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GESTATIONAL DIABETES MELLITUS

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Abstract
Gestational diabetes mellitus (GDM) is a common metabolic disorder characterized by glucose intolerance with onset or first recognition during pregnancy. It arises primarily due to pregnancy-induced insulin resistance mediated by placental hormones, combined with inadequate pancreatic β-cell compensation. The prevalence of GDM has increased globally, reflecting rising maternal age, obesity, and sedentary lifestyles. Although often asymptomatic, GDM is associated with significant short- and long-term complications for both mother and offspring, including preeclampsia, cesarean delivery, fetal macrosomia, neonatal hypoglycemia, and an increased lifetime risk of type 2 diabetes mellitus. Diagnosis is typically established through oral glucose tolerance testing during the second trimester, while management focuses on medical nutrition therapy, physical activity, glucose monitoring, and pharmacological treatment when necessary, with insulin as the preferred therapy. Postpartum follow-up is essential due to the high risk of recurrent glucose intolerance and future metabolic disease. Early detection and appropriate management of GDM are crucial to improving maternal and neonatal outcomes and reducing long-term health risks.

Keywords: Gestational diabetes mellitus; pregnancy; insulin resistance; hyperglycemia; maternal outcomes; neonatal outcomes; glucose tolerance test; metabolic disorders

Аннотация:
Гестационный сахарный диабет (ГСД) — это распространенное метаболическое нарушение, характеризующееся непереносимостью глюкозы, которое возникает или впервые выявляется во время

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беременности. Основной причиной является инсулинорезистентность, вызванная беременностью и опосредованная плацентарными гормонами, в сочетании с недостаточной компенсацией со стороны β-клеток поджелудочной железы. Распространенность ГСД во всем мире увеличилась, что отражает рост возраста беременных женщин, ожирение и малоподвижный образ жизни. Хотя заболевание часто протекает бессимптомно, оно связано с значительными краткосрочными и долгосрочными осложнениями для матери и плода, включая преэклампсию, кесарево сечение, макросомию плода, неонатальную гипогликемию и повышенный пожизненный риск развития сахарного диабета 2 типа. Диагностика обычно проводится с помощью перорального глюкозотолерантного теста во втором триместре, а лечение сосредоточено на медицинской нутритивной терапии, физической активности, контроле глюкозы и, при необходимости, фармакологическом вмешательстве, с предпочтением инсулина в качестве основного препарата. Постнатальное наблюдение крайне важно из-за высокого риска повторной непереносимости глюкозы и развития метаболических нарушений в будущем. Раннее выявление и адекватное управление ГСД имеют ключевое значение для улучшения исходов у матери и новорожденного и снижения долгосрочных рисков для здоровья.

Ключевые слова
Гестационный сахарный диабет; беременность; инсулинорезистентность; гипергликемия; исходы у матери; исходы у новорожденного; пероральный глюкозотолерантный тест; метаболические нарушения.

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as glucose intolerance with onset or first recognition during pregnancy and represents one of the most prevalent metabolic disorders affecting pregnant women. The incidence of GDM has increased globally over recent decades, reflecting changes in maternal demographics, including advanced maternal age, increased prevalence of obesity,

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and reduced physical activity. Reported prevalence rates range from 5% to 15% of pregnancies, depending on population characteristics and diagnostic criteria, underscoring its growing public health significance.

Pregnancy is characterized by progressive physiological insulin resistance, particularly during the second and third trimesters, largely mediated by placental hormones such as human placental lactogen, progesterone, estrogen, cortisol, and placental growth hormone. In normal pregnancies, pancreatic β-cells compensate for this insulin resistance by increasing insulin secretion to maintain glucose homeostasis. In GDM, however, this compensatory mechanism is insufficient, leading to maternal hyperglycemia. Maternal glucose readily crosses the placenta, resulting in fetal hyperinsulinemia, which is central to the development of many pregnancy and neonatal complications[1].

Although GDM is often asymptomatic and typically resolves after delivery, it is associated with significant adverse outcomes for both mother and child. Maternal risks include preeclampsia, cesarean delivery, and an increased likelihood of developing type 2 diabetes mellitus and cardiovascular disease later in life. Neonatal and long-term offspring complications include macrosomia, birth trauma, neonatal hypoglycemia, respiratory distress, and an elevated risk of obesity and glucose intolerance in later life. These consequences highlight the clinical importance of effective screening, diagnosis, and management of GDM.

Despite advances in understanding the pathophysiology of GDM, considerable variability remains in screening strategies, diagnostic thresholds, and management approaches across regions and healthcare systems. This variability contributes to differences in reported prevalence and clinical outcomes and underscores the need for continued evaluation of evidence-based practices[2].

The aim of this article is to review and synthesize current evidence on gestational diabetes mellitus, with particular emphasis on its pathophysiology, risk factors, diagnostic criteria, and management strategies, as well as its implications for maternal and neonatal outcomes.

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LITERATURE REVIEW

Gestational diabetes mellitus (GDM) has been widely studied due to its increasing prevalence and significant implications for maternal and neonatal health. Existing literature consistently characterizes GDM as a multifactorial condition resulting from the interaction between pregnancy-induced insulin resistance and inadequate pancreatic β-cell compensation. Numerous studies emphasize that physiological insulin resistance intensifies as pregnancy progresses, particularly during the second and third trimesters, largely due to placental hormones that antagonize insulin action. When compensatory insulin secretion fails to meet metabolic demands, maternal hyperglycemia develops, forming the basis of GDM pathogenesis.

Research has identified several well-established risk factors for GDM, including advanced maternal age, obesity, family history of diabetes, previous GDM, polycystic ovary syndrome, and certain ethnic backgrounds. Epidemiological studies highlight that the global burden of GDM varies considerably across populations, reflecting differences in genetic predisposition, lifestyle factors, and screening practices. The rising incidence of GDM worldwide has been closely linked to increasing rates of obesity and sedentary behavior among women of reproductive age, positioning GDM as a growing public health concern.

The adverse maternal and fetal outcomes associated with GDM are extensively documented. Maternal complications commonly reported include hypertensive disorders of pregnancy, particularly preeclampsia, increased rates of labor induction, and cesarean delivery. Longitudinal studies further demonstrate that women with a history of GDM have a substantially higher risk of developing type 2 diabetes mellitus and cardiovascular disease later in life. For the fetus and neonate, maternal hyperglycemia has been strongly associated with excessive fetal growth, or macrosomia, which increases the risk of birth trauma and operative delivery. Neonatal metabolic complications, including hypoglycemia and respiratory distress, have also been frequently reported. Moreover, emerging evidence suggests that intrauterine exposure to hyperglycemia contributes to long-term metabolic programming, predisposing offspring to obesity and glucose intolerance in childhood and adulthood.

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The literature also reflects ongoing debate regarding optimal screening and diagnostic strategies for GDM. While oral glucose tolerance testing remains the cornerstone of diagnosis, there is considerable variation in screening approaches and diagnostic thresholds across international guidelines. Studies comparing one-step and two-step screening methods reveal differences in detection rates, healthcare costs, and clinical outcomes, underscoring the lack of global consensus. Management of GDM has been extensively explored, with strong evidence supporting the effectiveness of lifestyle interventions as first-line therapy. When lifestyle measures are insufficient, insulin therapy is widely endorsed as the preferred pharmacological treatment due to its efficacy and safety in pregnancy[3].

Postpartum outcomes and long-term follow-up have gained increasing attention. Research consistently demonstrates that glucose intolerance often resolves after delivery; however, women with prior GDM remain at high risk for recurrent GDM in subsequent pregnancies and for the development of type 2 diabetes mellitus. Consequently, postpartum screening and lifestyle modification are strongly recommended, though adherence to follow-up care remains suboptimal in many settings.

DISCUSSION

GDM is a complex metabolic disorder with immediate obstetric risks and long-term implications for both mother and child. The pathophysiology involves insulin resistance and inadequate β-cell compensation, largely driven by placental hormones. Risk factors including maternal obesity, advanced age, and prior GDM have been consistently validated in epidemiological studies.

Maternal complications, such as preeclampsia and cesarean delivery, and fetal complications, including macrosomia and neonatal hypoglycemia, underscore the importance of early detection and management. Lifestyle interventions remain the first-line therapy, with insulin as the preferred pharmacologic treatment when necessary. Although oral agents like metformin are increasingly used, questions about long-term offspring outcomes remain[4].

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Screening and diagnostic practices vary globally, highlighting the need for standardized protocols. Postpartum follow-up is essential to identify recurrent GDM and prevent type 2 diabetes, yet adherence remains low. Future research should focus on optimizing preventive strategies, standardizing management, and evaluating the long-term impact of pharmacological therapies on both maternal and offspring health.

RESULTS

1. Prevalence and Epidemiology

Global studies indicate that GDM prevalence ranges from 5% to 15% of pregnancies, with higher rates among women with obesity, advanced maternal age, and specific ethnic backgrounds. Regional differences are influenced by variations in diagnostic criteria, screening methods, and population characteristics.

2. Risk Factors

Strong predictors include maternal obesity, advanced age (≥30 years), prior GDM, family history of diabetes, polycystic ovary syndrome, and high-risk ethnic backgrounds. Lifestyle factors such as poor diet and physical inactivity further contribute.

3. Maternal Outcomes

GDM increases the risk of preeclampsia, polyhydramnios, and cesarean delivery. Women with prior GDM have 30–50% risk of developing type 2 diabetes within 5–10 years postpartum.

4. Fetal and Neonatal Outcomes

Maternal hyperglycemia is associated with macrosomia, shoulder dystocia, neonatal hypoglycemia, respiratory distress, and long-term metabolic risks such as childhood obesity and insulin resistance.

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5. Screening and Diagnostic Practices

Screening approaches vary. One-step 75 g OGTT identifies more GDM cases than the two-step method, but both are widely used. Variability in glucose thresholds and timing affects prevalence estimates and clinical outcomes[5].

6. Management and Intervention Outcomes

Lifestyle interventions, including medical nutrition therapy and physical activity, are effective. Insulin therapy is the gold standard for pharmacologic treatment. Oral hypoglycemics such as metformin show promise but require further long-term study. Postpartum follow-up is critical but underutilized.

CONCLUSION

Gestational diabetes mellitus is a prevalent metabolic disorder with significant short- and long-term consequences for both mother and child. Early detection, individualized management, and sustained postpartum care are essential to minimize adverse outcomes. GDM should be regarded not merely as a temporary pregnancy complication but as an early marker of future metabolic risk. Standardized screening protocols, evidence-based management, and long-term follow-up are critical to improving maternal and neonatal health outcomes. Further research is required to harmonize diagnostic criteria, optimize treatment strategies, and assess the long-term safety of pharmacologic interventions.

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