

Gestational diabetes mellitus: A Systemic review

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ABSTRACT

As the most prevalent metabolic disorder during pregnancy, gestational diabetes mellitus is characterized by elevated blood glucose levels (hyperglycemia). Appropriate analysis and investigation into the effects of pregnancy on complications of hypertension and gestational diabetes mellitus led to the conception of this study. GDM is associated with chronic complications in both the mother and the progeny due to the initial detection of glucose intolerance during the very initial stage of pregnancy. Undiagnosed elevated glucose levels in young women have increased throughout the years and are associated with adverse maternal and progeny outcomes. Being overweight, having polycystic ovary syndrome, and having a genetic susceptibility to diabetes are among the various risk factors associated with GDM. At this time, various diagnostic standards are being implemented on a global scale, whereas guidelines concerning oral hyperglycemic medications, nutrition, exercise, and maintaining an adequate weight are urgently required. Despite the fact that it has been recognized for many years that women who have gestational diabetes during pregnancy have a significantly higher risk of developing type 2 diabetes in the future, there continues to be ongoing debate regarding the efficacy of identifying and managing GDM in the modern era.

Keywords: - Gestational Diabetes Mellitus, Pregnancy, Hyperglycaemia, Glucose, Offspring.

INTRODUCTION: -

Gestational Diabetes Mellitus is a prominent complication that presents enduring threats that affect the mother's health and the offspring throughout their lives (1). According to the study results, there was a linear correlation between a mother's glycemic measures and the risk of unhealthy pregnancy and progeny outcomes (2). Physical activity and controlled blood sugar levels are crucial for women with pregnancy-related diabetes, as they serve to prevent the accumulation of excessive weight during pregnancy and promote healthy growth of the fetus. The latest research has identified notable variations in the correlations between physical activity and several glycemic control measures when physical activity is implemented as an "attachment" therapy (3,4). The American Diabetes Association (ADA) recommends engaging in moderate-intensity physical activity for a minimum of 20–50 minutes every day, for two to seven days every week.

At least three to four times per week, for a maximum of thirty minutes per day, the patient with GDM must participate in cardiovascular activities, including cycling, sprinting, running, swimming, and aqua aerobics (5,6). Nutritional changes and engaging in physical exercise are the most efficacious remedies for gestational diabetes mellitus (7).

Review of Literature

Nakshine V and Jogdand S (2023) concluded about gestational diabetes mellitus and its effects on mothers' wellness and the psychological well-being of their kids. Gestational diabetes mellitus is a significant gestational issue that involves the appearance of chronic elevated blood sugar levels in women with no previous history of diabetes all through the course of their pregnancy (100).

Francis *et al* in 2023 An in-depth investigation of specific markers that could improve the detection of GDM as well as recognise women with GDM who are at higher risk of newborn difficulties. The synthesis studies, which include a total of twenty thousand women, showed that an elevated mother's body mass index with GDM predicts an enhanced likelihood of their adolescents becoming LGA.

This demonstrated significant areas for future research in the appropriate evaluation of GDM and identified novel biomarkers which could give rise to creative methods for treatment aside managing glucose levels in patients with type 2 diabetes.

Effect of Physical Activity on Prevention of GDM

Physical exercise has a preventative impact on gestational diabetes mellitus throughout preconception, the first trimester of pregnancy, as well as pregnancy itself (8). Every literature review showed that physical exercise prevented the initiation of GDM, with the exception of Madhuvrata, where there was a significant negative connection and a 23–59% total risk decrease (9, 10).

The comparison between the birth weight of the infant and the placenta indicates the quality of the baby's development within the uterus (11,12). This information is used by scientists to determine how efficiently the placenta supplied nutrients and adapted to various conditions, such as diabetes, during pregnancy (13,14). Fetal macrosomia, or the birth of larger-than-average infants, can result from elevated blood sugar levels in expectant women, regardless of diabetic complications or non-diabetes (15,16). Additionally, in comparison to women without diabetes, the placenta grows in women with diabetes, although not to the same extent as the baby's girth. This indicates that in cases of diabetes, elevated levels of blood glucose are associated with placental growth that is greater than that of the fetus. Diabetes mellitus during pregnancy is a complex situation (17) People disagree regarding the reason behind it. Some people think that one's dietary habits and way of life have an impact. This research investigates whether the lifestyle and diet of an expectant woman influence her risk of acquiring diabetes (18,19). Those who lacked knowledge regarding a healthy diet were more likely to fall victim to diabetes (20,21). Pregnant women who consumed white bread, sweetened foods, and engaged in fewer exercises appeared to have an increased risk of glucose issues (22).

The dietary and physical activity choices made by a pregnant woman during the early stages of pregnancy may impact her susceptibility to developing diabetes in the future (23,24). The ratio of the fetus's weight to the placenta's weight at birth is an indicator of the corresponding rates of growth as well as the effectiveness of nutrition supplied by the placenta (25,26). This ratio is also used to assess the adaptive changes made by the placenta during different types of pregnancies, particularly those affected by diabetes (27). Multiple studies have examined the levels of glucose in the blood of pregnant women without diabetes as well as those with gestational diabetes (28,29). These studies have shown that higher glucose levels are associated with larger birth weights, indicating a connection among elevated glucose, infant size at birth, and the probability of fetal macrosomia (30,31). In individuals with gestational diabetes mellitus and diabetes mellitus, placental weights are higher compared to those without diabetes (32). However, the rise in placental weights is greater than the increase in birth weights, resulting in bigger birth/placental weight ratios (33,34). The placental weight grows in proportion to the newborn's weight and is much bigger when the blood glucose level is higher or the duration of diabetes is longer (35,36). This supports the idea that there is a continuous association between elevated glucose levels and abnormal development of the placenta compared to the fetus in cases of gestational diabetes mellitus and diabetes mellitus (37,38).

Analysis

The root cause of gestational diabetes seems to be linked to two factors: 1) malfunction of beta cells in the pancreas or a delayed response of these cells to glucose levels; and 2) significant insulin resistance caused by the release of hormones from the placenta. A woman's placental lactogen is the primary hormone associated with greater insulin sensitivity in gestational diabetes mellitus (39,40). Additional hormones implicated in the progression of this condition include prolactin, growth hormone, progesterone and corticotropin-releasing hormone (41). These are the hormones that have a role in promoting resistance to insulin and hyperglycemia throughout pregnancy (42,43).

Certain medical risk indicators for the emergence of gestational diabetes have been documented. Among these clinical variables are (44)

- Higher body weight (a body mass index more than 25)
- Reduced physical education
- Having a close family member with diabetes mellitus
- Previous experience of gestational diabetes or having an infant with macrosomia and metabolic comorbidities such as hypertension
- Decreased levels of HDL
- Triglycerides exceeding 250
- Having polycystic ovary
- Haemoglobin levels above 5.7
- Unusual results on the oral glucose tolerance test
- Presence of a noticeable sign of insulin resistance
- Previous medical background of cardiovascular diseases (45)

Statal Data

In the United States, 2% to 10% of pregnancies are affected by gestational diabetes. During the ten to twenty years subsequent to childbirth, there is an increased susceptibility of women to develop diabetes mellitus and gestational diabetes by 35 to 60 percent (46,47).

Pathophysiology

Human placental lactogen is a placental-secreted hormone that occurs throughout pregnancy. Comparable in composition to growth hormone, it stimulates critical metabolic alterations throughout pregnancy in order to aid in the preservation of the dietary requirements of the fetus (48,49). This hormone possesses the ability to induce changes and adaptations in the receptors that receive insulin (50). There seems to be a correlation between the subsequent biochemical deviations and reduced utilization of glucose in peripheral cells: 1) modification at the molecular level of the beta-subunit insulin receptor; 2) reduction in tyrosine kinase phosphorylation; and 3) restructuring of insulin receptor substrate-1 and phosphatidylinositol 3-kinase (51,52).

Elevated maternal glucose levels pass via the placenta and result in increased blood sugar levels in the fetus (53). The fetal pancreas is activated when exposed to high blood sugar levels. The anabolic characteristics of insulin stimulate accelerated development in embryonic tissues (54,55).

There is data indicating that an elevated body mass index and adiposity are associated with the occurrence of a low degree of inflammation (56). Long-term inflammation triggers the production of xanthurenic acid, a compound that is linked to the occurrence of preliminary diabetes and gestational diabetes mellitus (57). Figure-1 represents data of Gestational diabetes

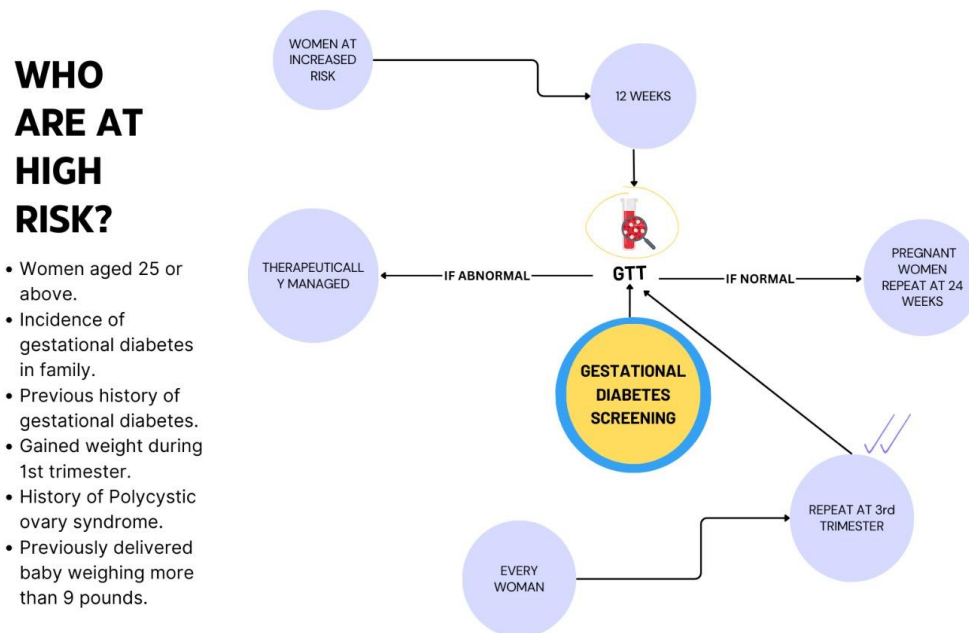


Figure-1: Data Screening of Gestational Diabetes

History

The previous obstetrical conclusions as well as family records of having type 2 diabetes mellitus are crucial elements of the medical background assessment for gestational diabetes mellitus (57). The medical manifestations of gestational diabetes mellitus may exhibit a wide range of characteristics (58). The presence of abnormal excess weight, obesity, and a high body mass index (BMI) might indicate certain characteristics. The evaluation is confirmed via analytical testing conducted between the 24th and 28th weeks during the pregnancy period (59,60).

There are reports indicating that the development of DSM during pregnancy is influenced by the gestational age, which in turn affects the fate of the pregnancy (61,62).

Evaluation

The American Diabetes Association advises that any overweight or obese women who are susceptible to at least one of the conditions listed should think about implementing an assessment plan to identify pregestational diabetes or early gestational diabetes mellitus (63).

- Sedentary lifestyle
- First-degree ancestor having diabetic complications
- Race or ethnicity associated with increased risk
- Previous experience of delivering a baby weighing 4000 grams or even more
- Former history of gestational diabetes, and -high blood pressure
- An inadequate fasting glucose level
- Any family background in cardiovascular disorders
- Additional medical problems/situations that are linked to insulin resistance

According to the American Diabetes Association (ADA), while haemoglobin A1C measurement is practical, it might not be optimal for standalone use because of its less sensitive nature in contrast to the oral glucose tolerance test (64,65).

Treatment

The therapy of gestational diabetes starts with nonpharmacologic interventions such as dietary adjustments, physical activity, and constant surveillance of glucose levels. The American Diabetic Association suggests that patients get dietary counselling from a qualified dietitian and have a tailored plan created based on their body mass index (BMI) (66,67). In certain circumstances, when nutritionists or dietitians are unavailable, physicians may give guidance on the basis of three fundamental dietary principles: calorie allocation, carbohydrate consumption, and caloric distribution (68,69).

The suggested exercise regimen for GDM consists of engaging in a half-hour of moderately intense aerobic activity on a minimum of 5 days per week, or a total of at least 150 minutes every week.

In cases where the patient's blood sugar management is inadequate, even with a perfect commitment to a healthy diet and physical activity, the first line of therapy should be medication. Insulin is the ADA's primary choice for treating GDM (70,71). Insulin treatment has been accepted as the standard of care for the treatment of gestational diabetes when diet and exercise alone are not sufficient to achieve appropriate glucose levels.

Insulin is incorporated into the treatment to assist in establishing an optimal regulation of metabolism if blood glucose levels exceed or equal 95 mg/dL while fasting, 140 mg/dL during one hour, or 120 mg/dL during two hours (72).

Despite lacking FDA permission, women experiencing gestational diabetes are becoming more dependent on the oral diabetes medications metformin and glyburide. The starting dose of glycoride is 2.5 mg, while the highest dosage is 20 mg. The recommended starting dosage for metformin treatment is 500 mg, with a maximum dose of 2500 mg (73,74).

Applying the 0.2 units/kg/day equation to the individual's body weight determines the basal insulin dosage. If the patient experiences an increase in blood glucose level afterward, the healthcare provider may issue a prescription for rapid-acting insulin (75) or conventional insulin with an initial dose of 2 to 4 units prior to a meal.

Throughout the first, second, and third trimesters, the average daily insulin requirement increases from 0.7 to 0.8 units/kg/day to 0.9 to 1.0 units/kg/day (76,77)

The patient should partition the complete daily dosage of insulin between 2 equal portions: one portion administered as basal insulin before going to bed, and the other portion distributed among the 3 meals and administered as rapid-acting or regular insulin prior to each meal.

Medical Diagnosis

A significant number of women do not undergo the necessary assessment and diagnosis of diabetic complications prior to pregnancy, making it difficult to differentiate between gestational diabetes and preexisting diabetes in many instances (78,79).

Complications

Maternal and foetal difficulties are two groups of problems associated with gestational diabetes. Macrosomia, shoulder dystocia, polycythaemia, hyperbilirubinemia, neonatal respiratory distress syndrome, hypocalcaemia, elevated perinatal mortality, and neonatal hypoglycaemia are among the foetal problems (80,81,82). Preeclampsia, hypertension, a higher possibility of acquiring diabetes mellitus, and a higher chance of caesarean birth are examples of maternal complications (83,84).

Deterrence and Patient Education

It is essential to educate patients. In patients with gestational diabetes, knowledge of suitable dietary adjustments, exercise regimens, and lifestyle modifications may assist in improving results (85,86).

Enhancing Healthcare Team Outcomes

For medical professionals and teams, managing and treating women with gestational diabetes is becoming more prevalent. Because of this, managing gestational diabetes now calls for an interdisciplinary team approach with medical professionals, specialty-trained healthcare professionals, and pharmacy technicians who work together beyond domains to accomplish the best possible outcomes for patients and stop potential issues from occurring. To properly identify them, initiatives and tactics are required (87,88). The creation of preventative measures would aid in the management of gestational diabetes as well as enhance overall health results. Over the ten to twenty years following pregnancy, women suffering from gestational diabetes are more likely to acquire type 2 diabetes (89,90).

A large number of pregnant women suffering from diabetes are undiagnosed for a long time afterward, which greatly raises the illness's morbidity (91,92).

These days, a lot of healthcare organizations provide diabetic clinics with pharmacists or certified nurse practitioners who educate pregnant women regarding diabetes (93,94). These medical centres send individuals to an endocrinologist after periodically monitoring blood sugar levels. This procedure eases the obstetrician's workload, decreases medical expenses, and facilitates the provision of the best care possible to individuals requiring it (95).

Collaboration and joint effort among all interprofessional medical care team members are imperative for the effective management of gestational diabetes. Nursing assumes a leading role in patient interactions by assessing compliance with medical recommendations, monitoring the effectiveness of treatment, and remaining vigilant for possible adverse consequences. In such cases, nurses promptly notify other members of the team about such developments (96). Medicine reconciliation, titration verification for insulin and other antihyperglycemic medications, and counselling with patients regarding commitment to prescriptions as well as lifestyle choices are responsibilities that pharmacists are required to fulfil (97).

CONCLUSION: -

Before 20 weeks of pregnancy, timely therapy for maternal diabetes merely reduces the risk of a complex of unfavorable consequences for the newborn compared to no treatment at all. Being exposed to hyperglycemic insults during pregnancy may predispose a person to the emergence of behavioral issues or another condition in their offspring (98). This happens as a result of the baby's brain developing neuro-inflammation and an amplification of the peripheral inflammatory response. Given the rise in maternal diabetes cases worldwide, it is critical to recognize the possible negative impacts of this metabolic disorder on a child's health and well-being from an early age (99).

Numerous research endeavors have endeavored to examine the influence of diabetes on the typical brain and its consequences for neurodevelopment. There is, however, a limited quantity of research investigating this relationship, and the studies show notable heterogeneity in participant counts and demographic attributes, including maternal socioeconomic variables like age, the severity, and the duration of hyperglycemia. It is difficult to get definitive findings because of the many variants.

Greater participation groups and the removal of variables are necessary for future experimental and human research to close this knowledge gap and provide reliable findings. It is very important to find the possible pathophysiological pathways through which maternal diabetes affects normal brain development. This is because it would allow the creation and use of personalized treatment methods as well as early prevention measures (99).

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Conflict of Interest

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