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Obstetric and Perinatal Adverse Outcomes of Mild Gestational Hyperglycemia: A Concise Review

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Abstract

Introduction: Gestational diabetes mellitus defined as glucose intolerance with onset during pregnancy, is a common disease affecting approximately 7-13% of pregnant women, depending on the study area. Maternal hyperglycaemia, which is below the diagnostic criteria for GDM, is associated with an increased risk of various adverse maternal and infant outcomes, such as caesarean delivery, preeclampsia, birth injury, macrosomia and neonatal hypoglycemia. Fortunately, several clinicians have reported that managing GDM and hyperglycemia that is below the diagnostic criteria for GDM improves maternal and infant outcomes. There is very little information on obstetrics outcomes of pregnant women with positive Glucose Challenge Test but negative for Oral Glucose Tolerance Test. This paper aims to provide information on possible obstetric and perinatal complications of pregnant women with a glucose challenge test positive and a negative or one abnormal value in oral glucose tolerance test.

Methods: A literature search was performed in order to identify publications. The latest prospective and case-control studies with multivariate Cox models were analysed, as well as some recent meta-analysis, which were considered for the study.

Results and conclusion: The findings shown in this review suggest that mild hyperglycaemia associated to pregnancy is mainly related to maternal and perinatal adverse outcomes as macrosomia, gestational hypertensive disorders, polyhydramnios and neonatal hypoglycaemia. Management of pregnant women with glucose intolerance could prevent obstetric and perinatal complications as in the treatment of gestational diabetes mellitus.

Keywords: Mild gestational hyperglycemia; diagnostic criteria; Fetal macrosomia; Gestational hypertensive disease; Polyhydramnios

Abbreviations: GDM: Gestational Diabetes Mellitus; GCT: Glucose Challenge Test; OGTT: Oral Glucose Tolerance Test, NDDG: National Diabetes Data Group; CC criteria: Carpenter and Coustan criteria; ADA: American Diabetes Association; ACOG: American College of Obstetrics and Gynaecology; HAPO: Hyperglycemia and Adverse Pregnancy Outcome study; IADPSG: Diabetes and Pregnancy Study Group; BMI: Body Mass Index; ACHOIS: Australian Carbohydrate Study in Pregnant Women; IGT: Impaired Glucose Tolerance; LGA: Large Gestational Age; FPG: Fasting Plasma Glucose; TG: Triglycerides; PIH: Pregnancy-Induced Hypertension

Introduction

Gestational diabetes mellitus (GDM), defined as glucose intolerance with onset during pregnancy, is a common disease affecting approximately 7-13% of pregnant women, depending on the study area [1]. GDM has short- and long-term implications for both mother and child [2].

Excluding those patients who previously had undiagnosed diabetes or very high blood glucose, GDM is not considered 'a disease' but a laboratory finding that implies changes on glucose metabolism.

The first diagnostic criteria proposed by O'Sullivan and Mahan in 1964 [3] were not based on pregnancy outcomes, but on the maternal risk of developing postpartum type 2 diabetes. However, there is no consensus regarding the criteria for diagnosing GDM and "one-step" or "two-step" strategies are recommended [4].

According to different diagnostic criteria of the National Diabetes Data Group (NDDG), the prevalence rate of GDM is 8.8% in the middle range in Spain [5], with a significant increase due to higher pre-pregnancy weight and maternal average age. There are unquestionable ethnic, social-economic position and maternal age differences in GDM prevalence, with non-Caucasian women being at higher risk [6,7].

Maternal hyperglycaemia that is below the diagnostic criteria for GDM or impaired glucose tolerance in pregnancy is highly predictive for the later development of diabetes, and is associated with an increased risk of various adverse maternal and infant outcomes, such as cesarean delivery, preeclampsia, birth injury, macrosomia, neonatal hypoglycaemia and subsequently development of maternal diabetes mellitus [8,9]. Fortunately, several clinicians have reported that managing GDM and hyperglycemia that is below the diagnostic criteria improves maternal and infant outcomes [10].

Therefore, there are many trial studies about GDM, criteria diagnosis and treatment, but there is very little information about obstetrics outcomes of pregnant women with positive Glucose Challenge Test (GCT) but negative Oral Glucose Tolerance Test (OGTT). This review aims to provide information on possible obstetric and perinatal

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complications of pregnant women with screening test positive tolerance to glucose and negative or one point positive test result confirmation.

Search Strategy

A literature search was performed in order to identify English-language publications. The search was performed up to October 2016, using the PubMed database with the following terms: Gestational diabetes mellitus, diagnostic criteria, glucose challenge test, oral glucose tolerance test, false positive screening, obstetric and perinatal outcomes, macrosomia, fetal hypoglycaemia, maternal hypertensive disorders, polyhydramnios, etc.

In addition, reference lists from relevant articles and press releases up to the same data were reviewed. The most recent prospective and case-control studies with multivariate Cox models were analysed and also were considered some recent meta-analysis.

Gestational Diabetes Mellitus

Diagnostic criteria

The early detection of GDM is important for reducing adverse pregnancy outcomes, but its diagnosis and the lack of agreement on the establishment of universal criteria remains controversial [11].

In 1964, O'Sullivan and Mahan proposed the first diagnosis criteria of GDM, using 100 g, 3 h OGTT to predict maternal diabetes after delivery, using whole blood [3]. These criteria were modified by the NDDG in 1979 [12]. In 1982 Carpenter and Coustan (CC) revised the cut-offs again [13].

In both cases (NDDG and CC) the diagnosis is performed in 2 steps, initial screening with 50 g of glucose ((Glucose Challenge Test)) and 100 g for confirmation. The American Diabetes Association (ADA) in 1990 and the American College of Obstetrics and Gynaecology (ACOG) assimilated the CC criteria in 2001 [14]. Thus GDM is diagnosed by two or more abnormal values on the OGTT with the use of either cut-off [15]. Although none or one elevated glucose tolerance test values were accepted as not having GDM, increased adverse maternal and perinatal outcomes are reported 8, questioning the diagnostic criteria.

In 2008, the Hyperglycaemia and Adverse Pregnancy Outcome (HAPO) Study found an association of maternal plasma glucose during 2 h, 75 g OGTT and adverse pregnancy outcomes. It was an observational study designed to determine the impact of varying degrees of maternal glycaemia less severe than evident diabetes on a number of pregnancy outcomes. The strengths of the study include its very large size (nearly 25,000 pregnant women took part) and its international scope (15 centers from 9 countries) [16].

Further analysis of HAPO study data suggests that birth weight, caesarean section rate and preeclampsia were more strongly associated with maternal body mass index (BMI) than with the degree of maternal glycaemia, although there was an interactive effect. A number of other neonatal morbidities also demonstrated linear but weak, associations with higher blood glucose, but such complications were infrequent.

Based on these findings, the International Association of the Diabetes and Pregnancy Study Group (IADPSG) proposed a new diagnostic strategy using "one-step" 75 g OGTT [17], which was adopted by the ADA in 2011, increasing the number of cases of GDM diagnosed and treated. It was accompanied by important health outcome benefits and improved outcomes resulted in significant economic savings, which support the widespread use of the IADPSGC for the diagnosis of GDM [18]. Since then, a large number of scientific societies have positioned themselves for and against the new criteria [19].

Although it is nearly 40 years since the inception of O'Sullivan and Mahan's [3] criteria for the diagnosis of GDM, there is no uniform consensus for this yet. The main reason is that the criteria were previously designed to HAPO study to identify pregnant women who were at high risk for developing subsequent diabetes after pregnancy rather than those who were at increased risk for adverse perinatal outcomes. According to this study, they provided grounds for the evidence-based modification of GDM diagnostic criteria showing that perinatal morbidity is proportionately related to maternal glycaemia.

The main diagnostic criteria for GDM with their respective glucose values are summarized in Table 1 [20].

Prevalence of GDM

GDM prevalence is higher using NDDG criteria reaching 11.6% overall 5, than previously reported in a small Spanish study [21-26]. This prevalence implies a 31.8% relative increase in GDM diagnosis according to NDDG criteria. Ferrara et al. have reported that proportional increases in prevalence were higher in subgroups at low risk according to age or ethnicity [27].

When rates for GDM were calculated in individual HAPO collaborating centers using IADPSG criteria, rates differed substantially, ranging from 9 to 26% [28].

Using traditional diagnostic criteria, GDM complicates 2-6% of pregnancies and is associated with macrosomia, neonatal hypoglycaemia and maternal preeclampsia [29,30]. Intervention trials have shown that the recognition of GDM and its management with diet, physical activity, home blood-glucose monitoring, insulin treatment are effective in improving clinical outcomes [31]. In addition to the obstetric and perinatal outcomes, this entity reports a more vulnerable population in later stages of life with a high probability of developing cardiovascular risk, metabolic syndrome, obesity, and hypertension and type 2 diabetes mellitus [32].

In recent decades, some studies are investigating the risks of adverse maternal-fetal and neonatal outcomes associated with impaired glucose

Guidelines	Glucose Challenge	Fasting PG mg/dL (mmol/L)	1 h PG mg/dL (mmol/L)	mg/dL (mmol/L)	3 h PG mg/dL (mmol/L)
WHO 1999 21	75 g OGTT#	≥ 126 (7.0)	Not required	≥ 140 (7.8)	Not required
ACOG 22	100 g OGTT##	≥ 95 (5.3)	≥ 180 (10.0)	≥ 155 (8.6)	≥ 140 (7.8)
Canadian Diabetes Association 23	75 g OGTT##	≥ 95 (5.3)	≥ 190 (10.6)	≥ 160 (8.9)	Not required
IADPSG 24	75 g OGTT#	≥ 92 (5.1)	≥ 180 (10.0)	≥ 153 (8.5)	Not required
ADA 2015 4	75 g OGTT#	≥ 92 (5.1)	≥ 180 (10.0)	≥ 153 (8.5)	Not required
	100 g OGTT##	≥ 95 (5.3)	≥ 180 (10.0)	≥ 155 (8.6)	≥ 140 (7.8)
Spanish Group of Diabetes and Pregnancy 25	100 g OGTT##	≥ 105 (5.8)	≥ 190 (10.0)	≥ 165 (8.6)	≥ 145 (7.8)

Table 1: Diagnostic criteria for GDM with their respective glucose cut-offs 20 (Note: #-One value is sufficient for diagnosis, ##-Two or more values required for diagnosis).

tolerance in non-diabetic pregnant women with positive screening or mild glucose intolerance [33,34]. They also show that the dietary treatment in this group of pregnant women significantly reduces the prevalence of macrosomia, shoulder dystocia and caesarean compared to untreated pregnant [35-37]. The prevalence of this group varies according to the criteria used for the diagnosis, in the same way as in DMG.

Obstetrical and perinatal complications of false positive test

Positive screening test should identify most women with GDM along with some women without GDM and the specific diagnostic test (OGTT) would separate the true and false positives [38].

Some of complications associated with labour and delivery includes induction of labour and caesarean section, which goes hand in hand with early induction as an intervention used to avoid complications during birth for medically complicated pregnancies, including diabetes [9].

A pregnant woman with uncontrolled diabetes may be subject to induction of labour at early term to avoid birth trauma and neonatal complications. A common complication of persistent hyperglycaemia during pregnancy is a large-for-gestational age (LGA) infant [39,40].

Although the risks associated with GDM are well recognised, impact on maternal and infant health outcomes is less clear for borderline gestational diabetes mellitus (BGDM), which is characterised by values of glucose tolerance intermediate between normal and gestational diabetes. Some studies have examined the influence of different levels of glucose tolerance on pregnancy complications and have revealed a significantly increased risk of preemclapsia, caesarean section, neonatal hypoglycaemia and hyperbilirubinaemia for women with BGDM, compared with women with normal glucose tolerance [41]. Other literature reports are consistent with these results, which identify an increasing risk of adverse maternal and infant outcomes with increasing plasma glucose values [42,43].

The Australian Carbohydrate Study in Pregnant Women (ACHOIS) trial confirmed that untreated mild GDM is associated with relatively rare but nonetheless significant adverse perinatal outcomes [31].

Stamilio et al. suggested that having a false positive GCT is identified as an independent risk factor for perinatal complications [44]. Thus, many obstetric providers treat patients with an abnormal GCT and negative OGTT with more intensive observation or therapy, identifying these patients as “glucose intolerant” or “borderline diabetic” [45].

While the importance of identification and treatment of GDM and the benefit of controlled blood glucose in the prenatal period are universally confirmed, knowledge on the mechanisms responsible for the impact of mild gestational hyperglycaemia on pregnancy outcome is inconclusive [46].

Other term related to glucose intolerance is gestational impaired glucose tolerance (IGT) [47]. Some authors suggest that the risk for different adverse maternal and perinatal outcomes varies depending on which single or combined IADSPG-defined OGTT threshold is equalled or exceeded [48]. They have demonstrated that women with gestational IGT are at higher risk of adverse pregnancy outcomes as compared with women with normal glucose tolerance.

A recent meta-analysis have shown that maternal gestational IGT increases the risk of LGA infants and is an independent factor, although not yet shown, whether the monitoring of blood glucose and control of blood sugar by means of lifestyle programs (e.g. physical activity, diet, etc.) are beneficial in reducing this risk [33].

In this review, some of the obstetric and perinatal outcomes related to false positives of GDM diagnosis will be mentioned.

Macrosomia

Fetal macrosomia may be defined by a birth weight >4000 g or higher cut-offs. Since a clear-cut definition of fetal macrosomia has not yet been established, a clinical value independent of gestational age, such as large for gestational age, is preferable. LGA infants are usually defined as those with a birth weight >90th percentile for gestational age. One of the reasons for induction of labour in case of suspected macrosomia is to reduce the likelihood of cesarean section and of difficult operative delivery, possibly resulting in maternal or perinatal morbidity.

GDM is a known clinical risk factor associated with fetal macrosomia and represents 90% of all types of diabetes occurring in pregnancy [49].

Genetic, environmental and constitutional factors, like pre-gestational BMI, excessive weight gain during pregnancy, as well as metabolic disorders, e.g. diabetes mellitus, are recognized as independent risk factors for fetal macrosomia [50,51].

Some studies have shown that a false-positive GCT is a significant independent risk factor for adverse perinatal outcome (including macrosomia and shoulder dystocia) and an increased risk for a maternal adverse outcome [44].

Additionally, Khan et al. have reported that patients with a positive glucose screening test and a negative OGTT are at increased risk for fetal macrosomia, caesarean delivery and preeclampsia [52].

Mello et al. [53] have demonstrated an overall tendency towards the upper percentiles of birth weight in patients with abnormal GCT screening and subsequently normal and abnormal OGTT. They found 40.7% of LGA infants in the group of mothers with early positive GCT [54].

The morbidity of an abnormally large infant might result in trauma to both mother and infant and fetal metabolic and respiratory complications. These large infants have been associated with high maternal and perinatal morbidity and mortality rates [55,56].

Gestational hypertensive disorders

Preeclampsia is characterized by hypertension and proteinuria beyond 20 weeks of gestation. The fetus suffers from placental hypoperfusion and prematurity, either spontaneous or induced. It is unclear whether gestational hypertension and preeclampsia are on the same spectrum of the same disease, or different diseases that share some common phenotypes [57].

There is an increased risk of developing preeclampsia and hypertensive disorders and an increased need for induction of labour for women with GDM [31]. Some studies have calculated the rate of pregnancy-induced hypertension (PIH). They have observed 2.3% of PIH outcomes in the false positive group, including preeclampsia [5]; lower than Toronto Tri-Hospital Study with 4.9% [58].

Stamilio et al. [44] did not find a higher risk of preeclampsia in 164 women with a false-positive GCT and negative OGTT, compared with 1661 with a normal GCT. In contrast, some retrospective studies have demonstrated a significant positive association between GCT and OGTT results and the risk of developing preeclampsia [57,59].

A probably greater debate exists about the significance of one abnormal level in the diagnostic of GDM. Thus, some authors have reported similar results of preeclampsia in both groups of negative screening and one abnormal GCT value (almost reaching the GDM group), in the evaluation of the effect of different degrees of glucose intolerance on maternal and perinatal outcomes [60]. Besides, an increased risk for hypertension and a revealed higher rate of caesarean section has been found in women with one abnormal glucose OGTT value [61]. These results have been shown in accordance to previously published studies, demonstrating an adverse influence of even one abnormal OGTT value on the outcome of pregnancy [62].

Polyhydramnios

The amniotic fluid surrounds the fetus and is essential for its continuous development and protection. The volume of amniotic fluid changes constantly during pregnancy and its balance is a consequence of complex interactions between fetal and maternal systems. Polyhydramnios is generally defined as amniotic fluid volume of 2000 mL or higher at term. The incidence has been estimated to range between 0.4 and 3.3% [63].

Maternal disorders, such as diabetes(gestational or pre-gestational), in utero infections, drug usage, placental abnormalities and fetal conditions like congenital and chromosomal abnormalities, Rh isoimmunization and multiple gestations, are generally associated with half of the cases with polyhydramnios, although in most cases aetiology remains unclear [64].

This complication affects an estimated 1.0% of the pregnancies and has previously been associated with adverse perinatal outcomes [65]. In a retrospective review of 409 patients, the group of patients whose screening result was positive but diagnostic test OGTT was negative, had higher polyhydramniotic pregnant and, although they were non-diabetic, they presented polyhydramniotic features like diabetic pregnant [45]. Furthermore, a similar rate of polyhydramnios was found in one abnormal OGTT value in women pregnant as GDM diagnosed pregnant in a retrospective study [61], suggesting both groups could be consider resembling.

Neonatal adverse outcomes

Since 1954, the hypothesis of Pedersen has been used to explain fetal macrosomia observed in GDM, by a mechanism involving maternal hyperglycaemia, which leads to fetal hyperglycemia, evoking an exaggerated fetal response to insulin for more than three decades [66]. However, since the 1980-1989 decade it is known that pregnant women with pre-gestational overweight not suffering from GDM still have a higher frequency of fetal macrosomia [67,68].

GDM and maternal obesity are independently associated with adverse neonatal outcomes, in particular macrosomia and LGA births, which in turn increase the risk of complications in both of them [68]. Moreover, pregnant women with GDM, despite being subjected to optimal glycemic control, still show unacceptably high frequencies of fetal macrosomia, a phenomenon that is concentrated in pregnancies with overweight or obesity prior pregnancy [69].

Neonatal complications consist of birth trauma associated with shoulder dystocia, hypoglycaemia, respiratory distress and may also result in impairment to health later in life [70,71] and some authors propose that triglycerides (TG) could be responsible for this accelerated fetal growth [70].

While Stamilio et al. [44] and Gumus et al. [45] results showed increased adverse perinatal outcomes for borderline GDM patients, Dudhbhai et al. [54] stated that this group of patients could be followed-up as low-risk patients.

A recent meta-analysis study of pregnant women with one-abnormal value in OGTT have found an increased incidence of macrosomia, LGA infants, increased birth weight, neonatal hypoglycemia, overall cesarean delivery, PIH and low APGAR scores, when they are compared with negative OGTT patients [71]. Moreover, these authors state that maternal and perinatal adverse outcomes appear to be similar to GDM patients, according to previously published small observational studies [34,57,72].

In 2004, a comprehensive review of maternal and neonatal data showed a statistical association between GDM and LGA neonates closely linked to high BMI before pregnancy, suggesting that maternal overweight acts as an independent risk factor for fetal macrosomia in this group [73]. A year later, Ricart et al. [74] showed that a BMI>26.1 kg/m^2 was not only a risk factor for fetal macrosomia independent of the presence of DMG, but also a better predictor of macrosomia than initial degree of hyperglycemia, determined by the OGTT. They conclude that it would be necessary to determinate physiological levels of "lipid profile" during the normal pregnancy, generating percentile tables of levels of TG and VLDL-cholesterol versus week gestation in healthy population with BMI normal pre-pregnancy. Additionally, a recent meta-analysis has shown that maternal gestational IGT increases the risk of LGA infants and is an independent predictor for neonatal LGA [33].

Some of the recent prospective and retrospective cohort and case control studies, which investigate false positive diagnosis of GDM and obstetric and perinatal adverse outcomes, are shown in Table 2 [75-79].

Discussion

Despite the growing evidence that women with GDM represent a metabolically heterogeneous group, this fact likely translates into a broad range of perinatal risk. Hence, this contributes to the controversy surrounding whether a treatment benefit exists for pregnancies complicated by this disorder. The management of patients with positive diabetes screening is still controversial.

This subgroup of patients is observed to be susceptible to the similar complications of GDM [80], which mechanism proposed is undetectable glucose intolerance and a resistance to insulin. Besides, Bo et al. have shown that neonatal outcomes are significantly worse in women with positive GCT, suggesting again that GCT identifies a "high-risk" group, even independently from the results of OGTT in pregnancies with different degrees of hyperglycaemia [78].

According to Langer et al. [81] one-value abnormal patients in 100 g OGTT should be accepted as GDM and followed with the same management guidelines. Some studies have reported an increase in the complication rate for patients with carbohydrate intolerance but not diagnosed as GDM [15]. Moreover, some patients who had a positive screening test for GDM but a negative OGTT had a complication rate similar to euglycemic group rather than patients who had been diagnosed and treated as GDM [75].

For optimal control of diabetes in pregnancy, experts advocate that obstetricians refer their patients early in pregnancy to a clinician specialized in diabetes during pregnancy. Excellent control of blood glucose is associated with a decrease in maternal and neonatal complications [82]. Furthermore, some randomized trials of treatment for mild gestational diabetes have demonstrated that treatment did not

First Author (Reference)	Patients (N)	False Positive Group (N)	Diagnostic Criteria	Main Findings
Prospective or retrospective cohort studies				
Gezer et al. [75]	281	192	2-step	Any significant difference to detect a subgroup of patients that was prone to develop complications.
		-Complicated	100g OGTT	*Limitation: small population size.
		-Uncomplicated		
Stamilio et al. [44]	1825	164	2-step	False positive group is at increased risk for adverse outcomes as endometritis, shoulder dystocia, fetal macrosomia, cesarean delivery and antenatal death.
			100 g OGTT,	
			NDDG criteria	
Ricart et al. [5]	9270	1838	2-step	Maternal characteristics of women with ADA-GDM criteria were between those of false positive group and women with NDDG-GDM criteria.
			100 g OGTT,	
			NDDG and ADA	
Dudhbhai et al. [54]	277	101	2-step	False positive group has different maternal characteristics and backgrounds, but normal outcomes.
			100 g OGTT,	*Limitation: small population size.
			CC criteria	
Biri et al. [60]	2029	326	2-step	Even in false positive groups, adverse outcomes such a macrosomia, LGA, respiratory complications, hyperbilirrubinemia and neonatal hypoglycemia are observed, increased with positivity values of OGTT.
			100 g OGTT,	
			O'Sullivan criteria	
Black et al. [48]	8711	391	2-step	Women with impaired glucose tolerance may have modestly elevated risk for primary cesarean delivery, shoulder dystocia/birth injury or having an LGA infant, compared with women without GDM.
			75 g OGTT,	
			IADSPG criteria	
Park et al. [76]		240	2-step	Design of a new logistic regression model to predict adverse outcomes based on FBG and BMI, with greater sensitivity and specificity than two-step diagnostic model.
	802		100 g OGTT,	
			CC criteria	
Wu et al. [77]		952 (IADSPG)	2-step	Prevalence of GDM by the IADPSG criteria is markedly higher than prevalence by the CC criteria and associated with a reduction in cesarean section rate.
	1840	888 (CC)	75 g OGTT (IADSPG), 100 g OGTT (CC)	
Lu et al. [29]		1776	2-step	False positive screening group did not differ from the negative screening group, the same as maternal outcomes in the multivariate analysis, except gestational hypertension.
	12274		100 g OGTT,	
			CC and NDDG criteria	
Case-control studies				
Bo et al.	700	350	2-step	Prevalence of neonatal macrosomia and icterus are similar in false positive group and increased severity of glucose tolerance groups is shown.
[78]			100 g OGTT,	
			CC criteria	
Crowther et al. [31]	1000	490 (Treatment)	2-step	Treatment of gestational diabetes reduces serious perinatal morbidity and may also improve the women health-related life quality.
	(ACHOIS trial group)	510 (Control)	75 g OGTT,	
			WHO criteria	
Landon et al. [79]	958	485 (Treatment)	2-step	Treatment of mild gestational diabetes mellitus did not significantly reduce the frequency of outcome, but it did reduce the risk of fetal overgrowth, shoulder dystocia, caesarean delivery and hypertensive disorders.
		473 (Control)	100 g OGTT,	
			CC criteria	

Table 2: Summary of some recent cohort and case control studies which investigate false positive diagnosis of GDM and obstetric and perinatal adverse outcomes.

significantly reduce the frequency of a composite outcome (still-birth, perinatal death and several neonatal complications), but it did reduce the risks of fetal overgrowth, shoulder dystocia, cesarean delivery and hypertensive disorder [79].

However, some authors have designed a new logistic regression model to predict adverse outcomes based on FBG and BMI, with greater sensitivity and specificity than two-step diagnostic model [76]; others have obtained a markedly higher prevalence of GDM with

these criteria, associating with a reduction in caesarean section rate [77]. There are some studies in which a frequency of early conversion of GDM to permanent glucose anomaly and the predictive potential of current GDM diagnostic criteria for the prediction of postpartum glucose anomaly have been determined [83].

Consequently, obstetric and perinatal outcomes in patients with mild hyperglycemia during pregnancy or with positive screening but negative glucose tolerance test are remarkable. Therefore, it is important to study this group and to introduce some dietary measures in these patients, as well as their similar treatment, but to a lesser extent, than patients with gestational diabetes mellitus.

Limitations

A limitation found in this review is that studies differ from each other because of the different diagnostic criteria used, due to the lack of consensus. It is possible that others factors not covered in these studies will have influence on hydrocarbon metabolism of pregnant women, such as alterations or dysfunction of lipid metabolism and the absence of treatment in these patients. Moreover, other factors may affect the mild hyperglycemia pregnancy-related, such as weight gain during pregnancy, pre-gestational weight, gestation age at delivery and others factors related.

Conclusion

The findings approached in this review suggest that many obstetric and perinatal adverse outcomes are shared among many false positive diagnosis of GDM. Nevertheless, prospective or retrospective studies with a common design focusing on all the considered comorbidities, different degrees of glucose intolerance during pregnancy and intensity of involvement in fetus and in obstetrical events, will be needed to understand better the real relation between false positive diagnosis of gestational diabetes mellitus and adverse outcomes in pregnancy.

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