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RESEARCH ARTICLE

A COHORT STUDY TO EVALUATE THE EFFECTS OF TYPE 2 DIABETES MELLITUS IN THIRD-TRIMESTER OF PREGNANCY

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Abstract

Background: Diabetes is the most common cause of pregnancy morbidity, and a sedentary lifestyle and family history are the most common contributing factors. Maternal diabetes is linked to poor maternal and newborn outcomes. The goal of this study is to predict the outcomes for both the mother and the fetus in cases of pre-existing type 2 diabetes during the third trimester of pregnancy.

Methods: A tertiary care facility in Central India was studied retrospectively. The research was conducted from March 3, 2022, to May 3, 2022. Women with FBS >126 mg/dl and an HbA1c >6.5 were classified as diabetic, those with FBS between 100 and 125 mg/dl and an HbA1c between 5.7 and 6.4 as pre-diabetic, and those with FBS 100 mg/dl and an HbA1c less than 5.6 as non-diabetic. Prenatal outcomes were assessed for both women and newborns. All of the data was processed using SPSS version 21.0 for Windows (IBM Corp., Armonk, NY).

Results: The study evaluated 190 (33.9%) diabetic and 370 (66.07%) non-diabetic women. In the two groups, adverse maternal outcomes were calculated. In diabetic women, gestational hypertension (68% vs. 25%; p: <0.0001), preeclampsia (69% vs. 25%; p: <0.0001), antepartum hemorrhage (22% vs. 09%; p: =0.0001), postpartum hemorrhage (89% vs. 217%; p: <0.0001), prolonged/obstructed labor (54% vs. 20%; p: <0.0001), urgent induction of labor (44% vs. 2%; p: <0.0001), and urgent caesarean section (CS) (69% vs. 29%; p: 0.0001) were significantly more common as compared to non-diabetic women. Adverse neonatal outcomes such as high birth weight >4kgs (HBW) (79% vs. 29%; p: <0.0001), preterm delivery (29% vs. 15%; p: <0.0001), stillbirth (11% vs. 3%; p: 0.001), and early neonatal death (6% vs. 2%; p: 0.0001), congenital heart defects (5% vs. 0.2%; p: <0.0001), hypoglycemia in newborn (27% vs. 2%; p: 0.001) were associated more with diabetes. We did not establish any reports of maternal mortality during the study.

Conclusion: Diabetes mellitus type 2 also hurts maternal and fetal outcomes during the third trimester. Proper blood glucose monitoring and effective control through diet, exercise, and medications are required to avoid such adverse outcomes.

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Introduction:-

Type 2 diabetes is rapidly escalating in occurrence across all age groups and populations. [1] Complications from pre-existing diabetes mellitus occur in 0.2% to 0.3% of pregnancies. [2] It puts both the mother and the fetus in grave danger. Despite major advancements in clinical care, the prevalence of abnormalities and prenatal morbidity is higher in the diabetic population compared to the non-diabetic population. Most of the countries in Europe have ratified the St. Vincent Declaration, which calls for (an outcome in diabetic pregnancy approximating the non-diabetic women). [3]

Normal Glucose Regulation during Pregnancy:

During pregnancy, both the mother and the fetus experience metabolic changes as a result of the increased nutritional demands. Two metabolic processes are visible during pregnancy:

1. Pregnancy-related progressive insulin resistance begins in the second trimester and rises through the third trimester to a level that is comparable to that of people with type 2 diabetes mellitus. Insulin resistance is brought on by increased maternal adiposity and placental hormone production (progesterone, cortisol, placental lactogen, prolactin, and growth hormone). Due to placental hormones, which also contribute to this condition of resistance, this insulin resistance soon disappears after birth.
2. To combat pregnancy-related insulin resistance, the pancreatic beta-cells secrete more insulin as a form of compensation. Thus, normal blood glucose levels are maintained.^[4]

Neonatal, fetal and maternal outcomes of diabetes during pregnancy:

Table 1:- Foetal complications.

Congenital anomalies: cardio-vascular central nervous system, skeletal (sacral agenesis), and genitourinary complications
Excessive fetal growth (macrosomia)
Fetal growth retardation (in diabetic pregnancy complicated by nephropathy)

Table 2:- Neonatal complications.

Traumatic delivery
Surfactant deficiency
Hypoglycemia
Polycythemia
Hypocalcemia
Hypomagnesemia
Hyperbilirubinemia

Table 3:- Maternal Complications.

Hyperosmolar Hyperglycemic coma
Retinopathy
Pre-eclampsia
Hypoglycemia
Deterioration of Nephropathy
Miscarriages
Preterm delivery
Polyhydramnios

Methods:-

This was a review of the cohort of all patients delivered in the Obstetrics and gynecology department of a tertiary care hospital in India from March 03, 2022, to May 03, 2022. This study was approved by the institutional review board. Only those data records that had at least one record of blood glucose levels in the first & second trimesters and one-trimester third trimesters were included.

Maternal and newborn information was disseminated in a pre-structured, shareable manner. Based on the patients' third trimester HbA1c and FBS values, two groups of patients were created. Women were classified as diabetic if their FBS levels were above 126 mg/level and non-diabetic if they had FBS levels below 126 mg/dl. Age, height, body weight, smoking status, and parity were among the demographic characteristics on-anemic that were noted.

Fasting blood glucose levels in the first and/or second trimesters of the present pregnancy were documented, together with the history of antenatal visits and the results of previous pregnancies. Both the moms' and the newborns' pregnancy outcomes were evaluated. Maternal outcomes included in the study were gestational hypertension, preeclampsia, eclampsia, antenatal hemorrhage (any bleeding from the genital tract at 24+0 weeks of gestation till before delivery), postpartum hemorrhage (>500 ml of blood loss during or within 24 hours of delivery), obstruction of labor (OL)/prolonged labor (PL), induction of labor (IOL), emergency CS/laparotomy, and maternal mortality. Fetal outcomes included fetal distress, high birth weight (LBW) (less than 2,500 grams), congenital diseases, prematurity (childbirth before 37+0 weeks of gestation), neonatal intensive care unit (NICU) admission, stillbirth, and early neonatal death.

Statistical analysis was completed through SPSS version 21.0 for Windows (IBM Corp., Armonk, NY). Categorical data are presented as frequencies and percentages. Continuous data are presented as mean and standard deviation (SD). A chi-square test was performed to analyze the correlation between categorical variables. A p-value of ≤ 0.05 was considered significant.

Results:-

There were 560 records included in the analysis. The mean age of the women was 27.4 (± 12.5) years. The mean BMI of the women was 29.3 (± 6.4). There were 190 (66.09%) women who were diabetic in their third trimester and 370 (62.2%) who were non-diabetic. Their baseline characteristics were compared. It showed that diabetic women were older, had higher body weight, more likely to be smokers (Table 1).

Baseline characteristics	Diabetics (n=190), 33.9%	Non- diabetes (n=370) 66.09%	P-value
	Maternal age		
Less than 20 years	30 (15.79%)	54 (14.59%)	0.002
20-30 years	56 (29.47%)	227 (61.35%)	0.002
More than 30 years	104 (54.73%)		0.002
	BMI		
Underweight (<18.5)	12 (0.63%)	20	<0.001
Normal (18.5-24.9)	43 (22.63%)	53	<0.001
Overweight (25-29.9)	99 (52.1%)	11	<0.001
Obese	36 (18.9%)	Nil	<0.001
Smoker	36 (18.9%)	289 (78.10%)	
Non-Smoker	154(81.05%)	81 (21.89%)	
Total	190	370	560

Table 1:- Comparison of baseline characteristics of diabetic and non-diabetic pregnant patients.

In the diabetic group, 52.63% had FBS of >126mg/dl and the percentage increased to 84.86% as compared to the non-diabetic study group. The mean FBG level of the anemic diabetic was 124 (± 2.5) mg/dL in the third trimester. A comparison of the clinical characteristics of both groups was performed, which showed that diabetic women had significantly higher HbA1c levels (Table 2).

Clinical Characteristics	Diabetic (n=190)	Non-diabetic (n=370)	P-value
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	Fasting blood glucose in third trimester		
<120	100 (52.63%)	314 (84.86%)	<0.001
120-140	46 (24.21%)	54 (14.59%)	<0.001
>140	44 (23.15%)	2 (0.005%)	<0.001
	HbA1c in third trimester		
<5.5	106 (55.78%)	329 (88.91%)	<0.005
5.5-6.5	43 (22.63%)	40 (10.81%)	<0.005
>6.5	41 (21.57%)	1 (0.27%)	<0.005
Total	190	370	560

Table 2:- Comparison of clinical characteristics of diabetic and non-diabetic study population.

The study also compared maternal and neonatal outcomes of diabetic and non-diabetic populations. In the diabetic group pregnancy-related complications like pre-eclampsia, Hyperosmolar hyperglycemic coma, polyhydramnios, late-pregnancy miscarriages, preterm labor, deterioration of diabetic retinopathy, and nephropathy were higher. A higher incidence of fetal distress and prolonged labor leading to emergency C-section delivery was noted. The neonatal outcomes were also poor in the diabetic population. There were no maternal mortalities and 18 (3.21%) neonatal mortalities out of which 12 (2.14%) deaths were in the babies of diabetic mothers.

Pregnancy outcomes	Diabetic	Nondiabetic	Pvalue
Gestational hypertension	62	10	<0.005
Pre-eclampsia	16	-	<0.01
Eclampsia	4	-	<0.1
Antepartum hemorrhage	3	1	<0.02
Hyperosmolar Hyperglycemic coma	1	0	<0.005
Postpartum hemorrhage (>500ml)	22	0	<0.005
Major obstetric 3 hemorrhage (>1000ml)	3	1	<0.001
Need for blood transfusion in 24hrs of delivery	12	2	<0.01
Prolonged/obstructed labor	35	4	<0.01
Induction of labor	56	0	<0.5
C-section delivery	32	91	<0.03
High birth weight (>4kg)	35	51	<.005
Preterm delivery	-	10	<.005
Early neonatal death (within 48 hrs)	6	6	<.001
Stillbirth	10	3	<0.05
Congenital anomalies	8	1	<.002
NICU admission	19	14	<0.01

Table 3:- Comparison of maternal and neonatal outcomes in diabetic and non-diabetic population

Discussion:-

Obstetricians around the world frequently deal with the issue of maternal anemia. In this study, we discovered a link between type 2 maternal diabetes and unfavorable pregnancy outcomes. As the results were mostly focused on instances at a single healthcare facility, even if this study highlights the key issues, its consequences cannot be broadly applied. Due to its retrospective nature, there is a strong likelihood that the data may be inaccurate.

There is more research that demonstrates the same patterns of the relation between Type 2 Diabetes mellitus and pregnancy. In their global investigation, Boyd E. Metzger et al. pointed to numerous connections between maternal glycemia and its consequences.^[5] In another study in China Wenhui Mao, Et al discussed the complications of diabetes and its burden on the economy and healthcare.^[6]

The impact of obesity, sedentary lifestyles, and the problems of Type 2 diabetes, particularly during pregnancy, have also been the subject of a great deal of research. H D McIntyre et al. carried out a study in Australia to highlight the problems with diabetes during pregnancy.^[7] The American Diabetes Association (ADA) published the "Standards of Medical Care in Diabetes" to inform patients about the various facets of diabetes care, general treatment goals and guidelines, and tools to evaluate the level of care. These standards include the organization's most recent clinical practice recommendations.

The significance of reaching and maintaining as close to euglycemia as safely possible before conception and throughout pregnancy should be made clear to all diabetic women of reproductive age. Anencephaly, microcephaly, congenital heart disease, renal abnormalities, and caudal regression are all examples of diabetic embryopathy, and observational studies have shown a direct link between raised HbA1c levels during the first 10 weeks of pregnancy and these conditions.^[8] WHO wants to promote and support the adoption of successful strategies for the surveillance, prevention, and control of diabetes and its complications, particularly in low- and middle-income countries.^[9] There is abundant evidence from studies on both humans and animals that preserving a normal maternal metabolic environment, particularly blood glucose concentrations, can avoid or minimize pregnancy-related issues linked to higher morbidity and death in the mother and her infant. Engaging a multidisciplinary team to optimize care is essential for successful outcomes in pregnancies complicated by diabetes because it has considerably reduced maternal and perinatal morbidity/mortality in IDMs.^[10]

This study found that type 2 diabetes and its consequences are more common during the third trimester of pregnancy. More protocols for managing high blood sugar during pregnancy must be implemented right away. In our opinion, this study brought to light the negative effects of diabetes during pregnancy in a group of Indian women. More research should be conducted to determine the significance of timely blood glucose management. To benefit both mothers and babies, there should be a greater awareness of the need for women of reproductive age to change their lifestyle and diet. It is critical to acknowledge the need for a larger sample size in interventional studies.

Conclusions:-

Maternal diabetes is associated with poor maternal and newborn outcomes. Women who are at risk must be identified and treated as soon as possible. Through awareness programs, women must be made aware of the importance of maintaining their health and well-being. Women should be encouraged to seek antenatal care, with a focus on improving maternal nutrition and lifestyle choices. In the third trimester, proper prenatal care can help prevent negative outcomes such as type 2 diabetes. All women of childbearing age should be made aware of the importance of good maternal health, and awareness campaigns should not be limited to pregnant women.^[11]

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