EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 12
Issue: 9
Year: 2025

EFFECT OF GESTATIONAL DIABETES MELLITUS ON MATERNAL AND NEONATAL OUTCOME

Dr. Rani Varadaraju*, Dr. Ahamed Munshira A.S

India.

***Corresponding Author: Dr. Rani Varadaraju**
India.

Article Received on 02/07/2025 **Article Revised on 23/07/2025** **Article Accepted on 13/08/2025**

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is defined as impaired glucose tolerance resulting in hyperglycemia diagnosed for the first time during pregnancy. GDM is emerging as a global epidemic constituting significant complications for both mother and fetus. Hence its high time that diagnosis and interventions should be made at its earliest in order to prevent and minimize its effects. Methods: Patients attending the antenatal OPD were screened for GDM using 2hr OGTT. The patients were followed in antenatal period upto delivery. Maternal and neonatal outcomes were studied. **Results:** Out of 1528 deliveries, total 146 patients diagnosed to have gestational diabetes mellitus. The prevalence of GDM in the population studied was 9.5%. 62% of patients had GDMA2 and was managed with either metformin or insulin or both. Pre-eclampsia complicating pregnancy was noted in 17% patients. Out of the 146 patients, 74% delivered vaginally, 5% had instrument delivery and 21% contributes to LSCS. **Conclusions:** Gestational diabetes mellitus is identified to be one of the major medical complications in pregnancy causing adverse outcomes to mother and neonates. Evidence suggests that early and timely diagnosis of GDM with vigilant glycemic control can significantly reduce complications as well as difficulties during labour.

KEYWORDS: Diabetes, outcomes, complications, preeclampsia, pregnancy.

INTRODUCTION

- Gestational diabetes mellitus [GDM] according to American college of Obstetrics and Gynaecology (ACOG) is “any degree of glucose intolerance that either commences or is first diagnosed in pregnancy”.[1] This definition includes women whose glucose tolerance will return back to normal after pregnancy and also those who will persist with glucose intolerance and develop type 2 mellitus. In line with the global epidemic of obesity and its related metabolic disorders, gestational diabetes mellitus [GDM] has emerged as one of the most common complications during pregnancy, posing significant risks for both mother and their infants.[2]

- In early pregnancy, the basal glucose and insulin levels remain unchanged, and the glucose tolerance is normal or slightly improved in normal women.[3] The fasting blood glucose levels gradually falls to reach a nadir at the end of the first trimester, when they are 10-15 mg/dl lower than the non-pregnant state. With advancing gestation, the basal as well as the post prandial insulin secretion increases progressively to reach almost twice the non-pregnant levels by third trimester.[4] This is paralelled by an increasing insulin resistance. The high levels of maternal and placental hormones, particularly human chorionic somatotrophin, oestrogen, progesterone, prolactin and cortisol are implicated in the development of this gestational insulin resistance. Indian women have high prevalence of diabetes and their relative risk of developing GDM is 11.3 times compared to white women.[5]
- According to the latest estimates of the International Diabetes Federation [IDF], GDM affects approximately 14% of pregnancies worldwide, representing approximately 20 million births annually.[6] Mothers with GDM are at risk of pre-eclampsia. Pre-eclampsia occurs in around 10% of patients with GDM. Studies have shown that the GDM patients who developed preeclampsia were younger, nulliparous, obese and gained significantly more weight during pregnancy. Other complications includes preterm labour, chorioamnionitis, polyhydramnios, urinary tract infections and termination of pregnancy via caesarean section.
- Glucose crosses the placenta by facilitated transport. Maternal insulin does not cross the placenta and the

fetus produces its own insulin from late first trimester. However, the fetal insulin response in a normal pregnancy is sluggish, and it is likely that fetal insulin plays less of a role in glucose homeostasis, and more in promoting growth. Pederson proposed the theory of 'hyperglycemic hyperinsulinism'.[7] According to this, maternal hyperglycemia leads to fetal hyperglycemia, which in turn stimulates fetal pancreatic beta cells hypertrophy leading to fetal hyperinsulinemia. This fetal hyperinsulinemia is responsible for the increased fat deposition and macrosomia, organomegaly, especially of the liver and heart, increased erythropoietin production and decreased surfactant production. The consequences of these effects are an increased risk of birth trauma and intrapartum asphyxia, respiratory distress syndrome(RDS), polycythemia and hypoglycemia in newborn.

- The WHO published their criteria for diagnosis of GDM. According to these guidelines, elevated fasting and post-prandial plasma glucose levels reflect the presence of pre-existing DM. For a diagnosis of GDM, a 75g OGTT is recommended at 24-28 weeks with fasting and 2- hour post glucose measurements. A venous plasma glucose of $\geq$140 mg/dl (7.8 mmol/l) at 2 hours was classified as GDM.[8]
- DIPSI (Diabetes in Pregnancy Study Group India) proposed a single step screening and diagnosis procedure irrespective of the last meal. Pregnant women attending the antenatal OPD were 75g glucose in 250-300ml of water and plasma glucose was estimated after 2 hours. A 2-hour plasma glucose of $\geq$140 mg/dl is taken as GDM.[9] The non-fasting one-step approach makes the test more practical and simple to institute in a low resource setting, but it has been criticized for missing women with GDM.
- In 2008, the HAPO (Hyperglycemia and Adverse Pregnancy Outcomes) study[10] showed that adverse maternal and neonatal outcomes were correlated in a linear fashion to blood glucose levels, even within the euglycaemic range, that is, in women who had a normal GTT. Based on this study, the IADPSG released its recommendations for a new set of diagnostic criteria for GDM in 2010.[11] An OGTT is done with 75g of glucose at 24-28 weeks and GDM diagnosed if any one of the following cut-off is met, that is, fasting $\geq$92 mg/dl, 1 hour $\geq$180 mg/dl, or 2 hours $\geq$153 mg/dl.
- American College of Obstetrics and Gynaecologists (ACOG) practice bulletin on GDM (2018)[12] continues to recommend the two-step approach for screening and diagnosis of GDM. A 50-g glucose challenge test is used for screening at 24-28 weeks of pregnancy, in which a 50-g glucose load is administered, irrespective of the time of the last meal and the plasma glucose is measured one hour later. If the glucose challenge test is positive, that is plasma glucose level is $\geq$140 mg/dl, a 3 hour 100-g GTT is recommended as the diagnostic test.
- The most recent guideline for diagnosis of diabetes of pregnancy is from ADA -Standards of Medical Care in Diabetes- 2019.[13] The recommendations are as follows:

1. Test for undiagnosed diabetes at the first antenatal visit in women who are at high risk for diabetes using standard diagnostic criteria. If the test result is normal, screening should be repeated at 24-28 weeks.
2. Test for GDM at 24-28 weeks either using one-step 75-g OGTT (IADPSG) or two step 50-g glucose challenge test followed by 100-g OGTT.
3. Test women with GDM at 4-12 weeks postpartum for pre-diabetes or diabetes using 75-g OGTT.
4. Women with GDM should have lifelong screening atleast every 3 years.
5. Women diagnosed as pre-diabetic should be given intensive lifestyle advice or metformin to prevent frank diabetes.

AIMS AND OBJECTIVES

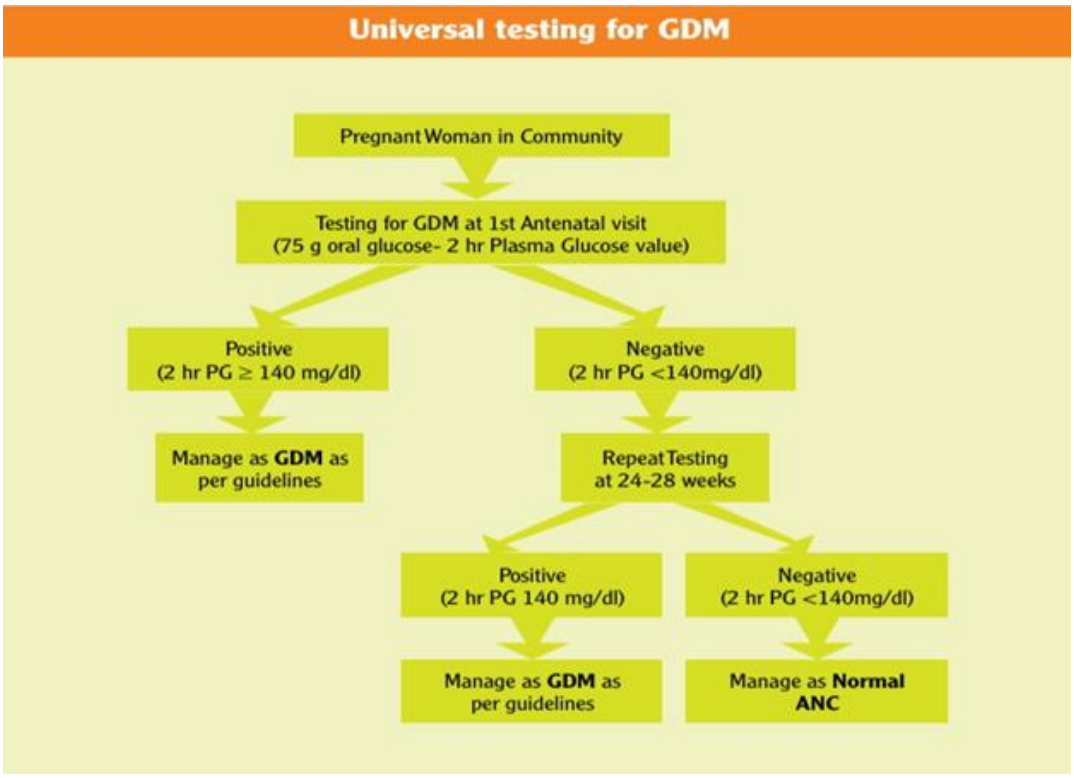
- To assess the maternal and fetal outcomes in pregnancies complicated by gestational diabetes mellitus.

MATERNAL RISK	FETAL RISK
• Polyhydramnios	• Intra-uterine death
• Pre-eclampsia	• Stillbirth
• Prolonged labour	• Congenital malformation
• Obstructed labour	• Shoulder dystocia
• Cesarean section	• Birth injuries
• Uterine atony	• Neonatal hypoglycemia
• Postpartum hemorrhage	• Respiratory distress syndrome
• Infection	• Hyperbilirubinemia

MATERIALS AND METHODS

- This study was carried out prospectively in the department of Obstetrics and Gynaecology, Arokya Women Center, Salem over the period of six months from September 2024 – Febraury 2025.All pregnant women attending the outpatient department were screened for GDM. A detailed history of all patients were taken. All patients at first antenatal visit were screened for universal screening of GDM using a 2-h 75g OGTT. In this screening test, 75g of oral anhydrous glucose was given and 2 hours later, the blood sugar level was measured. If this level is more

than 140mg/dl then it is considered screening and diagnostic of GDM. The OGTT was repeated for patient who had a negative result on screening test at 24-28 weeks. The patients were followed in antenatal period up to delivery.



INCLUSION CRITERIA

- All pregnant women who found to have blood sugar level of more than 140mg/dl 2 hours after 75grams of oral glucose irrespective of the last meal.

EXCLUSION CRITERIA

- Pregnant women with pre-existing diabetes mellitus.

RESULTS

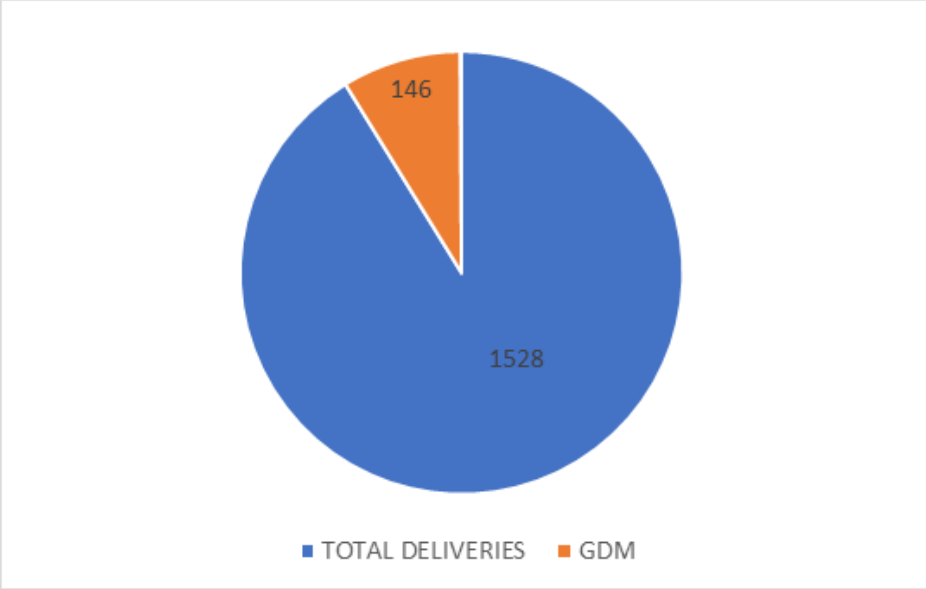


Figure 1: Prevelance.

- The prevalence of GDM in the present study was found to be 9.5%

Table 1: Distribution of Gdm.

	NUMBER OF CASES	PERCENTAGE
GDMA1	55	38%
GDMA2	91	62%
TOTAL	146	100%

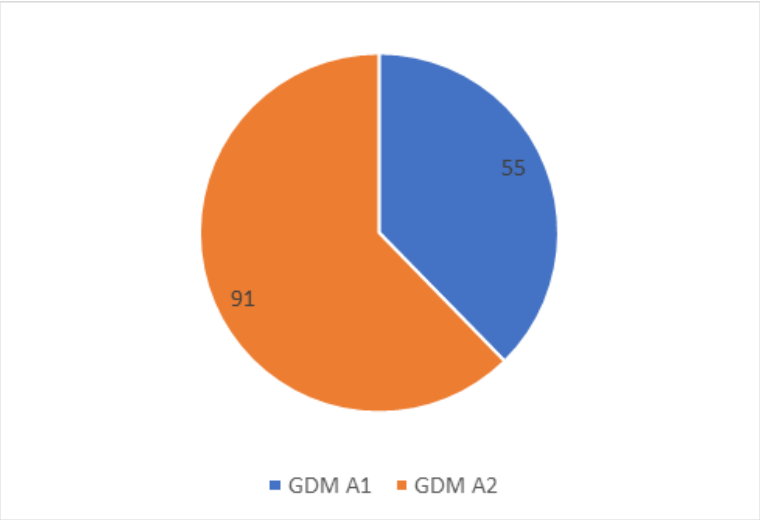


Figure 2: Distribution of Gdm.

Out of the 146 patients of gestational diabetes mellitus, 55 patients were diagnosed to be GDMA1 (38%) managed with Medical nutritional therapy (MNT) alone. 91 patients were diagnosed to be GDMA2 (62%) managed with medications.

Table 2: Mode of Treatment.

MODE OF TREATMENT	NUMBER OF CASES	PERCENTAGE
METFORMIN	87	95%
INSULIN	5	5%

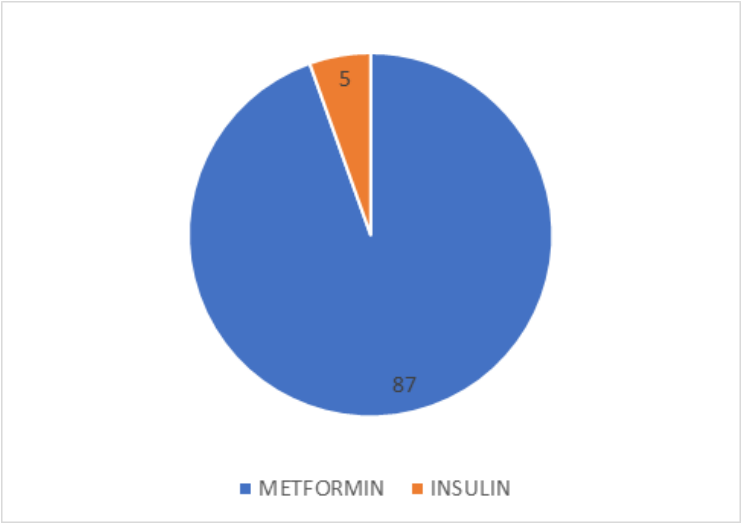


Figure 3: Mode of Treatment.

The patients managed with medications majority of them (95%) were treated with metformin while only a very few (5%) were treated with insulin.

Table 3: Age distribution.

AGE	NUMBER OF CASES	PERCENTAGE
<20	2	1%
21-25	42	29%
26-30	65	45%
>30	37	25%

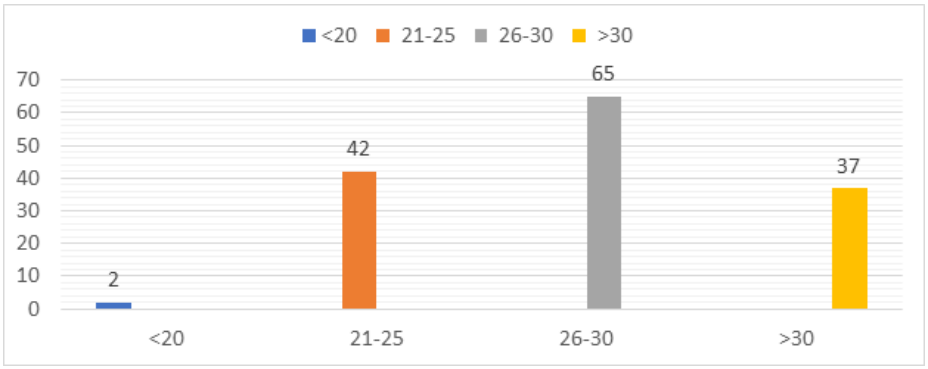


Figure 4: Age Distribution.

In the present study, 1% patients of gestational diabetes belonged to age less than 20 years, 29% belonged to age group 21-25 years, the maximum number of patients, that is 45% were in age group of 26-30 years and 25% were in age group of more than 30 years.

Table 4: Parity.

Parity	Number of Cases	Percentage
PRIMI	72	49%
MULTI	74	51%

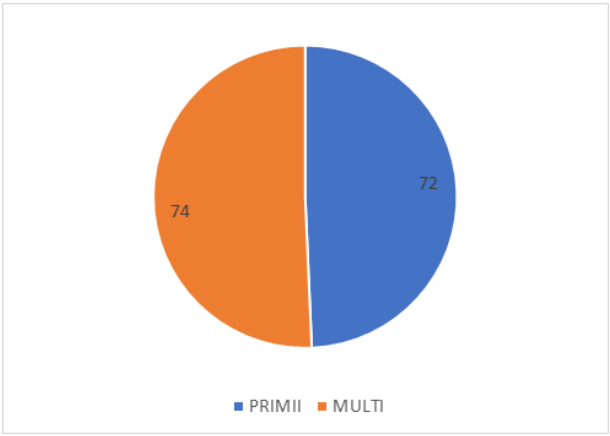


Figure 5: Parity.

Gestational diabetes is distributed almost equally between the primi and the multi in our study group.

Table 5: Mode of Delivery.

Mode of delivery	Number of Cases	Percentage
NORMAL VAGINAL	108	74%
INSTRUMENTAL	8	5%
LSCS	30	21%

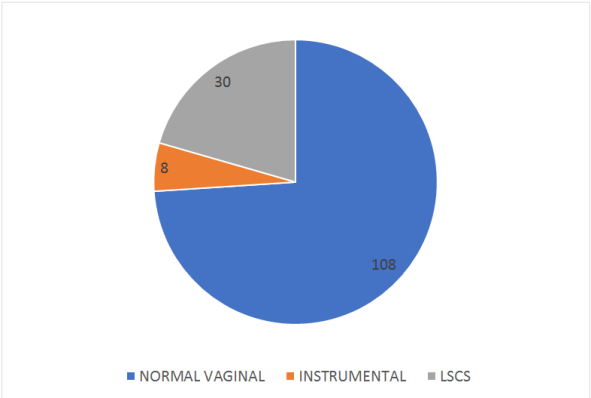


Figure 6: Mode of Delivery.

In the present study, it was observed that majority of the patients 74% had normal vaginal delivery, 5% patients required instrumental vaginal delivery and 21% patients delivered by cesaerean section.

Table 6: Gestational Age.

	Number of Cases	Percentage
PRETERM	18	12%
TERM	128	88%

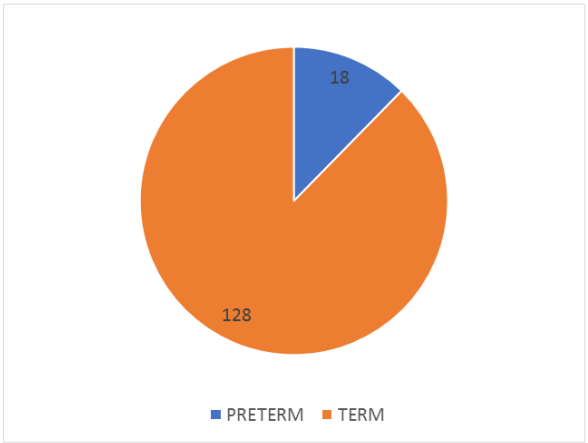


Figure 7: Gestational Age.

In our study, majority of the patients (88%) were delivered at term, only a few (18%) delivered at preterm.

Table 7: Birth Weight At Delivery.

Birth Weight At Delivery (In Kgs)	Number of Cases	Percentage
2 - 2.5	17	12%
2.51 – 3	78	53%
3.1 - 3.5	46	32%
> 3.5	5	3%

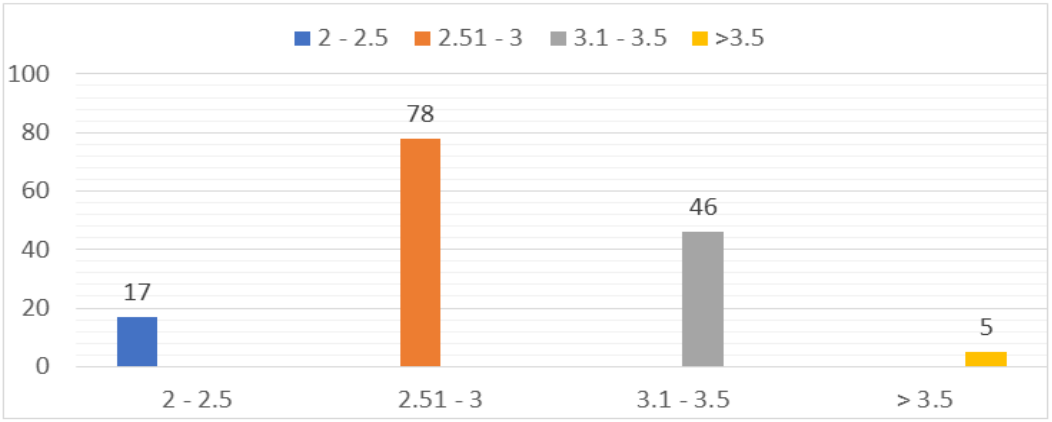


Figure 8: Birth Weight At Delivery.

12% of babies were born with birth weight of 2 – 2.5 kgs, 53% were born with birth weight of 2.51 – 3 kgs which accounts for majority of the patients in our study group, 32% were born with birth weight of 3.1 -3.5 kgs and only 3% of babies were born with weight more than 3.5 kgs.

Table 8: Significant Past History.

Past history	Number of Cases	Percentage
GDM IN PREVIOUS PREGNANCY	8	5%
H/O NEONATAL DEATH	3	2%
H/O ABORTION	31	21%
PREV ANOMALOUS BABY	3	2%

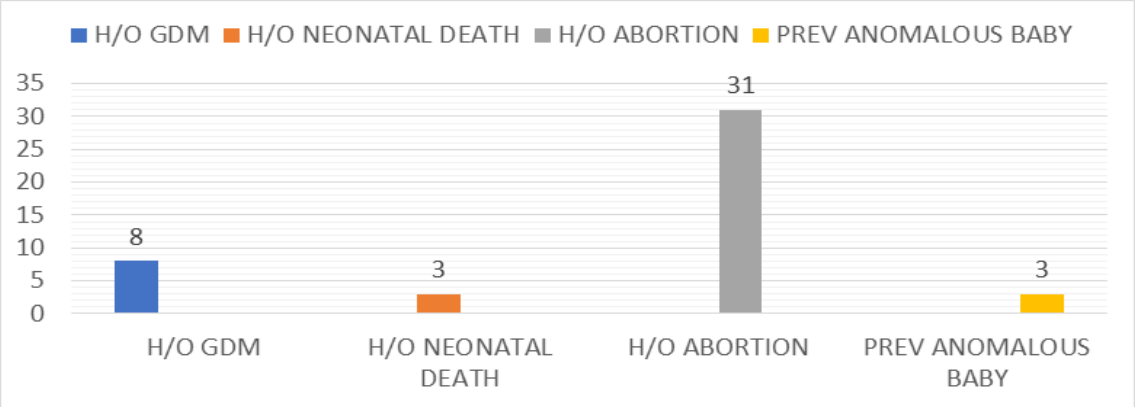


Figure 9: Significant Past History.

In our study, 8 patients (5%) had gestational diabetes in previous pregnancies. 3 patients (2%) had previous history of neonatal death. Previous history of abortion/s was seen in 31 patients (21%). And 3 patients (2%) had previous anomalous baby.

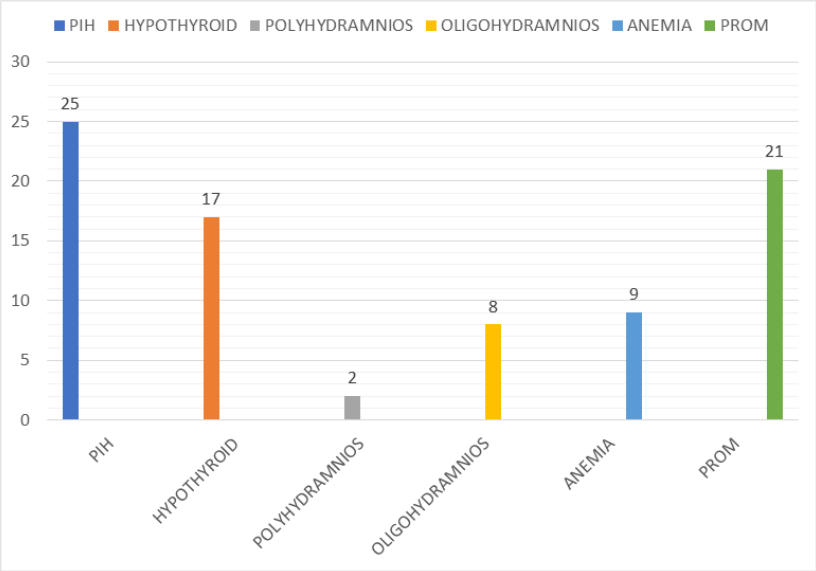


Figure 10: Associated Antenatal Complication.

Preeclampsia complicating pregnancy was noted in 25 patients (17%), Hypothyroidism was seen in 17 patients (11%), only 2 patients(1%) had Polyhydramnios, whereas 8 patients (5%) had oligohydramnios, 9 patients (6%) had anemia, PROM was seen in 21 patients (14%).

Table 9: Postpartum Complications.

POSTNATAL COMPLICATIONS	NUMBER OF CASES	PERCENTAGE
PPH	5	3%
WOUND GAPPING	15	10%

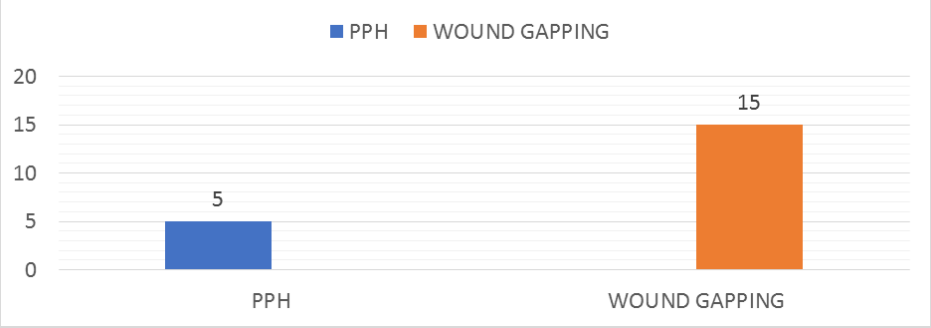


Figure 11: Postpartum Complications.

Postpartum hemorrhage was seen in 5 patients (3%), and wound gapping of both episiotomy and LSCS wound was noted in 15 patients (10%).

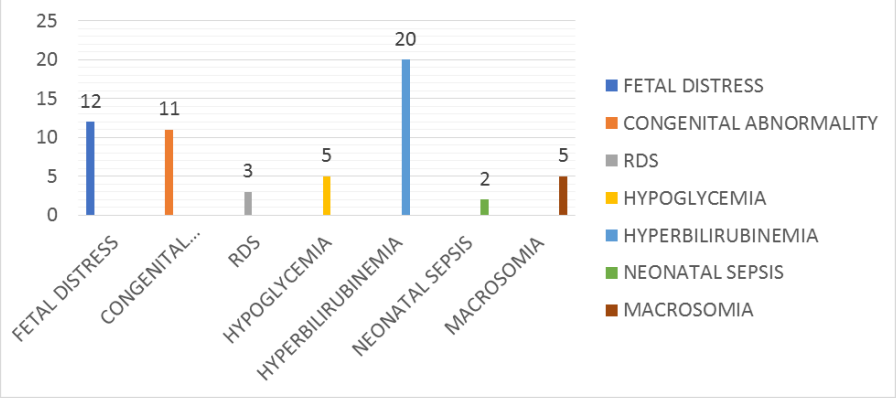


Figure 12: Neonatal Complications.

Fetal distress was seen among 12 babies (8%). A total of 11 babies (7.5%) had congenital abnormalities. Respiratory distress syndrome owing to the prematurity was present in 3 babies (2%). Hypoglycemia was seen in 5 babies (3%) and 20 babies (13%) had Hyperbilirubinemia. Neonatal sepsis was diagnosed in 2 babies (1%). 5 babies (3%) had weight more than 3.5 kgs.

DISCUSSION

- The present study was conducted in a teaching hospital to assess cases of gestational diabetes mellitus, to study their obstetric and fetal outcomes.
- According to the American Diabetes Association (ADA), GDM complicates approximately 7% of all pregnancies. GDM prevalence has been reported variably from 1.4% to 14% worldwide and differently among the racial and ethnic groups.[14] Another study done in Tamil Nadu during 2005-2007, GDM was detected in 17.8%, 13.8% and 9.9% of the women in urban, semi-urban and rural areas respectively.[15] The prevalence of GDM in our present study is found to be 9.5%.
- In a study by Rathod JK et al prevalence of GDM was maximum (60%) in the age group of more than 30 years.[16] Another study by Dudhwadkar AR et al, maximum patients (56%) were clustered in age group of 26-30 years and 30% of patients were over 30 years which was comparable to our present study in which prevalence of GDM was maximum (45%) in age group of 26-30 years and 25% in age group more than 30 years.[17]
- In a study by Thomas et al it was observed that incidence of GDM was 47.7% in primi and 50.3% in the multi.[18] In our present study it was 49% in primi and 51% in multi.
- In our study, 21% of patients had history of abortion which was higher than finding of Jani et al, which shows that 8.6% patients had history of unexplained abortions. In our study, 5% had history of GDM in previous pregnancy and 2% of patients had a history of perinatal loss. In the study of Jani et al, 33.6% had history of GDM in pregnancy and 2.8% had history of perinatal loss.[19]
- Preeclampsia can complicate the course of pregnancy and has an adverse effect on the feto-maternal outcome. In this study 17% of GDM patients has associated preeclampsia which was lower than the study of Jani et al (46.1%) and Saxena et al (40%).[19,20] According to Xiong et al, mothers with GDM are at increased risk of presenting with preeclampsia.[21] Thus there is an association between preeclampsia and GDM and early diagnosis and initiation of treatment should be done to improve the outcome.
- Hypothyroidism was noted in 17 patients (11%) which was higher than the study of Dudhwadhkar et al (6%).[17]
- In the present study, Polyhydramnios was noted in only 2 patients (1%), which was lower than the study of Rathod JK et al which was 44%.[16]
- In the present study, 74% patients delivered vaginally, 5% deliveries was instrumental and 21% patients underwent LSCS. According to Jindal et al cesaerean section was required in 44% cases and in Rathod JK et al it was 64%.[16,22] The rate of LSCS in our present study is almost half as that of other studies owing to early intervention and treatment which reduces the incidence of macrosomia and further complications. The Indian consensus is that a newborn weighing more than 3.5 kgs should be considered as macrosomia. ACOG suggests that if gestational diabetes remains undiagnosed or untreated, the risk of macrosomia is high as 20%.[23] In present study, 3% babies were macrosomic which is low compared to Jani et al (10.5%)and Dudhwadkar et al (40%).[17,19]
- 88% of babies were born at term and 12% at pre term in our study. In a study by Mahalakshmi MM et al, in South India, 77.5% of babies were term live births while 19% were pre term live births.[24] Pre term births in our study were attributed to premature preterm rupture of membranes, preterm labour and early induction in cases of severe preeclampsia.
- Neonatal complications in babies born to GDM mother includes fetal distress, RDS, metabolic and electrolyte abnormalities, congenital anomalies. Hypoglycemia being the major complication that occur to GDM mother babies. In the present study, 3% of babies had hypoglycemia whereas in the study of Dudhwadkar AR et al 8% babies had hypoglycemia.[17] In our study 7.5% had congenital anomalies, while according to Saxena et al, 10% babies had congenital anomalies.[20] Maternal glycosylated haemoglobin levels in the first trimester may help to predict the risk of occurrence of congenital anomalies in the fetus in cases of pregestational diabetes. Studies[25] shows that:

1. HbA1c less than 7% - no greater risk for anomalies than nondiabetic mothers.
2. 7-8.5% - risk of 5% for anomalies.
3. >10% - risk of anomalies rises to 22%.

CONCLUSION

- Diabetes Mellitus has become one of alarming Gestational challenges faced by Obstetricians. In the present health milieu of state burden of GDM is only going to increase in near future. Therefore, awareness about occurrence of GDM, N proper health education about glycemic control and early screening for GDM to be given to future mothers. Efforts should be made to provide high quality of care and education about risks arising from the consequences of poor glycemic control.
- In our group, incidence of macrosomia and LSCS was found to be less often when compared to other studies which indicate appropriate early screening and timely adequate interventions in providing good

glycemic control. In conclusion, early short term intensive care will relatively reduce influence of hyperglycemia on maternal outcome as well as fetal development.

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