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Advances in the Diagnosis and Treatment of Gestational Diabetes Mellitus in Traditional Chinese and Western Medicine

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Abstract: ***Gestational diabetes mellitus (GDM) refers to diabetes that is first diagnosed or develops during pregnancy. In recent years, the incidence of GDM has shown a year-on-year increasing trend, which not only elevates the risk of adverse maternal and fetal outcomes but also imposes a significant medical burden. To improve the clinical efficacy for GDM patients and reduce maternal and neonatal complications, the rational application of integrated traditional Chinese and Western medical approaches is highly beneficial. This article reviews the current advancements in the diagnosis and treatment of GDM using both traditional Chinese and Western medicine.***

Keywords: Gestational diabetes mellitus (GDM), Diagnosis and Treatment, Gestational Diabetes Mellitus, TCM.

1. Definition of Gestational Diabetes Mellitus

Gestational diabetes mellitus (GDM) refers to diabetes that is first identified or occurs during pregnancy. It is characterized by varying degrees of carbohydrate intolerance, leading to abnormal elevation in blood glucose levels [1]. GDM not only increases the risk of adverse maternal and fetal outcomes but also imposes a significant healthcare burden. Early identification of at-risk pregnant women and timely preventive interventions are crucial for improving maternal and neonatal outcomes [2]. This article focuses on the treatment approaches for GDM in both Traditional Chinese Medicine (TCM) and Western medicine.

2. Epidemiology of Gestational Diabetes Mellitus

Previous studies indicate that in multiethnic Western societies, Chinese and Asian populations have a 3–7 times higher incidence of GDM compared to other ethnic groups, even after accounting for differences in oral glucose tolerance test (OGTT) methods. A study in London found that after adjusting for age, body mass index (BMI), and parity, Southeast Asian women had a relative risk (RR) of 7.6 for GDM, with an actual incidence of 3.5% [3]. Another London study reported GDM prevalence rates of 5.8% in Asian women compared to only 1.2% in white women [4]. In New York, the prevalence was 4.5% in East Asian women versus 2.3% in white women (adjusted OR = 2.61) [5]. Chicago reported the highest prevalence among East Asian women at 10.5%, significantly higher than the 2.7% in white women [6]. In San Francisco, Chinese women had a GDM rate of 7.3%, compared to 1.7% and 1.6% in Black and white women, respectively [7]. The highest prevalence was reported in Australia, where Chinese women in Melbourne had a GDM incidence of 13.9%, compared to 5.2% in women born in the UK or Northern Europe, with a higher proportion of severe GDM cases among Asian women [8]. This trend was further confirmed in another study, where Asian women had a 10.6% prevalence versus 2.9% in white women [9]. Similarly, in New South Wales, Chinese women had a 15.0% prevalence, while white women had only 3.0% [10].

With China's "three-child policy" and the rising national diabetes prevalence, the incidence of hyperglycemia during pregnancy-including pregestational diabetes mellitus (PGDM), prediabetes, and GDM-has been increasing annually. Over 90% of hyperglycemia cases during pregnancy are GDM, with current incidence rates ranging between 17% and 20%, showing a significant upward trend. GDM substantially increases the risk of adverse maternal and fetal outcomes, including gestational hypertension, infections, miscarriage, preterm birth, postpartum hemorrhage, fetal malformations, and neonatal hypoglycemia, which can be life-threatening in severe cases [11].

3. Diagnostic Criteria for Gestational Diabetes Mellitus

China's GDM diagnostic criteria are primarily based on the 2015 American Diabetes Association (ADA) standards [12]. A 75g oral glucose tolerance test (OGTT) is performed at 24–28 weeks of gestation, with diagnostic thresholds of ≥5.1 mmol/L (fasting), ≥10.0 mmol/L (1-hour), and ≥8.5 mmol/L (2-hour). If any one of these values is met or exceeded, GDM is diagnosed. This "one-step" 75g OGTT method was established by the International Association of Diabetes and Pregnancy Study Groups (IADPSG) in 2011 based on the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study and has since been adopted by the World Health Organization (WHO) and most countries [13]. China has followed this standard since 2011 [14]. In contrast, the American College of Obstetricians and Gynecologists (ACOG) still recommends a "two-step" approach: a 50g glucose challenge test followed by a 75–100g OGTT if needed. Although different diagnostic methods may yield varying GDM incidence rates, effective clinical interventions can reduce adverse maternal and neonatal outcomes regardless of the approach used [15, 16].

4. Pathogenesis of Gestational Diabetes Mellitus

The pathogenesis of GDM is complex and is currently believed to resemble that of type 2 diabetes, primarily involving increased insulin resistance and impaired pancreatic β-cell function [17-19]. It is also associated with adipokines, inflammatory factors, placental hormones, and other contributors. Additionally, emerging research highlights the roles of genetics and epigenetics, exosomes, oxidative stress and mitochondrial dysfunction, gut microbiota dysbiosis, and ferroptosis in GDM development [2]. Some studies suggest a strong correlation between vitamin D deficiency and the onset of obesity-related GDM [20].

Traditional Chinese Medicine (TCM) Perspective Ancient TCM texts, such as *Su Wen·Qi Bing Lun*, attribute GDM (termed "pregnancy-consumptive thirst") to excessive consumption of rich, sweet foods: "This condition arises from indulgence in fatty and sweet foods, which generate internal heat and abdominal fullness, causing upward overflow of qi and transforming into consumptive thirst." The *Ling Shu·Wu Bian* associates emotional disturbances with the disease: "Anger drives qi upward, accumulating in the chest and disrupting blood flow... transforming into heat that consumes the body, leading to wasting-thirst disorders."* Furthermore, the *Wai Tai Mi Yao·Xiao Ke Xiao Zhong links it to excessive sexual activity: *"Overindulgence depletes kidney essence, generating lower-jiao heat that induces renal dryness and thirst." Comprehensive TCM Pathogenesis: Root Causes: Kidney essence deficiency and spleen dysfunction. Contributing Factors: Liver qi stagnation, internal heat, phlegm-dampness, and blood stasis. Pathology: A combination of pregnancy-induced physiological changes and diabetic metabolic dysregulation, where impaired fluid-nutrient distribution manifests as GDM. Key TCM Mechanism: A deficiency-rooted and excess-manifested disorder, where kidney-spleen-liver dysfunction interacts with heat-dampness-stasis to drive disease progression [21].

5. Western Medical Treatment for Gestational Diabetes Mellitus

Currently, insulin or insulin analogs are the only glucose-lowering drugs officially recommended for GDM patients in China. Although these medications are considered relatively safe during pregnancy (classified as Category B drugs) [22], frequent insulin injections often cause discomfort for pregnant women. Pharmacological Treatments. Metformin: Due to its oral administration (avoiding injections), metformin has emerged as a viable alternative to insulin [23]. Studies indicate it may reduce neonatal complications [24]. However, as it crosses the placenta, it is not yet a first-line treatment in China. Glibenclamide: While effective for glycemic control, it carries a higher risk of hypoglycemia and placental transfer, similarly limiting its use as a primary option. Insulin remains the gold standard for GDM management due to its safety profile and non-placental transfer. Non-Pharmacological Interventions Dietary Therapy A controlled study compared GDM patients with vs. without dietary intervention. The intervention group showed significant reductions in fasting blood glucose, 2-hour postprandial glucose, and HbA1c levels. A scientifically tailored diet ensures balanced nutrition and improves maternal-fetal outcomes [25]. Exercise Therapy. Structured exercise programs enhance glucose metabolism efficiency. Key recommendations: Initiate exercise before 32 weeks of gestation to avoid preterm labor risks [26]. Maintain a target heart rate during sessions, with a frequency of ~3 times/week. Studies confirm that exercise significantly improves glycemic control and reduces adverse pregnancy outcomes compared to non-intervention groups. Clinical Implications: First-line: Insulin (safety prioritized). Adjuvant: Metformin (convenience/emerging evidence) and glibenclamide (cautious use). Lifestyle: Diet + exercise are cornerstone therapies, demonstrating measurable benefits in glycemic control and pregnancy outcomes [27].

6. Traditional Chinese Medicine Treatment for Gestational Diabetes Mellitus

As previously mentioned, the etiology of gestational diabetes (Xiao Ke) involves kidney deficiency, spleen weakness, and liver stagnation. Therefore, the treatment principles focus on tonifying the kidneys, strengthening the spleen, and soothing the liver, while simultaneously addressing the disease and protecting the fetus.

A scholar conducted a systematic cluster analysis of the syndrome patterns in pregnant women diagnosed with gestational diabetes mellitus during prenatal check-ups at the First Affiliated Hospital of Henan University of Chinese Medicine. The main syndrome patterns identified were yin deficiency with damp-heat, liver-kidney yin deficiency with damp-heat, spleen deficiency with damp stagnation, and qi-yin deficiency with damp-heat. This indicates that the liver is the primary pathological location in gestational diabetes, while yin deficiency, dampness, and heat are the main pathological factors [28].

In terms of TCM prevention and treatment, traditional Chinese medicine has long emphasized the preventive concept of "treating disease before it arises," as mentioned in the Huangdi Neijing. This principle also applies to gestational diabetes, where preventive healthcare and interventions can be implemented through dietary regulation, emotional adjustment, physical exercise, and other methods [29].

The "King of Medicine," Sun Simiao, was the first to propose dietary intervention for treating Xiao Ke (diabetes). He emphasized, "There are three precautions: first, alcohol; second, sexual activity; and third, salty foods and wheat products... Those who ignore these, even with miraculous elixirs, cannot be saved..." This underscores the importance of dietary control, moderation in desires, and abstaining from alcohol in treatment.

7. Prognosis of Gestational Diabetes Mellitus

Numerous studies have shown that diabetes increases the risk of maternal complications, such as polyhydramnios, macrosomia, miscarriage, preterm birth, diabetic ketoacidosis, gestational hypertension, preeclampsia, premature rupture of membranes, genital and urinary tract infections, and a higher rate of cesarean delivery, among other adverse outcomes.

Due to prolonged exposure to maternal hyperglycemia during pregnancy, the fetus may develop neonatal hypoglycemia, neonatal respiratory distress syndrome, hyperbilirubinemia, polycythemia, obesity or overweight during growth, childhood obesity, and cardiovascular diseases in adulthood. Additionally, the risk of developing type 2 diabetes later in life is also significantly increased.

However, research indicates that reasonable oral hypoglycemic drug intervention for pregnant women with gestational diabetes can effectively improve maternal glucose metabolism, enhance neonatal outcomes, and ensure neonatal safety, making it a viable option for widespread clinical application [30]. Therefore, maintaining proper blood glucose control during pregnancy can protect both the newborn and the mother from the adverse effects of abnormal glucose metabolism.

8. Conclusion

In recent years, both traditional Chinese medicine (TCM) and Western medicine have accumulated considerable experience in treating gestational diabetes mellitus (GDM). TCM has demonstrated a high efficacy rate and minimal adverse effects in GDM management. However, due to the relatively short period of research on this condition, there is still a lack of unified and clear diagnostic and classification standards. Most studies remain at the stage of clinical observation, with insufficient controlled trials and reproducibility, making many findings difficult to validate and limiting the widespread adoption of these approaches.

Therefore, the author believes that future TCM research on GDM should focus on establishing standardized diagnostic and classification criteria, integrating modern medical advancements, and conducting rigorous scientific and clinical studies. Large-scale, multicenter clinical trials should be carried out to identify the most effective treatment methods from an evidence-based medical perspective.

Given the increasing severity of GDM in China’s population, the short- and long-term effects of maternal diabetes, and the rising prevalence of GDM, it is foreseeable that GDM will become one of the most critical health challenges in China in the near future. While current treatments cannot completely cure GDM, improvements in prenatal and intrapartum management may mitigate the impact of pregestational diabetes (PGDM) and GDM on offspring. This could be one of the most crucial measures in the medical management of gestational diabetes.

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