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MATERNAL AND FETAL OUTCOME IN GESTATIONAL DIABETES MELLITUS AT TERTIARY CARE CENTRE

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Abstract:

Introduction and background: Diabetes is the most frequent medical consequence of pregnancy. Women with diabetes can be divided into two categories, diabetes before pregnancy - Pregestational or Overt, and those diagnosed during pregnancy-Gestational Diabetes. In the early 1900s, overt diabetes complicated a mother and her child's horrifying morbidity and mortality during pregnancy. Although tremendously mitigated by the discovery of insulin, overt and gestational diabetes still are formidable complications of pregnancy.[1]

Aim and objectives

Aim:

- To study the maternal and fetal outcome in Gestational Diabetes Mellitus (GDM) at a teaching hospital.

Objectives:

1. To study the prevalence of Gestational Diabetes Mellitus (GDM) at a teaching hospital.
2. To study the maternal and fetal outcome in Gestational Diabetes Mellitus (GDM) at a teaching hospital.

Materials and methods:

A prospective observational study conducted among 591 Pregnant women attending the ante-natal OP, Government Maternity Hospital, Tirupati were screened for GDM and those diagnosed with GDM elsewhere were followed up to study fetal and maternal outcomes during one year period.

Inclusion criteria:

1. Pregnant women of gestational age between 24-28 weeks who have given consent will be screened for GDM.
2. Pregnant women diagnosed with GDM elsewhere and attending the antenatal OP.
3. Patients diagnosed with GDM were followed up to delivery, to study the maternal and fetal outcomes.

Exclusion criteria:

1. Patient who are known cases of Diabetes mellitus.
2. Patients on drugs like Steroids, Calcium channel blockers and Thiazides.

Results and analysis:

- In this study, the maximum population of GDM patients came under the age group 26-30 years (33.7%). GDM in teenage pregnancy was encountered in 12.7% of the study population. The elderly gravidas covered 6.8%. In this study, the occurrence of GDM was lesser in the extremes of the age group.

The lower incidence in the elderly could be probably because these mothers would have had

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established pregestational diabetes and therefore did not meet the inclusion criteria.

- Out of 590 women, 43.7% were primi gravida. 41.5% were 2nd gravidas with a previous live child. Higher order births constituted 11.7%.
- In this study, 352 out of 591 women were started on insulin (59.5%), 121 (20.5%) were started on OHA and the remaining 118 (20.0%) women had their glycemic control achieved with medical nutrition therapy (MNT) alone.

Discussion:

Gestational diabetes mellitus (GDM) is a serious complication of pregnancy that affects an estimated 2–14% of all pregnancies annually. It is characterized by glucose intolerance that begins or is first recognized during pregnancy. GDM during pregnancy is more likely to occur in women who are older, have higher BMIs, are multiparous, or have had GDM in the past. Preeclampsia, shoulder dystocia, birth injuries, neonatal hypoglycemia, neonatal hyperbilirubinemia, and admission to a neonatal intensive care unit are all perinatal outcomes associated with hyperglycemia in pregnancy. Other outcomes include fetal weight equal to or greater than the 90th percentile, primary cesarean delivery, preeclampsia, and preeclampsia without shoulder dystocia.

Key words:

Gestational Diabetes, Pregnancy, Maternal & Fetal outcome.

INTRODUCTION

Diabetes is the most frequent medical consequence of pregnancy. Women with diabetes can be divided into two categories, diabetes before pregnancy - Pregestational or Overt, and those diagnosed during pregnancy-Gestational Diabetes. In the early 1900s, overt diabetes complicated a mother and her child's horrifying morbidity and mortality during pregnancy. Although tremendously mitigated by the discovery of insulin, overt and gestational diabetes still are formidable complications of pregnancy.[1]

GDM is a medical condition of hyperglycemia or intolerance to glucose with the first diagnosis in the second or third trimester of pregnancy that is not clearly overt disease prior to gestation.[2]

Gestational diabetes was originally defined by **O'Sullivan** in pregnant women in Boston in the **1960s** as Plasma glucose levels more than two standard deviations from the mean on a 100 g oral glucose tolerance test.[3] According to the American College of Obstetrics and Gynaecology (ACOG) - GDM is "any degree of glucose intolerance that either commenced or is first diagnosed in pregnancy".[4] GDM has become a major health concern in pregnant women, and its prevalence has been increasing worldwide.[2]

In woman with GDM, although the secretion of insulin and the basal production of glucose is the same as in non-diabetic woman, insulin is less effective in suppressing hepatic gluconeogenesis (unlike non-diabetic pregnancies), and there is a marked increase in the peripheral resistance to insulin. This leads to increased plasma glucose levels which directly correlates with fetal weight and other fetal and neonatal complications.[5]

By triggering the uptake of glucose from the circulation into fat, liver, and skeletal muscle cells, the peptide hormone insulin, which is generated and released by beta cells of the pancreatic islets, fine-tunes the metabolism of carbs, lipids, and proteins.

Diabetes mellitus is a disorder of carbohydrate metabolism. It is caused by a combination of hereditary and environmental factors and is characterized by either inadequate secretion or inadequate

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action of insulin. Diabetes complicating pregnancy has become more common worldwide. The etiological classification is based on the underlying cause for glucose intolerance.[4]

It can be classified as follows:[4]

I. Insulin dependent or type 1 diabetes
II. Insulin independent or type 2 diabetes
III. Gestational diabetes mellitus (GDM)
IV. Other causes:
- Abnormality in insulin receptor
- Abnormality in insulin action
- Disease of exocrine pancreas, e.g., Pancreatitis
- Endocrine abnormality, e.g., Cushing's syndrome, acromegaly
- Chromosomal abnormality, e.g., Trisomy 21

WHITES CLASSIFICATION:[4]

The Whites classification is another categorization that takes into account the length of the sickness, the age at which it first manifested, and the complications. It makes a distinction between type gestational diabetes and pre-pregnancy diabetes (pregestational diabetes). These groupings are further separated based on the risks and management they have.[4]

The two varieties of gestational diabetes are as follows:

Type A 1: Abnormal oral glucose tolerance test, but normal fasting and postprandial (2 hours after meals) blood glucose levels. Dietary modifications are sufficient to control blood glucose levels.

Type A 2: Abnormal OGTT compounded by abnormal glucose levels during fasting and/or after meals. Additional therapy with insulin or other medications is required.

Type B: Onset at age 20 or older and duration of less than 10 years. Type C: Onset at age 10–19 or duration of 10–19 years

Type D: Onset before age 10 or duration greater than 20 years Type E: Overt diabetes mellitus with calcified pelvic vessels Type F: Diabetic nephropathy

Type R: Proliferative retinopathy

Type RF: Retinopathy nephropathy Type H: Ischemic heart disease

Type T: Prior kidney transplant

EFFECTS OF DIABETES ON PREGNANCY:[5]

1. Maternal Effects:
    a. Pre-eclampsia
    b. Polyhydramnios
    c. Preterm labor
    d. Chorioamnionitis
    e. Urinary tract infection
2. Fetal Complications:
    a. Macrosomia
    b. Stillbirth

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c. Preterm labor
d. Congenital malformations
e. Spontaneous abortion

3. Neonatal Complications:
   a. Neonatal hypoglycaemia
   b. Hyperbilirubinemia
   c. Neonatal hypocalcemia
   d. Polycythaemia
   e. Neurodevelopmental abnormalities

Historical risk factors suggestive of gestational diabetes have been known for a long time. There is a general consensus now that screening for diabetes in pregnancy is cost-effective and reduces maternal and perinatal complications in pregnancy.[5] Hence the present study is done to prevent the maternal and neonatal compications of gestational diabetes.

The recommended two-step approach begins with either universal or risk-based selective screening using a 50-g, 1-hour oral glucose challenge test. In the Fifth International Workshop Conferences on Gestational Diabetes participants endorsed the use of selective screening criteria.[1]

GDM risk assessment: should be done at the first prenatal visit

Low risk: Blood glucose testing not routinely required if all the following are present; Member of an ethnic group with a low prevalence of GDM
No known diabetes in first-degree relatives Age <25 years
Weight normal before pregnancy Weight normal at birth
No history of abnormal glucose metabolism
No history of poor obstetrical outcome

Average risk: Perform blood glucose testing at 24 to 28 weeks using either;
Two-step procedure: 50g oral glucose challenge test (GCT), followed by a diagnostic 100g OGTT for those meeting the threshold value in the GCT.
One-step procedure: diagnostic 100g OGTT performed on all subjects.

High risk: Perform blood glucose testing as soon as feasible, using the procedures described above, if one or more of these are present: Severe obesity (BMI>30), strong family history of diabetes

If GDM is not diagnosed, blood glucose testing should be repeated at 24 to 28 weeks gestation or at any time symptoms or signs suggest hyperglycemia.

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The 50-gram glucose challenge test, which is done between 24-28 weeks of pregnancy, is the most often used screening procedure. No matter when the last meal was, a 50- gm glucose load is given, and an hour later, plasma glucose is assessed.[5]

According to the 1997 recommendations, screening and diagnosis were undertaken as a two-step approach. If the screening test, the glucose challenge test, is positive, that is, the plasma glucose level is ≥140 mg/dl, the diagnostic test, 3 hours 100 g GTT is recommended. Using the cut-off at 140 mg/dl, about 80% of gestational diabetes can be detected. Although using a lower cut-off of 130 mg/dl would increase the sensitivity of the test to nearly 90%, it would also mean a corresponding increase in the number of women who would need GTT. The cut-off values used for diagnosis were as per the values given by Carpenter and Coustan. Gestational diabetes is diagnosed if any two values are met or exceeded. If only one value is abnormal, it is labeled as gestational impaired glucose tolerance.[5]

Diagnosis of GDM by 100g 3 - hour OGTT by Carpenter and Coustan Criteria (1982)[5]:

Fasting	95 mg/dL
1 hour	180mg/dL
2 hour	155mg/dL
3 hour	140mg/dL

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MATERIALS AND METHODS:

A prospective observational study conducted among 591 Pregnant women attending the ante-natal OP, Government Maternity Hospital, Tirupati were screened for GDM and those diagnosed with GDM elsewhere were followed up to study fetal and maternal outcomes during one year period.

Inclusion criteria:

4. Pregnant women of gestational age between 24-28 weeks who have given consent will be screened for GDM.
5. Pregnant women diagnosed with GDM elsewhere and attending the antenatal OP.
6. Patients diagnosed with GDM were followed up to delivery, to study the maternal and fetal outcomes.

Exclusion criteria:

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4. Patients on drugs like Steroids, Calcium channel blockers and Thiazides.

Sample collection:

- After counselling the patient and taking consent for the study, screening test is done.
- Data was collected in standardized proforma from patients who attended antenatal OP.
- All the patients of gestational age 24-28 weeks, a detailed history was taken regarding family history, obstetric history, past history and about current pregnancy.
- Screening for GDM was done using a two-step approach.

- In the two-step approach, the first step was a 1-hour Glucose challenge test in which the blood glucose level was obtained after the oral administration of a 50-g glucose load irrespective of the fasting state. Women with a blood glucose level of at least 200 mg per decilitre (11.1 mmol per litre) on the challenge test were considered to have gestational diabetes and did not undergo further testing. Women who had a positive glucose challenge test with a blood glucose level below 200 mg per decilitre (≥140 mg per decilitre [≥7.8 mmol per litre]) underwent a diagnostic fasting 3-hour Oral Glucose - Tolerance Test (OGTT) in which the blood glucose level was obtained after the oral administration of a 100-g glucose load.
- Gestational diabetes was diagnosed if two or more of four glucose thresholds were met: a fasting level of at least 95 mg per decilitre (≥5.3 mmol per litre), at least 180 mg per decilitre at 1 hour, at least 155 mg per decilitre (≥8.6 mmol per litre) at 2 hours, or at least 140 mg per decilitre at 3 hours.
- Treatment for gestational diabetes was based on the same national practice guidelines, regardless of the screening approach.
- Test sample was collected in vaccum tubes and sent for glucose estimation to the clinical laboratory at Government Maternity Hospital.
- Those who screen positive with GCT will be followed with GTT for the diagnosis of GDM.
- Glycemic control was achieved on medical nutrition therapy or oral hypoglycemic antenatal period till delivery. Feto-maternal complications were evaluated during the study period.
- Patient diagnosed as GDM will be closely monitored to prevent complications arising from GDM to both Mother and Fetus.

OUTCOMES ANALYSED:

1. Antepartum complications:
    a. Pre-eclampsia
    b. Polyhydramnios
    c. Preterm Labour
    d. Urinary tract infection
2. Maternal outcome: mode of delivery
3. Fetal complications:
    a. Macrosomia
    b. Stillbirth
    c. Congenital malformations

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d. Shoulder dystocia or trauma

4. Neonatal complications:
    a. Neonatal hypoglycemia

STATISTICAL ANALYSIS:

- Primary data was entered in MS Excel and analyzed using SPSS.
- The results were presented in terms of tables and graphs.
- The descriptive statistics frequency and percentage were calculated.

RESULTS AND ANALYSIS:

- In this study, the maximum population of GDM patients came under the age group 26-30 years (33.7%). GDM in teenage pregnancy was encountered in 12.7% of the study population. The elderly gravidas covered 6.8%. In this study, the occurrence of GDM was lesser in the extremes of the age group.

The lower incidence in the elderly could be probably because these mothers would have had established pregestational diabetes and therefore did not meet the inclusion criteria.

- Out of 590 women, 43.7% were primi gravida. 41.5% were 2nd gravidas with a previous live child. Higher order births constituted 11.7%.
- In this study, 352 out of 591 women were started on insulin (59.5%), 121 (20.5%) were started on OHA and the remaining 118 (20.0%) women had their glycemic control achieved with medical nutrition therapy (MNT) alone.
- In this study, out of 591 women, 103 women had polyhydramnios (17.4%). Of these 103, 57 women had isolated polyhydramnios and the remaining 46 had other associated maternal complications.
- As shown in the above table, polyhydramnios was seen in 17.4% of the study population. Excess liquor, AFI: 21 -24 was seen in 22.6% of the population and AFI: 15 -20 was seen in 20% of the population.
- Pre-eclampsia was seen in 25.90% of the study population (n=153). Of these 153, 116 (75.8%) women were on insulin treatment. The incidence of pre-eclampsia was more in those women who were treated with insulin than those women whose glycemic control was achieved with OHA or MNT and the p-value was statistically significant (p value<0.001). This can be explained by the theory that insulin resistance also plays a role in the pathogenesis of pre-eclampsia and the two conditions share common factors contributing to the pathogenesis.
- 65 out of 591 GDM (11%) women had urinary tract infection. Out of these 65 women 47 women underwent preterm labour (72%), giving birth to low weight babies.
- In this study 8.8 % had preterm labour (n= 52). Most of them had associated complications of polyhydramnios and urinary tract infection indicating that these could be the causative factors for preterm birth.
- Out of 591 women, 40 (6.8%) had premature rupture of membranes.

Majority of the study population delivered via lower segment caesarean section (49.1%).

The most common indications for emergency LSCS were the following in order:

- Failed induction – 65.3 %

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- Meconium-stained liquor – 15.2%
- Fetal distress- 15.5%
- Cephalopelvic disproportion in labour -14% The indications for elective LSCS included:
- Macrosomia
- Repeat LSCS

- 50.9% of the study population delivered vaginally out of which 45.9% delivered via normal labor and 5% via instrumental delivery. The most common indication for instrumental delivery was a large baby with a birth weight of more than 3.5kg.
- Out of the 591 GDM pregnancies, 547 were live birth (92.6%). Intra Uterine Death (IUD) was seen in 2.4% (n=14). Out of these 14, 6 of them were preterm IUDs and the remaining 8 were term IUDs. Out of the 591 pregnancies, 7 were stillborn (1.2%) and early neonatal death (within 7 days) was seen in 3.9%. The causes of early neonatal death in order are hypoglycemia, and HIE (n=8), Respiratory Distress Syndrome (n=8), and sepsis (n=7).
- Most (45.0%) of the babies born to GDM mothers had birth weight ranging from 2.5 to 3.5 kg (n =266). 12.4 % of babies were low birth weight (n= 73). Of these 73 babies, 54 were preterm. 29.6% (n= 175) weighed between 3.6 to 4 kgs.
- Macrosomia (>4kg) was seen in 13.0% of the babies (n = 77). Of these babies, 69 were born to mothers, who were on insulin.
- Out of 591 pregnancies, shoulder dystocia and birth trauma were seen in 1.7% (n=10). This was encountered in large babies with birth weight ranging from 3.9 to 4.3 kgs. 5 babies had birth asphyxia (10 minutes APGAR<3), however, these babies improved in the neonatal period and had a good neonatal outcome.
- The incidence of congenital anomalies was seen in 4.9 % (29/591). 50 % of these congenital anomalies occurred in early onset GDM (n =15), where the gestation age was less than 20 weeks. The babies had congenital anomalies compatible with life. The most common congenital anomalies encountered were septal defects.
- The incidence of neonatal hypoglycemia was seen in 45%, and most062
- of them were corrected by frequent breastfeeding. Only a few cases needed intravenous 10% dextrose infusion.

DISCUSSION:

Gestational diabetes mellitus (GDM) is a serious complication of pregnancy that affects an estimated 2–14% of all pregnancies annually. It is characterized by glucose intolerance that begins or is first recognized during pregnancy. GDM during pregnancy is more likely to occur in women who are older, have higher BMIs, are multiparous, or have had GDM in the past. Preeclampsia, shoulder dystocia, birth injuries, neonatal hypoglycemia, neonatal hyperbilirubinemia, and admission to a neonatal intensive care unit are all perinatal outcomes associated with hyperglycemia in pregnancy. Other outcomes include fetal weight equal to or greater than the 90th

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percentile, primary cesarean delivery, preeclampsia, and preeclampsia without shoulder dystocia.

The maximum incidence of GDM occurred between 26 to 30 years of age (32.7%). Women with GDM were older (mean age 29.8 [SD 5.1] years) than women without GDM (mean age 27.9 [SD 5.1] years).[6]

In Finland, the prevalence of GDM increased from 8.9% in 2009 to 15.9% in 2015, encompassing women who were both primiparous and multiparous. The results of their study showed a significant prevalence of GDM—16.5%. The extensive GDM screening in accordance with the Finnish Current Cure Guidelines for GDM from 2008 can be used to explain the high incidence of GDM in primiparous women in the city of Vantaa, Finland.[6], but the present study shows no significant difference.

Mutummatou Leibi et al[7] studied that cesarean section rates were higher in women with GDM (52%). In this study, the incidence of cesarean section was higher (49.1 %) when compared to normal labor (45.9%). In a study done by Jeenah Sohn et al [8] the rate of CD in the GDM group was considerably higher than that in the non-GDM group (73.9% vs.49.3%, P=0.028).

Mutummatou Leibi et al[7] observed an increased frequency of preterm labor and polyhydramnios in GDM patients. In this study, preterm labor was encountered in 8.8 % of the population and PROM in 6. 8%.

In women with PPROM, Hamza et al.[9] discovered a direct link between gestational diabetes and polyhydramnios; gestational diabetes was linked to an increased risk of polyhydramnios, which can result in PPROM.

In the present study adverse fetal outcome (stillborn, intrauterine death, early neonatal death) was seen in 7.5% of the study population and birth asphyxia in 6.9% when compared to a study by Rajesh Jain et al which showed that Stillbirth, Perinatal & neonatal mortality were respectively 2, 3.3 & 6 times higher in GDM, compared to non-GDM.

In the present study, congenital anomalies were encountered in 4.9% of the study population, while in the study by Ameya et al[10], 8% had congenital anomalies.

The incidence of macrosomia was 13.2% in this study whereas a higher incidence was noted in the other studies (40% in the study by Ameya et al and 23 % in the study by Mutummatou et al).[7,10]

In the present study, the LBW was observed in 12.4% of the population, but it was observed that the Low Birth Weight (LBW) was 35% in GDM compared to 16% in Non-GDM, in a study done by Rajesh Jain et al, which was significantly different – showing an increased relative risk for LBW in GDM.[11]

In a study done by Kouhkan et al, adverse pregnancy outcomes such as emergency CS, preeclampsia, polyhydramnios, PROM, preterm delivery, and neonatal hyperbilirubinemia were significantly associated with GDM diagnosis (OR = 1.88, 3.64, 2.44, 4.53, 2.52, and 2.00, respectively) compared to non-GDM women.[12]

In the current study, 45% of infants had neonatal hypoglycemia. Similarly, Bhat et al. found that patients with gestational diabetes had considerably greater rates of newborn hypoglycemia than those in the control group.[13]

CONCLUSION

To conclude, based on the observations of this study, GDM is associated with adverse complications in both the mother and fetus. A large proportion of women also progress to become overt diabetics in the future hampering their quality of life by causing morbidity in

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various forms. Therefore, all antenatal women attending the OPD should be offered a simple Glucose challenge test and if found negative the test has to be repeated every trimester. Once diagnosed with GDM appropriate glycemic control either via insulin or Oral Hypoglycemic Agents or Medical Nutrition Therapy has to be achieved for good pregnancy outcomes and to prevent complications. Proper counseling should be given to the patient at the time of discharge to have her sugars checked in the postpartum period. Early detection and prompt management of this condition can tremendously reduce the short-term and long-term complications in both the mother and neonate.

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