocol using OAE. This screening was done within 72 hours after birth, newborn who fail on that day were assessed again on 10th day after birth. Children who tested as refer on OAE were sent for further evaluation with BERA. All necessary data were collected and compiled in a Microsoft excel sheet. Descriptive analysis, Chi-square and odds ratio were calculated using statistical package for the social sciences (SPSS) V20.0.

RESULTS

In this study a total of 92 pregnant women were selected and divided into two groups, A and B. The mean age was observed as 27.8±5.4 year. The average gestational age was 38.3±2.1 weeks, and most of the mothers were between 36 weeks to 40 weeks. We conducted glucose challenge test among study participants as screening test for GDM, among group A, the mean levels were 282±93.42 mg/dl and in group B it was observed as 131±12.1 mg/dl. Both group of newborns delivered by vaginal delivery and caesarean delivery were included in the study (Table 1).

In assessment done within 72 hours after birth, 18 (39.1%) of the neonates in group A failed in OAE, whereas only 4 (8.7%) of the neonates in group B failed in OAE. When we reassessed it on 10th day after birth, in group A, 6 (13.04%) neonates failed. Whereas only 1 (2.2%) neonate in group B failed in OAE, which was statistically significant with p value <0.05 as shown in the Table 2.

Table 1: Distribution of age, gestational age and GCT levels among study participants.

Variables	Frequency (N)	Mean	Standard deviation
Age (years)	92	27.8	5.4
Gestational age (weeks)	92	38.3	2.1
Glucose challenge test			
Group A (mg/dl)	46	282	93.42
Group B (mg/dl)	46	131.1	12.1

Table 2: OAE results on neonates in the study group.

Parameters	Neonates of group A		Neonates of group B		P value
	Failed, N (%)	Total screened, N (%)	Failed, N (%)	Total screened, N (%)	
Within 72 hours after birth	18 (39.1)	46 (100)	4 (8.7)	46 (100)	<0.05
10th day after birth	6 (13.4)	18 (39.1)	1 (2.2)	4 (8.7)	<0.05

15.2% (7) of the study participants reported to have hearing loss, 13% in group A and 2.2% in group B and the odds ratio observed was 6.75. This implies that children born to mother with GDM are at a 6.7 times higher risk to develop congenital hearing impairment, as shown in the Table 3.

Table 3: Hearing loss among study participants.

Parameters	Hearing loss present	Normal hearing	Odds ratio
GDM mother	6 (a)	40 (c)	6.75
Normal ANC	1 (b)	45 (d)	

DISCUSSION

This study is intended to assess the impact of GDM and neonatal hearing outcomes, we observed that 39.1% of the neonate born to GDM mother got failed on OAE within 72 hours after birth, but only 8.7% of neonates born to non GDM mothers failed in their initial OAE screening. Similar results were observed by Yıldız et al 20 (40.8%) newborn in GDM group failed hearing screening and only 5 (7.7%) newborns without GDM failed hearing screening test.[10] In contrast Padmadasan et al in their study observed that 10% of children born to GDM mothers failed in initial assessment, in which approximately 4.16% of them were diagnosed to have hearing impairment in BERA.[11] Zhou et al too observed a contrast finding, where only 4.35% newborns of GDM group failed the initial hearing screening.[12] In our study on 30th day assessment for OAE, 13.4% of the newborn born to GDM mothers and 2.2% of the newborn born to non-GDM mothers failed in OAE assessment, a similar results were observed by Gupta et al which reflects lower incidence of hearing impairment among children born to non-GDM mothers compared to GDM mothers. Samanth et al observed that in GDM group, 15.8% newborns reported bilateral absent DPOAEs and 1.7% reported unilateral absent DPOAEs.[13] Srikanth et al in their study they observed that OAE has shown that 40% babies had bilateral refer and 18% had unilateral refer in GDM mothers which significantly higher than the normal mothers.[14]

Srikanth et al in their study also observed that BERA showed that 14% had hearing loss among those of the GDM mothers which was significantly higher than the normal mothers. Comparison of abnormal hearing screening between the two groups were significant ($p<0.05$).[13] We also observed that the odds ratio for hearing impairment and gestational diabetes status of the mother was 6.5.

Limitations

The limitation of this study is that it includes a small population and their evaluation. A larger population can be used to establish a better inference. And follow up with BERA would help establish a definitive diagnosis and treatment protocol. There is scope for further studies in this aspect.

Our study may be limited by using data from one gynaecological practice, as opposed to a more heterogeneous population.

CONCLUSION

This present study shows a significant association between gestational diabetes mellitus and neonatal hearing impairment. Neonates born to GDM mothers have higher failure rate in OAE screening compared to neonates born to non-GDM mothers. This study insists on the importance and need for screening of neonates born to GDM mothers and also need for further research on the pathophysiology of this hearing impairment among GDM mothers. We also recommend further studies to find the association between well controlled sugars in GDM mothers as against uncontrolled GDM and their effect on neonatal hearing loss.

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