International Journal of Medical Science in Clinical Research and Review
Online ISSN: 2581-8945
Available Online at http://www.ijmscrr.in Volume 05|Issue 06 (November-December)|2022 Page: 1092-1096

Original Research Paper

COMPARATIVE EVALUATION OF THE EFFECT OF GESTATIONAL DIABETES MELLITUS ON NEONATAL HEALTH OUTCOMES

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Article Received: 25-09-2022 Revised: 15-10-2022 Accepted: 05-11-2022

ABSTRACT:

Background: Health of growing fetus and the new born babies depend on the health status of the mother. Hence during gestational period, maintenance of good maternal health is crucial to prevent any untoward neonatal outcomes. Hyperglycemia in pregnancy, also called as gestational diabetes mellitus being one of the major complications faced by pregnant females imposes significant risk of neonatal complications and mortality. **Aim:** Thus this study was initiated with an aim of evaluating and comparing patterns of neonatal outcomes among the neonates born from GDM mothers and healthy mothers. **Method**: This study included 300 participants. 150 were healthy pregnant female while 150 were the females with GDM. After parturition, the health of the neonates from the mothers in each group was evaluated and monitored. The neonatal anthropometric parameters like birth weight, birth length, circumference of head and chest were measured. APGAR scores and 1 minute, 5 minutes and 10 minutes were also calculated. The birth complications shown by the neonates were also noted. The comparative evaluation of obtained data was done using SPSS 20. **Results:** The neonatal anthropometric parameters were significantly high in case of neonates from GDM mothers compared to the neonates from healthy mothers. Similarly, the APGAR scores at 5 minutes and 10 minutes after birth were significantly in the neonates from GDM mothers. The most common neonatal complications observed were hyperbilirubinemia (26%), polycythemia (25%), hypoglycaemia (16%), macrosomia (16%) and pre-term birth (14.7%) **Conclusion**: This study provides the evidence of risk of abnormal health outcome in the neonates from GDM mothers. This can be minimised with proper control of maternal glycemia. Hence early screening and regular monitoring of maternal glycemia is suggested.

Key words: Glycemia, neonate, APGAR, gestation

INTRODUCTION:

Gestational diabetes, a diabetes occurring in pregnancy but absent at other periods, is prevalent in varying ranges in different ethnic groups, 4% on an average [1]. Diagnosis is based on screening process carried out at 24^{th}- 28^{th} weeks of gestation. GDM increases the risk of preeclampsia, operative delivery and gestational hypertension in mothers. Further, the risk of development of overt diabetes also increases since the previous studies have reported that 15%-60% of GDM mothers may develop overt diabetes with 5-15 years after delivery [2]. Maternal hyperglycemia also leads to adverse fetal and neonatal outcomes viz; macrosomia, hypoglycaemia, respiratory distress syndrome, hyperbilirubinemia, congenital anomalies, birth injuries, shoulder dystocia etc. Further there is increased risk of developing obesity and overt diabetes in child at later stages of life. The neonatal complications can be prevented and totally rely on the control of maternal glycemia. Strict management of maternal glycemic status though reduces the associated complications; the morbidity still persists in moderate and alternate patterns [3]. A large study conducted in a multi ethnic population showed that GDM despite of early diagnosis and intensive management still lead to the adverse pregnancy outcomes [4]. Therefore, the management of newborns from GDM mothers is a still a matter of challenge in neonatal health care. The

morbidity associated with GDM and be evaluated by a scoring system known as APGAR score which depends on 5 features of neonates viz: heart rate, muscle tone, reflexes, respiratory effort, and colour. Each component is given score from 0- 2, making total score of 10. The scores at calculated at 3 intervals namely 1 minute, 5 minutes and 10 minutes. The APGAR score serves as a valuable indicator of neonatal survival and requirement of resuscitative interferences [5, 6]. Thus in this study, we made an attempt to evaluate the patterns of neonatal outcomes in the babies born from GDM mothers and effect of GDM on neonatal APGAR scores. The results were compared with the results from babies born to healthy mothers.

MATERIAL AND METHODS:

This case control study was conducted in the Department of Physiology. Before commencement, ethical approval was obtained. In total 300 neonates were included, of which 150 were born to GDM mothers and rest 150 were born to healthy mothers. Each participant (mothers from both groups) were detailed about research and informed consent was collected from all of them. After parturition, all the neonates kept under observation for 24 hours to detect any congenital anomalies. The blood sugar level of neonates was routinely estimated to check for hypoglycemia. The neonates were also observed for the presence of hypocalcemia, polycythemia, hyperbilirubinemia and respiratory distress. All neonates were regularly monitored in the postnatal care section until discharged. Other data related to neonates like birth weight and length, circumference of chest and head, and APGAR scores were evaluated. The weight was measured using electronic scale while the length was measured using infantometer. Circumference of head and chest were measured by inch tape. Head circumference corresponded to the distance between occipital prominence and glabella while chest circumference was taken at the position of nipples. APGAR scores were calculated considering 5 criteria namely heart rate, muscle tone, reflexes, respiratory rate and skin colour. The values obtained were recorded in a excel sheet and evaluated by SPSS 20. The comparative analysis was done using Mann Whitney test and p value less than 0.5 implicated statistical significance.

RESULTS:

The rate of caesarean delivery was high in females with GDM (15%) compared to healthy females (10%) (table 1). The rate of preterm delivery was high in GDM cases. It was 15% in GDM cases compared to 10% in control group. Likewise 88% and 2% of neonates born to females in control group were full term and post term respectively. Similarly, 79% and 6% of neonates born to females in case group were full term and post term respectively (table 2). The mean value of the birth weight and length, circumference of chest and head of neonates delivered by women with GDM was high and it was significant statistically compared to the neonates from healthy females (table 3) The one minute APGAR was high in the neonates born from the women with GDM but it was not significant statistically. However, the five minutes and ten minutes APGAR scores were significantly high in the neonates born from the women with GDM compared to the neonates from healthy females (table 4) The neonatal complications observed in this study were pre-term, macrosomia, polycythemia, congenital abnormalities, respiratory distress syndrome, hyperbilirubinemia, hypoglycaemia and hypocalcemia. The most frequently observed neonatal complications were pre-term birth (10%) and hyperbilirubinemia (6%) in case of neonates born from women in control group. In case of the neonates born from the women with GDM, the most commonly observed complications were hyperbilirubinemia (26%), polycythemia (25%), hypoglycaemia (16%), macrosomia (16%) and pre-term birth (14.7%)

Table 1: Comparison mode of delivery (control and case)

Mode of delivery	Control	Case (GDM)
Caesarean	14% (21)	22% (33)
Vaginal	86% (129)	78% (117)

Table 2: Comparison delivery outcome (control and case)

Outcome	Control	Case (GDM)
Pre-term	10% (15)	15% (23)
Term	88% (132)	79% (118)

Post term	2% (6)	6% (9)

Table 3: Comparison of neonatal parameters (control and case)

Neonatal parameters	Control	Case (GDM)	p
Birth weight (Kg)	2.58±0.41	3.25±0.45	<0.001**
Birth length (cm)	43.61±5.55	46.76±4.28	<0.001**
Chest circumference (cm)	33.14±4.84	33.84±4.84	0.031*
Head circumference	32.72±4.96	33.79±3.76	0.067

Table 4: Comparison APGAR scores in control and case groups

APGAR scores	Control	Case (GDM)	p
1 minute	7.37±1.07	7.25±1.47	0.58
5 minutes	8.56±0.66	8.12±1.07	0.024*
10 minutes	8.91±0.67	8.95±1.13	0.011*

Table 5: Comparison of neonatal complications in control and case groups

Parameter	Control		Case (GDM)	
	Number	Percentage	Number	Percentage
Pre term	15	10%	22	14.7%
Macrosomia	4	2.7%	24	16%
Polycythemia	3	2%	37	25%
Congenital abnormalities	2	1.3%	5	4%
Respiratory distress syndrome	3	2%	9	6%
Hyperbilirubinemia	9	6%	39	26%
Hypoglycemia	1	<1%	24	16%
Hypocalcemia	1	<1%	14	9.3%

DISCUSSION:

In this study, neonatal outcomes in the neonates from GDM mothers were evaluated and compared those outcomes with the neonates from healthy mothers. GDM increases the risk of both morbidity and mortality in fetus as well as new born babies. In this study, the incidence of preterm neonates was 10% and 15% respectively in case group and control group. Similar result was presented by Capula C *et al* [7]. Several other studes like that of Gasim T *et al* [8], Ghosh S *et al* [9], Malinowska PA *et al* [10] and Al-Khalifah R *et al* [11] have documented high rate of preterm deliveries and low birth weight in GDM. As per Johns K *et al* [12], increased rate of caesarean section is associated with pregnancy induced hypertension. In this study the rate of caesarean delivery was 22% in cases and 14% in controls. The neonatal features like birth weight, birth length, circumference of head and chest were compared between the neonates from GDM mothers and healthy mother. It was found that these features were significantly high in case of neonates from GDM mothers. Several studies like that of Kaur M *et al* [13], Kataria SK *et al* [14] and Taksande AM *et al* [15] have reported similar patterns of neonatal anthropometry. The most frequently observed neonatal complications were hyperbilirubinemia (26%), polycythemia (25%), hypoglycaemia (16%), macrosomia (16%) and pre-term birth (14.7%) in case of neonates born from GDM mothers. Such complications potentiate the risk of morbidity and mortality in neonates. High incidence of hyperbilirubinemia was also reported in the study of Misra S *et al* [16] which was in support of findings in studies from Malinowska PA *et al* [10] and Ghosh S *et al* [9] respectively. Incidence of polycethemia is also significantly high neonates from GDM mothers, a finding similar to that of Capula C *et al* [7]. Maternal hyperglycemia causes fetal hypertrophy called as macrosomia. 15-45% of diabetic pregnancies lead to macrosomia further increasing the likelihood of caesarean section or instrument assisted vaginal delivery. A study in Uganda reported high prevalence of macrosomia, still birth and shoulder dystocia in nenates from GDM mothers [17]. Macrosomia was reported in 15%, 40% and 27.6% cases respectively in the studies of Anjum SK *et al* [18], Shirazi H *et al* [19]

and Shefali AK *et al* [20]. According ADA fasting hyperglycemia (glucose>105 mg/dL) may lead to increased fetal death risk in the third trimester [21]. Neonatal hypoglycemia is frequently observed complications of GDM. In study of Sanjay KM *et al* [22], 43.6% of neonates from GDM women were hypoglycaemic. Several previous studies have shown the prevalence range of 2.7%-16% for neonatal hypoglycaemia [8-11]. Neonatal hypoglycemia results when blood glucose level is < 40 mg/dL in neonates irrespective symptoms whether present or absent. Nearly 2-4% of full term, 5-10% of preterm and 50 % of babies from GDM are affected with hypoglycaemia [23]. Maternal hyperglycemic produces hyperinsulinemia in fetus. Clamping of umbilical cord after birth stops the supply of maternal glucose to baby. The excess insulin present in neonates causes utilisation of glucose in neonatal blood within few hours leading to hypoglycemia [18]. Previous literatures have documented occurrence of motor impairment and learning disabilities in children later [24]. The APGAR score gives approximation of the neonate vitality after parturition. The score generated at 5 minutes after birth is reported to be more accurate in predicting neonatal health outcomes compared to the scores at 1 minute and 10 minutes [9]. The APGAR score ranging between 0-3, 4-6 and 7-10 at 5 minutes implicates high risk, moderate risk and low risk of neonatal mortality [5]. In this study, the difference in APGAR scores generated at 5 minutes and 10 minutes between the neonates from GDM mothers and healthy mothers was significant. This was similar to results of previous studies of Ipekci SH *et al* and Stuart AE *et al* [26, 27]. In contrast, Jang HJ *et al* [28] and Yeagle KP *et al* [29] reported insignificant association of maternal GDM with neonatal APGAR scores (1 minute and 5 minutes).

CONCLUSION:

Our study shows that GDM imposes significant risk of neonatal health burden like macrosomia, hypoglycaemia, hyperbilirubinemia, shoulder dystocia, low APGAR scores etc These risks can be minimised with adequate management of maternal glycemia. For this purpose, early screening of hyperglycemia is pregnant females should be carried out which aids in identification of neonatal risks. It will facilitate monitoring monitoring and proper management of complications required for neonatal health care. It will reduce economic and social burden that results due to untreated cases.

Conflict of interest: Nill

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