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Original Article

Early postpartum metabolic syndrome in women with or without gestational diabetes: Results from Life after Gestational Diabetes Ahvaz cohort study

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ABSTRACT

Aims: This study aimed to determine the prevalence rate of metabolic syndrome and its potential risk factors, 6–12 weeks postpartum in women with GDM compared to women with normal glucose tolerance.
Methods: LAGAs is an ongoing population-based prospective cohort study that started in March 2015 in Ahvaz, Iran. During 11 months of study progression, 176 women with GDM pregnancy and 86 healthy women underwent a fasting glucose test, 75-g OGTT and fasting lipid tests at 6–12 weeks postpartum. GDM was defined based on IADPSG criteria. Postpartum glucose intolerance was defined according to ADA criteria and metabolic syndrome using 2 sets of criteria.
Results: The overall rate of metabolic syndrome at 6–12 weeks postpartum was 16% by NCEP-ATP III criteria (18.2% in women with GDM and 11.6% in controls) and 19.1% by IDF criteria (21% in women with gestational diabetes and 15.1% in controls). Pre-pregnancy overweight or obesity, (OR 1.89, 95% CI: 1.05-3.38, P = .03), pregnancy systolic blood pressure (OR 1.03, 95% CI: 1.008–1.52, P = .006) and requiring insulin or metformin (OR 3.08, 95% CI: 1.25–7.60, P = 0.01), were associated risk factors for the presence of MetS in GDM-exposed women. In women with normal glucose during pregnancy, pre-pregnancy BMI $\geq$25 kg/m^2 was a risk factor of metabolic syndrome (OR 2.82, 95% CI: 1.11–7.15, P = .02).
Conclusion: The rate of metabolic syndrome in women with or without GDM at 6–12 weeks postpartum is high particularly in women with high BMI. An early postpartum prevention and screening program for cardiovascular risk factors is important for women with GDM.

1. Introduction

Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders. It defined as any degree of glucose intolerance with onset or first recognition during pregnancy [1]. The incidence of GDM is rising along with an increasing trend in its potential risk factors in the general population, including obesity and diabetes type 2 [2–4]. The undeniable rise in GDM could be due to advanced maternal age in pregnancy or the application of new diagnostic

Abbreviations: GDM, gestational diabetes mellitus; LAGAs, life after gestational diabetes Ahvaz Study; NCEP ATP III, National Cholesterol Education Program Adult Treatment Panel; OGTT, oral glucose tolerance test; IDF, International Diabetes Federation; MetS, metabolic syndrome; BMI, body mass index; FPG, fasting plasma glucose (FPG).

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criteria that lower thresholds and single abnormal value required for diagnosis, and hence, a higher incidence of GDM is the pattern [5–7].

GDM has been accepted as the strongest predictor of type 2 diabetes later in life [8]. Among middle aged women, history of GDM is considered a potential risk factor for cardiovascular diseases [9].

Apart from GDM, metabolic syndrome (MetS), a global health concern, is considered a cluster of signs and symptoms including central obesity, hypertension, dysglycemia and lipid abnormalities [10]. Sedentary life styles and unhealthy diet in recent decades have increased rapidly the prevalence of MetS [11].

Similarly to GDM, MetS is associated with higher risk of cardiovascular outcomes. The following outcomes are reported among people diagnosed with MetS: a fivefold increase in the risk of type 2 diabetes, a two- to fourfold increase in the risk of stroke and finally a three- to fourfold increase in the risk of myocardial infarction [12].

Comparable characteristics between GDM and MetS (e.g., dyslipidemia, insulin resistance and endothelial dysfunction [13]) as well as similar risk factors (e.g., age, BMI and history of diabetes) have led scientists to believe that these two diagnoses share a common pathogenesis [14].

This is mainly the reason why a number of studies have investigated the association between GDM and MetS. Although there are some contradictory findings [14], some of them have shown a greater risk of MetS years after pregnancy in this population [15,16]. It is possible that the findings of these studies are only a representative of long-term follow-up.

It is also not clear whether or not GDM is an independent predicator of future MetS (and other negative outcomes) or its relationship has been due to pre-pregnancy obesity and/or future type 2 diabetes [9]. Everything considered, the association between GDM and MetS is not completely clear, mainly because screening for Mets is not included in routine prenatal care and a postpartum screening program [9,17].

It is understandable why most international societies place emphasis on early screening of glucose status for development of pre-diabetes or diabetes in women with gestational diabetes at 6–12 weeks postpartum using the 75-g 2-h oral glucose tolerance test (OGTT) and thereafter [18–20]. But management strategies targeting future cardiovascular risk in this population have been neglected.

Furthermore, the diagnosis of women with mild hyperglycemia as GDM (using IADPSG criteria) may improve mother and fetal outcomes [21], but concerns about cost effectiveness, increase in workload and maternal anxiety in such screening programs are rising [22]. Moreover, short-term and long-term metabolic outcomes of GDM, after applying the IADPSG criteria, are unclear [23].

Our study aimed at clarifying these issues. We set out to determine the rate of MetS at 6–12 weeks postpartum. Additionally, contributing risk factors and potential differences with peers in the control group were assessed according to IADPSG criteria.

2. Methods

2.1. Study design and settings

This population-based prospective cohort study investigated the potential metabolic outcomes of GDM in mothers and their offspring compared with a healthy population during pregnancy and followed the study participants for 2 years after delivery. Life after Gestational Diabetes, Ahvaz Study (LAGAs) started from in 2015. The first gestational diabetes clinic in Khuzestan province was established as the center of the cohort study in Golestan teaching hospital in October 2013 in Ahvaz city, for this reason. Ahvaz the capital of Khuzestan is located in southwestern Iran and has a high prevalence of obesity, MetS and type 2 diabetes [24–26]. Moreover, there is a high incidence of GDM according to IADPSG criteria (29.9%) [27], low rate of postpartum glucose testing [28], high rate of postpartum hyperglycemia and dyslipidemia [29,30], in Ahvaz city, where the study is currently in progress.

2.2. Study population, biochemical and clinical assessment during pregnancy

Pregnant women seen at 25 urban public and private prenatal care clinics as of March 2015 were invited to participate in the study. Initial assessment for plasma glucose level was performed in the first trimester using fasting plasma glucose (FPG) test. Women with FPG between100 and 125 mg/dl received dietary and exercise counseling and had blood glucose check every three weeks.

Women with FPG $\geq$ 126 mg/dl were excluded and women with normal glucose underwent a 75-g OGTT between 24 and 32 weeks of gestation, and one elevated value of $\geq$92 for fasting or $\geq$180 and $\geq$153 mg/dl for 1-h and 2-h plasma glucose level was considered indicative of GDM according to IADPSG criteria. Women in the control group were selected randomly in the same setting.

Medical and health profile records were used for pre-pregnancy body weight. Anthropometric measurements Including weight, height, waist circumference, blood pressure and hip circumference measured at baseline visit during pregnancy. Weight and blood pressure measurements repeated at each pregnancy visit and recorded.

A weekly list of women with GDM and their pairs in the control group, with details of their contact information, was sent to one of the members of research team, and women were referred to Golestan Hospital if they agreed to participate in the study. We used different methods of communication to encourage them to participate and to continue attendance for follow-up.

2.3. Inclusion criteria

- Women with GDM in first trimester diagnosed by FPG
- Women with GDM in second or third trimester by 75-g OGTT
- Availability of clinical and medical records or health profile

2.4. Exclusion criteria

- Pre-gestational diabetes type 1 or type 2
- Women with FPG $\geq$ 126 mg/dl at initial assessment in first trimester
- Planning to move from Ahvaz city within the subsequent 2 years
- Women who refused to continue at any stage of the study

2.5. Data collection

Interviewer-administered questionnaires were used to collect the following data: socio-demographic features, pregnancy outcomes, medical and obstetric history, potential risk factors of GDM and MetS, and details of delivery and potential postpartum problems among mothers or their infants. A trained researcher at the prenatal care center recorded pregnancy-related data, and filled out short forms of delivery completed during 3–5 days postpartum at 2 main centers for screening of neonatal

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