Laboratory and Clinical Predictors for Gestational Diabetes Mellitus among Kosovo Pregnant Women

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Abstract

BACKGROUND: Gestational diabetes mellitus (GDM) is a condition increasing yearly worldwide.

AIM: We investigated the prevalence and the arrangement of common risk predictors for developing GDM among Kosova pregnant women after 24 gestational weeks.

MATERIALS AND METHODS: A total of 202 hospitalized pregnant women participated in this prospective study. All participants underwent a detailed clinical examination for risk factors for GDM, followed by appropriate biochemical blood analysis and anthropometric measurements. The glucose tolerance test results were interpreted according to the criteria established by the World Health Organization (WHO) and American Diabetes Association. Participants in the first part of the study were divided into the four risk groups and in the second part GDM group (case group) or a normal glucose tolerance group (control group) to determine the risk factors for GDM and associated clinical and biochemical predictors.

RESULTS: The prevalence of gestational diabetes was 5.9%.The average age was 30.0 ± 5.5. Main characteristics of high-risk group of women for GDM were: ages above 30-year-old (p = 0.001), positive glucose intolerance (p = 0.0001), personal history for GDM (p = 0.0001), familiar history for DM (p = 0.0001), obesity (p = 0.0001), previous childbirth with weight higher than 4000 g (p = 0.0001), vulvovaginal infection (p = 0.0001), and polyhydramnios (p = 0.0001). Almost the same characteristics were found also for the GDM group: Like personal history for GDM (p = 0.0018), and family history for DM (p = 0.0018). Moreover, the group with GDM was characterized with significantly higher laboratory parameters such as fasting glycemia (p = 0.0000), triglycerides, and cholesterol concentrations (p = 0.0001). Anthropometric measurements such as weight (p = 0.002), body mass index (p = 0.0015), and systolic (p = 0.0163) and diastolic (p = 0.042) blood pressure were also significantly higher than the control group.

CONCLUSIONS: Older age, family history of diabetes and personal history for GDM, polyhydramnios, stillbirth >4000 g, were significant risk factors for GDM. Screening for risk factors can easily bring at GDM early diagnosis and prevention. Public awareness-raising on the risk factors for GDM and the need for early screening should be strongly pursued, particularly for the women at risk for GDM, especially in developing countries. At every level of health service, GDM screening to pregnant women should be incorporated as a routine antenatal visit.

Introduction

Gestational diabetes mellitus (GDM) is a condition specified as certain glucose intolerance with the onset or first manifestation during pregnancy. Any woman can develop GDM during pregnancy. GDM is detected by screening pregnant women for risk factors, followed by testing the high-risk group for abnormal glucose tolerance with a screening test named oral glucose Tolerance Test (OGTT). It was shown that during the past 20 years, the prevalence of GDM has increased worldwide, and it is expected to be raised along with the increase in pre-conception obesity and pregnant women affected by obesity [1]. The prevalence rate of GDM in population-based studies worldwide varies from 1 to 22% [2]. This diversity also depends on ethnic origin and age, and an increasing prevalence associated with the global epidemic of obesity and diabetes [2]. The importance of GDM clinical detection lays in the identification of high-risk pregnancies for fetal and maternal morbidity and mortality such as macrosomia, large for gestational age, caesarian section delivery, and preterm birth. In addition, GDM may lead to long-lasting health consequences, including type 2 diabetes mellitus and cardiovascular disease, for both, mother and offspring. The recommendation applies screening for GDM to all non-diabetic pregnant women between 24 and 28 weeks' gestation [3], [4] or early screening for pregnant women at high risk of GDM, i.e., being obese, having a history of DM in first-degree family members, experiencing intrauterine fetal death, previous macrosomia baby, and maternal age above 35 years[3], [4].

Materials and Methods

This study was conducted in the Department of Pathology in the Clinic of Gynecology and Obstetrics, University Clinical Center of Kosova, during the 1 year period of time, 2006–2007 where the pregnant women were generally referred for further examination of different pathology during their pregnancy, diagnosing for GDM, assessing of risk factors, and having other associated symptoms.

Characteristics of the patients in the study

This study was conducted with 202 pregnant women above 24 weeks of gestational age. No patients with gestational age less than 24 weeks were enrolled. Data were collected from Gynecology and Obstetrics hospitals in Prishtina and included general demographic data, previous pregnancy, current pregnancy, and maternal laboratory examinations.

The control group (non-GDM control group) was selected of the pregnant women under the age of 25 and having none of the risk factors for GDM (obesity, glucose intolerance or glucosuria, personal history of GDM, family history of type 2 DM, and polyhydramnios).

In the group of women at low risk of developing GDM were selected pregnant women with none of the risk factors for GDM but above the age of 25 years. The group of mid-risk of developing GDM was chosen by pregnant women above the age of 35 years without having any other risk factors, while the group of high risk of developing GDM was made of the pregnant women that have one or more risk factors for GDM.

Exclusion criteria for all patients included in the study were: Age <18 years, multiple pregnancy, hypertension, hormonal disorders, chronic infectious diseases, consuming alcohol, smoking, or taking drugs during pregnancy.

Screening tests for GDM were performed using OGTT (with 75 g glucose) according to the 2006 World Health Organization and American Diabetes Association criteria (2) (criteria for GDM are as in following: if one or more of the following criteria are met: fasting plasma glucose ≥7.0 mmol/l (126 mg/dl), 2-h plasma glucose ≥11.1 mmol/l (200 mg/dl) following a 75g oral glucose load, random plasma glucose ≥11.1 mmol/l (200 mg/dl) in the presence of diabetes symptoms). In addition, along with anthropometric measurements, routine biochemical tests such as total cholesterol, triglycerides, glycemia, urea creatinine, albumin, total proteins, and HbA1C have been measured for all participants in the study.

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of the Department of Gynecology and Obstetrics of Medical Faculty, University of Pristina (protocol code 2/5, date of June 28, 2006). Informed consent was obtained from all participants involved in the study and to publish this paper.

The data obtained are presented in the respective statistical parameters such as arithmetic mean, standard deviation, odds ratio, x^2 test, Fisher test, t-test, and variance analyses. Verification of the tests was done with confidence level 99.7% ($p < 0.01$) and reliability of 95% ($p < 0.05$).

Results

The prevalence of GDM in the study group was 5.9% and the incidence was 3, 5%. The average age was 30.0 ± 5.5. Most of the women were overweight 54.5% and 10.9% were obese for gestational age. Thirty-five point six percent of women were with high-risk criteria for GDM. We found that from all participants in the study screened for GDM, just 2. 5% were with university education, 28.7% with secondary school, 64.8% with primary school, and 4% with no education at all (Table 1).

Table 1: Background characteristics of pregnant women screened for gestational diabetes mellitus

Variables	Frequency (%)
Gestational age (weeks)	n = 202
24–28	80 (39.6)
29–32	74 (36.6)
34–38	46 (22.8)
> 386	2 (1.0)
Age (years)	30.0 ± 5.5
< 35	156 (77.3)
> 35	46 (22.77)
No education	8 (4.0)
Four years of primay school	52 (25.7)
Eight years of primary school	79 (39.1)
Secondary school	58 (28.7)
University	5 (2.5)
Normal weight	70 (34.7)
Overweight	110 (54.5)
Obesity	22 (10.9)
GDM risk criteria	
BMI > 25 kg/m²	132 (65.4)
Macrosomic child in any previous pregnancy	9 (4.5)
GDM in any previous pregnancy	22 (10.9)
Type 1 or type 2 diabetes in first or second degree relatives	26 (12.9)
Age>35 years	46 (22.77)
Prevalence	12 (5.9)
Incidence	7 (3.5)
Groups by risk factor*	
No risk	25 (12.4)
Low risk	83 (41.1)
Middle risk	22 (10.9)
High risk	72 (35.6)

*Risk factors: Conventional indications such as previous macrosomia, obesity, history of DM in first-degree relatives, previous intrauterine fetal death, recurrent miscarriages. DM: Diabetes mellitus, BMI: Body mass index, GDM: Gestational DM.

The main characteristics of a high-risk group of women for GDM that significantly ($p = 0.001$) differ from other groups were: ages above 30 years old (62.5%), positive glucose intolerance (50%), personal history for GDM (30.6%), familiar history for DM (36.1%), obesity (30.6%), previous childbirth with a weight higher than 4000g (12.5%), vulvovaginitis (48.6%), and polyhydramnios (4.2%). Glucose intolerance was present in 50.0% of pregnant women in the high-risk group and 2.4% in the low-risk group. In the high-risk group, 12.5% of women have born children over

4000 g. In all other risk groups, there were childbirths weights over 4000 g (Table 2).

Table 2: Main parameters of the high-risk group for gestational diabetes mellitus as compared to the other groups

Main parameters	Groups				p
	Control (%)	Low risk (%)	Middle risk (%)	High risk (%)	
Preterm birth	8.0	18.1	4.5	15.3	0.1602
Preterm birth with malformation	-	2.4	-	4.2	0.075
Habitual abortion	20.0	36.1	45.5	40.3	0.2341
Risk for abortion	20.0	14.5	9.1	18.1	0.9660
Mors feti in utero	-	9.6	9.1	13.9	0.3003
Plohidramnion	-	-	-	4.2	0.0001
Obesity	-	-	-	30.6	0.0001
Stillbirth>4000 g	-	-	-	12.5	0.0001
Glucose intolerance	-	2.4	-	50.0	0.0001
Personal history for GDM	-	-	-	30.6	0.0001
Familiar history for DM	-	-	-	36.1	0.0001
Hypertension	12.0	30.1	27.3	43.1	0.0590
Edema	4.0	1.2	4.5	11.1	0.0200
Vulvo-vaginal infection	4.0	3.6	-	48.6	0.0001
Urinary infections	28.0	22.9	18.2	34.7	0.8480

DM: Diabetes mellitus, GDM: Gestational DMs.

With the one-way analysis of variance analysis, a significant difference in age-relevant statistics was obtained between study groups except in the middle age group of low-risk and high-risk groups (Figure 1).
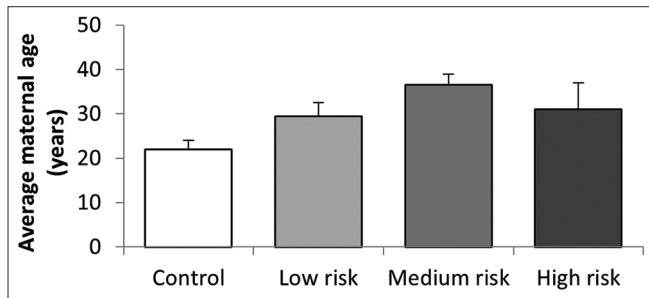

Figure 1: Pregnant women according to the risk groups and their age

The same characteristics we found also for the GDM group of women significantly manifested personal history for GDM 37.4 times more, and family history for DM 37.4 times more than the control group (Table 3).

Table 3: Main predictors associations for gestational diabetes mellitus

Main parameters	Groups		OR (95% CI)	p
	GDM (12), n (%)	Control (25), n (%)		
Preterm birth				
Yes	2 (16.7)	2 (8.0)	2.3	0.582
No	10 (83.3)	23 (92.0)	(0.28–18.7)	
Habitual abortion				
Yes	6 (50)	5 (20.0)	4.0	0.1216
No	6 (50)	20 (80.0)	(0.894–17.87)	
Mors feti in utero				
Yes	1 (8.3)	-	6.65	0.324
No	11 (91.7)	25 (100.0)	(0.25–176.1)	
Personal history for GDM				
Yes	5 (41.7)	-	37.4	0.0018
No	7 (58.3)	25 (100.0)	(1.847–757.3)	
Familiar history for DM				
Yes	5 (41.7)	-	37.4	0.0018
No	7 (58.3)	25 (100.0)	(1.847–757.3)	

OR: Odds ratio, CI: Confidence interval, DM: Diabetes mellitus, BMI: Body mass index, GDM: Gestational DM.

Moreover, the group with GDM significantly manifested with higher laboratory measurements such as fasting glycemia, triglycerides, and cholesterol concentrations, whereas HbA1c was higher in the group of GDM but not significantly. Anthropometric measurements such as weight, body mass index (BMI), and systolic and diastolic blood pressure were significantly higher (Table 4).

Table 4: Main clinical and laboratory characteristics of women with gestational diabetes mellitus

Main parameters	Mean ± SD		p
	GDM (n = 12)	Control (n = 25)	
Wheigh	76.8 ± 6.1	67.9 ± 8.3	0.0022
Height	164.7 ± 5.4	162.7 ± 5.1	0.2806
BMI	29.0 ± 3.6	25.5 ± 2.5	0.0015
Systolic blood preasure	141.3 ± 28.5	119.6 ± 22.4	0.0163
Dyastolic blood preasure	87.0 ± 11.1	76.8 ± 14.9	0.042
Fasting glycemia	7.7 ± 2.2	4.2 ± 0.5	0.0000
Afer 1 h of OGTT	11.6 ± 2.6	/	/
After 2 h of OGTT	8.6 ± 2.6	/	/
HbA1C	5.1 ± 1.0	4.7 ± 0.4	0.089
Creatinine	61.5 ± 11.2	62.6 ± 7.0	0.716
Urea	2.6 ± 0.4	2.8 ± 0.9	0.4692
Proteins	59.0 ± 5.2	59.6 ± 7.1	0.8632
Tryglicerides	3.5 ± 1.4	1.8 ± 0.4	0.0001
Total cholesterol	6.9 ± 1.5	5.3 ± 0.8	0.0001

DM: Diabetes mellitus, GDM: Gestational DM, SD: Standard deviation, BMI: Body mass index, OGTT: Oral glucose tolerance test, HbA1C: glycosylated haemoglobin

Discussion

In Kosovo, so far, there is still no developed institutional strategy for early screening and diagnosis of GDM and it was not known what the prevalence is, until the consequences of undiagnosed and absent of early treatment are evident. With early diagnosis and treatment of GDM, fetal and maternal morbidity and mortality can be reduced.

In our study, we found that about one-third of pregnant women were at high risk for GDM. These results are similar to the study of pregnant women, where it was found that one-third of them were of high risk and the rest with low risk for GDM. In that study, substantial geographical differences related to GDM have been reported [5], but these differences are believed to be reflected by the application of different screening criteria and techniques and depend on the population selected in the study [5], [6].

Related statistics for the prevalence of GDM also it was found in Croatia [7].

Many studies have found that women with GDM are older [8], [9] and with the largest BMI [10], [11], [12], [13] than nondiabetic pregnant women, same as in our study.

We found that majority of pregnant women were with low educational levels. It was found that education has an important impact on women's health conditions [14] and low education may unfavorably affect a person's nutrition knowledge [15].

We found significantly higher systolic and diastolic blood pressure in GDM than in another study with the same group of women [16]. In our study, the triglycerides and cholesterol have been quite increased in the GDM whereas for HbA1C there was no difference between study groups. Same conclusions for HbA1C have been found in different studies [17], [18].

Between all the risk factors identified in our study, personal history of GDM and family history

of DM was the strongest predictor of GDM. Our findings regarding the risk ratio of a family history of diabetes for GDM are similar to those reported in other studies [19], [20], [21], [22].

Conclusions

We can conclude that advanced maternal age, low education level, family history of diabetes, personal history for GDM, and high BMI are the best clinical and laboratory criteria to predict GDM in Kosova, which is the same to other countries.

Screening for risk factors can easily bring to GDM diagnosis and prevention. Public awareness raising on the risk factors for GDM and the need for early screening should be strongly pursued, particularly for women at risk for GDM, especially in developing countries. At every level of health service, screening and management of GDM should be incorporated as routine antenatal services and those at risk counseling for healthy food, exercise, and lifestyle during pregnancy.

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