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Prevalence of Gestational Diabetes Mellitus in Patients with Polycystic Ovary Syndrome

Vázquez Lara Julia[1], Sing Pérez Juan Carlos[1], Hernández Coria Mayra Ivonne[2], Quintanilla Flores Dania Lizet[2], Tamez Peña Alejandra Lorena[2] and Tamez Pérez Héctor Eloy[2]*

[1]*Hospital de Gineco-Obstetricia # 23 IMSS Monterrey, Nuevo León, Mexico*
[2]*Facultad de Medicina y Hospital Universitario "Dr. José Eleuterio González" UANL, Mexico*

Abstract

Objective: To determine the prevalence of gestational diabetes mellitus in polycystic ovary syndrome.

Research design and methods: We conducted a retrospective observational study in a tertiary care medical institution in Monterrey, Mexico. Ninety-one patients were enrolled. We excluded patients with twin pregnancies or with an incomplete medical record. Data were obtained in the postpartum wards by review of medical records. A diagnosis of gestational diabetes mellitus was made according to current criteria of the American Diabetes Association.

Results: We included 91 patients with a mean age of 27 ± 6 years. Of these patients, 77% had a family history of type 2 diabetes mellitus, and 8% received treatment to become pregnant. The prevalence of gestational diabetes mellitus in our study cohort was 65%.

Conclusion: Gestational diabetes mellitus has a high prevalence in patients with polycystic ovary syndrome. A consensus between early detection and classification criteria to standardize the diagnosis should be sought.

Keywords: Polycystic ovarian syndrome; Gestational diabetes mellitus; Prevalence

Abbreviations: PCOS: Polycystic Ovarian Syndrome; GDM: Gestational Diabetes Mellitus; T2DM: Type 2 diabetes mellitus; GTT: Glucose Tolerance Test; BMI: Body Mass Index; ADA: American Diabetes Association; IADPSG: The International Association of Diabetes in Pregnancy Study Groups; WG: Weeks of gestation; WHO: World Health Organization

Introduction

Polycystic ovarian syndrome (PCOS) is a heterogeneous endocrine and metabolic disorder with a prevalence between 5% and 15% in women of reproductive age [1,2]. According to the Rotterdam consensus [3], PCOS is defined as the presence of two of the following criteria: hyperandrogenism, ovulatory dysfunction, and polycystic ovaries on ultrasound (12 or more follicles, 2-9 mm in diameter, and/or increased ovarian volume >10 ml); disorders that mimic the clinical features of PCOS are excluded [1-6].

It is well known that hyperinsulinemia and obesity are common features of PCOS. These alterations can lead to glucose metabolism disorders and increased risk of developing gestational diabetes mellitus (GDM). Furthermore, pregnancy itself induces insulin resistance [1,2,4,5].

The prevalence of GDM in PCOS varies in the literature from 0.15 to 12.3% [7-10].

According to previous studies, PCOS is associated with an OR of 2.32 (95% CI, 1.88-2.88) in GDM; of 1.45 (95% CI, 1.24-1.69) in preeclampsia, and of 2.21 (95% CI, 1.69-2.90) in preterm birth [4,7,10].

In the present study, our aim is to determine the prevalence of gestational diabetes mellitus in patients with polycystic ovary syndrome.

Material and Methods

We conducted a retrospective observational study in a tertiary care referral clinic in Monterrey, Mexico in 2010. A total of 91 pregnant women with a diagnosis of PCOS according to the Rotterdam consensus [3,8] and with no previous diagnosis of pregestational diabetes, T2DM or secondary causes of hyperglycemia and with a reported serum glucose level during pregnancy after a 75 g glucose tolerance test (GTT), were evaluted. We excluded patients with a twin pregnancy or with an incomplete medical record. Data were obtained by review of medical records.

Demographic (age, family history), anthropometric (weight, height, and body mass index [BMI]), and clinical and biochemical variables for both the mother (hypertensive syndrome, gestational hypertensive syndrome, preeclampsia, hirsutism, acne, acanthosis nigricans, anovulation, infertility, and glucose level) and child (birth weight, height, sex, gestational age,) were collected. GDM was diagnosed according to currently accepted criteria of the American Diabetes Association (ADA) and The International Association of Diabetes in Pregnancy Study Groups (IADPSG), considering fasting glucose levels ≥ 92 mg/dL, 1 h post-glucose load glycemia of 180 mg/dL or a 2 h post-glucose load glycemia of 153 mg/dL as diagnostic [11].

BMI was recorded at first presentation to clinic (6-8 weeks of gestation [WG]) and was classified according to current criteria of the World Health Organization (WHO) as low <18.5 kg/m^2, normal 18.5-24.9 Kg/m^2, overweight 25- 29.9 Kg/m^2 and obese >30 Kg/m^2 [12]

***Corresponding author:** Tamez Pérez Héctor Eloy, Facultad de Medicina y Hospital Universitario "Dr. José Eleuterio González" UANL, Mexico, Tel: (52)8183294050; E-mail: hectoreloytp@gmail.com

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Characteristic	n (%)
	n = 91
Family history of T2DM	70 (77)
Hypertensive syndrome	20 (22)
Gestational hypertension syndrome	14 (15)
Preeclampsia	6 (7)
Hirsutism	56 (62)
Acne	42 (46)
Acanthosis nigricans	65 (71)
Anovulation	63 (69)
Infertility	7 (8)

T2DM: Type 2 Diabetes mellitus; PCOS: Polycystic Ovary Syndrome; GDM: Gestational Diabetes Mellitus

Table 1: Characteristics of the Study population.

Characteristic	Study group	GDM+	GDM−	*P*
Total, n (%)	91 (100)	59 (65)	32 (35)	-
Age (yrs)	27 ± 6	26 ± 5	28 ± 7	NS
BMI (kg/m^2)	29 ± 7	30 ± 7	28 ± 6	NS
Low weight	3 (3)	2 (3)	1 (3)	NS
Normal weight	27 (30)	17 (29)	10 (31)	NS
Overweight	24 (26)	13 (22)	11 (34)	NS
Obesity	37 (41)	27 (46)	10 (31)	NS
Weight gain	83 (91)	52 (88)	31 (94)	NS
*Weight gain kg.	6/2-10	5/2-10	11/5-22	0.008
Weight loss	8 (9)	7 (12)	1 (3)	NS
*Weight loss, kg	4 ± 3	4 ± 3	3 ± 0	0.013

Data are presented as mean and standard deviation and percentages in parenthesis,
*Median/intercuartilic range.
GDM+: With Gestational Diabetes Mellitus; GDM−: Without Gestational Diabetes Mellitus; BMI: Body Mass Index

Table 2: Anthropometric Characteristics.

Variable	GDM+	GDM−	*P*
n (%)	59 (65)	32 (35)	–
GTT			
*First glucose level (mg/dL) [a]	112 ± 24	80 ± 8	<0.001
*Glucose level 1 hr post load (mg/dL)	196± 20	145 ± 16	<0.001
*Glucose level 2 hrs post load (mg/dL)	175 ± 32	131 ± 24	<0.001

GTT: Glucose Tolerance Test; GDM+: With Gestational Diabetes Mellitus; GDM−: Without Gestational Diabetes mellitus; WG: Weeks Gestation; [a]24 ± 6 WG
*Mean and standard deviation.

Table 3: Glycemic values.

Gestational hypertension was defined as a blood pressure greater than 140/90 mmHg without proteinuria in a pregnancy greater than 20 WG; preeclampsia was considered when blood pressure was greater than 140/90 mmHg in combination with proteinuria greater than 0.3 g/24 h after 20 WG. A preterm birth was considered as that occurring between 22 and 37 WG; post-term pregnancy was defined as a birth after 42 WG [13].

The study was previously approved by the institutional ethics committee. All data were captured and analyzed using SPSS version 19. Descriptive statistics for quantitative variables are presented as measures of central tendency and dispersion. Qualitative variables are expressed in ratios and proportions. The prevalence of GDM was determined A $P<0.05$ was considered significant.

Results

We included 91 patients with a mean age of 27 ± 6 years. Of these patients, 77% had a first order family history of T2DM, and 8% received treatment to become pregnant.

Hirsutism was present in 62%, acne in 46%, acanthosis nigricans in 71%, chronic anovulation in 69%, and infertility in 8%. Hypertensive syndrome was present in 22%, of which 15% had gestational hypertension, and 7% preeclampsia (Table 1).

Mean BMI in early pregnancy was 29 ± 7 kg/m^2, distributed as 3% underweight, 30% normal weight, 26% overweight, and 41% obese. There was a weight gain of 10 ± 5 kg in 91% of the patients, median 6 kg and intercuartil range (IR) 2-10 kg. In 9% there was a weight loss of 4 ± 3 kg, median 5 kg and IR 1-8 kg. These variables showed a significant difference only in weight loss, which was greater in patients with GDM according to both classifications (P=0.008) (Table 2).

The first fasting glucose determination was obtained at ~~40~~ 24 ± 6 WG. The prevalence of GDM was 64.8% (95% CI, 54.6-73.9). Mean age was 26 ± 5 and 28 ± 7 with and without the diagnosis of GDM, respectively. When evaluating the patients, a mean fasting glucose of 112 ± 24 mg/dL for the diagnosis of GDM and of 80 ± 8 for those without a diagnosis of GDM was found. The mean of the second measure at 1 h post load was 196 ± 20 mg/dL and 145 ±164 mg/dL and of the third glucose measure at 2 h post glucose was 175 ± 32 mg/dL, and 131 ± 24 mg/dl, with and without the diagnosis of GDM, respectively (Table 3).

Perinatal outcomes were the following: of the newborns, 52% were male and 48% female with a mean of 38 ± 2 WG; 12% were preterm and 1% post mature; 8% weighed <2500 g, 84% were between 2500 and 3999 g and 8% > 4000 g. All newborns preterms weighed < 2500 g and post mature newborns corresponding to the no GDM group weighed > 4000 g. Vaginal deliveries occurred in 26%, and 74% were born by cesarean section (Table 4).

Only 83% of the patients received treatment for GDM: 11%, only diet, 78%, metformin and 11% metformin plus insulin. We found no difference in weight gain when comparing the treatment group with those who did not receive treatment. On the other hand, patients who did not receive treatment had a greater weight loss (p <0.001).

Discussion

To date, there are several studies that describe the risk of obstetric complications in women with PCOS, with inconclusive results. An increased risk of DMG GDM, hypertensive disorders during pregnancy, obesity, hyperinsulinemia, and preterm birth have been identified in

Variable	Total	GDM+	GDM−	*P*
n (%)	91	59 (65)	32 (35)	–
Birthweight				
< 2500 (g)	7 (8)	2 (3)	5 (16)	0.05
2500-3999 (g)	77 (84)	50 (86)	25 (81)	NS
≥ 4000 (g)	7 (8)	6 (10)	1 (3)	NS
Height (cm)*	51 ± 6	51 ±7	51 ± 3	NS
Female	44 (48)	30 (51)	13 (42)	NS
Male	47 (52)	29 (49)	18 (58)	NS
Gestational age (weeks)*	38 ± 2	38 ± 2	39 ± 2	0.025
Preterm	11 (12)	5 (9)	6 (19)	NS
Posterm	1 (1)	–	1 (3)	NS
Vaginal delivery	24 (26)	17 (29)	7 (22)	NS
Cesarean	67 (74)	42 (71)	25 (78)	NS

*Data are presented as mean and standard deviation.
GDM+: With Gestational Diabetes Mellitus; GDM−: Without Gestational Diabetes Mellitus

Tabla 4: Neonatal outcomes.

these patients [1,2,4,5]. A meta-analysis of PCOS in women found a significantly higher probability of developing gestational diabetes (OR 3.66; 95% CI: 1.20- 11.16). [6] Pregnant women with PCOS experience a higher incidence of perinatal morbidity from GDM, pregnancy-induced hypertension, and preeclampsia. Their babies are at an increased risk of neonatal complications, such as preterm birth and admission to a neonatal intensive care unit [14]. On the other hand, studies show that the prevalence of these complications is not altered if there is a history of PCOS, as demonstrated by Haakova et al. in 2003 [2].

The prevalence of GDM in our study was significantly greater than that reported in previous studies, including our country. Reyes-Muñoz, in a cohort study found an incidence of GDM of 26.9% among pregnant Mexican women with a history of infertility and PCOS [9].

The risk of developing this form of diabetes increases with age, obesity, it is often associated with a strong genetic predisposition complex and not fully defined in our population.

Various risk factors for developing GDM have been described, including obesity and hyperinsulinemia, which are also associated with increased insulin resistance in women with PCOS. These patients present increased adiposity, particularly abdominal, associated with hyperandrogenemia. Previous reports suggest that the increased incidence of GDM is largely explained by obesity and less by PCOS [2,7,10,15]. However, other authors relate it more to pre-gestational hyperinsulinemia regardless of weight and weight gain [2,15].

Our patients with GDM had a higher rate of obesity at the start of their pregnancy than those who did not develop GDM, with no statistically significant difference; likely due to sample size. We also noted greater weight variability during pregnancy, which contrary to what was expected, was lower in patients with GDM. Remarkably, the GDM group presented a lower weight gain although this was not statistically significant possibly due to the fact that 83% of the patients received treatment. This study was a retrospective review and treatment decision was made by the attending physicians.

Pre-pregnancy, antenatal, and intrapartum care should be aimed at reducing the risk of GDM. The use of drugs during pregnancy to lower insulin resistance has been proposed to reduce the probability of developing preeclampsia or gestational diabetes but randomized controlled trials to support this treatment strategy during pregnancy are necessary [14].

Early detection of GDM is critical because these patients are at risk for developing T2DM, which occurs in up to 50.4% [1,8,9,15]. It has also been associated with the development of neonatal abnormalities such as: macrosomy, hypoglycemia, hypocalcemia, polycythemia, hyperbilirubinemia, hyaline membrane syndrome, obesity in later life, and perinatal mortality in up to 7%, and other disorders not clearly associated with GDM, such as cardiomyopathy and renal vein thrombosis [10,11,13,16].. We found no significant differences in the prevalence of macrosomic newborns.

Other characteristics such as hirsutism, acne, acanthosis nigricans, chronic anovulation, infertility, hypertensive syndrome, gestational hypertension, and preeclampsia were similar to other reports.

As a retrospective observational study, our main limitation was the inability to control for potentially confounding variables. Our observations were based on clinical record review in a tertiary care medical institution, the prevalence of GDM in their population is so much higher than what has been reported in the literature including the possibility of referral bias since the study population. We did not evaluate a control group.

Given the high prevalence of GDM found in our study, we believe that our results show strong evidence of an association between GDM and PCOS.

Conclusions

The prevalence of GDM was much higher in our study compared to other reports. We suggest that long-term monitoring of patients with PCOS who develop GDM is mandatory; however, future prospective studies are needed that focus on glycemic control in women with PCOS during pregnancy.

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