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Depressive Symptoms in Pregnant Women: Does Diabetes Have an Impact?

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Abstract

Background: Potential adverse consequences of maternal depression such as preterm labour and delivery, NICU admission, and altered development in the offspring underscore the need to better delineate contributing risk factors. Despite the association of diabetes and depression in non-gravid populations, there is limited data on the impact of a diabetes diagnosis on the prevalence of depression during pregnancy. The objectives of this study were to examine the prevalence of self-reported depressive symptoms in pregnant women with and without diabetes.

Study Design: This observational study utilized a cross-sectional convenience sampling method. The Beck Depression Inventory, Second Edition (BDI-II) was used to screen women during a routine obstetrical visit. Rate comparisons were performed using the independent *t*-test, the Wilcoxon rank-sum test, and the Kruskal-Wallis test.

Results: Two hundred women were screened. 22% of participants with diabetes and 23% of participants without diabetes reported depression symptoms classified as moderate or severe. There were no statistically significant differences between the two groups regarding somatic, cognitive, or total BDI-II scores.

Conclusion: Given the rates of depression symptoms reported in this population and the possible negative sequelae of untreated depression, screening for this condition should be a routine component of quality prenatal care regardless of comorbidities.

Keywords: Depression; Pregnancy; Diabetes; Prenatal Care; BDI-II

Introduction

Depression is the leading cause of disease-related disability in women around the world [1]. Lifetime prevalence rates of depression vary throughout the women's life and women of childbearing age in particular are at high risk for this condition [2]. Pregnancy is a major neuroendocrine and psychosocial life event that may be a time of increased vulnerability for depressive symptoms [3,4]. Estimates of depression prevalence in pregnancy vary widely. One systematic review reported depression rates of 7% in first trimester patients and 12% in second and third trimester patients [5].Another meta-analysis reported between 14% and 23% of pregnant women will experience a depressive disorder while pregnant [2]. Antenatal depression often goes unrecognized and difficult to identify secondary to the overlap in the many of the discomforts of pregnancy are similar to symptoms of depression [6]. A recent study examined the optimal cut off scores for multiple depression scales and fulfilling diagnostic criteria for major depression, demonstrating the potential utility of self-rated scales such as the Beck Depression Inventory in the obstetrical clinic.

Risk factors for depression in pregnancy include a prior history of depression or premenstrual dysphoric disorder, younger age [7], limited social support [8], living alone, greater number of children, marital conflict [9], and ambivalence about pregnancy. A recent study examined the association of diabetes, both gestational and pre-gestational, as an independent risk factor for depression in pregnancy [10].

The association of diabetes and depression in non-gravid samples has yielded some interesting results. A meta-analysis found that the presence of diabetes doubled the odds of comorbid depression [11]. Major depression occurs in approximately 11% to 15% of patients with diabetes and is associated with both hyperglycemia and increased risk of diabetes complications. Notably, treatment of depression has been associated with improved glycemic control in both short and long-term treatment studies of patients with diabetes [12]. Patients with diabetes require a great deal of self-care including adherence to meal plans, self-monitoring of blood glucose, medication management, and frequent follow-up clinic visits. The presence of comorbid depression has been associated with decreased compliance with diabetes self-management [13]. Good glycemic control and preventive wellness is even more critical during pregnancy to ensure good outcomes for the mother and the neonate, as well as the future health of the child.

The prevalence of diabetes in pregnancy has increased along with the prevalence of diabetes in the general population [14]. Poorly-controlled maternal diabetes early in pregnancy is associated with increased risk of spontaneous abortion, fetal malformation, and preeclampsia. Fetal exposure to hyperglycemia later in pregnancy is associated with high birth weight, increased childhood and adult obesity and increased risk of type 2 diabetes in the offspring [15,16]. These risks, combined with

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the risks of untreated depression in pregnancy, could substantially raise the possibility of adverse maternal and fetal outcomes.

The objectives of the current study were to assess the prevalence of self-reported depressive symptoms in women with and without diabetes receiving prenatal care at a University-based Women's Clinic (UWC).

Materials and Methods

Participants, study design and process

This study surveyed a cross-sectional, convenience sample of pregnant women at a UWC between June 2006 and December 2008. This UWC is an integral part of an extensive outreach program established by the University Division of Maternal Fetal Medicine to provide health care for low-income patients throughout a Southern state with approximately 90% of the patients receiving State-funded Medicaid.

Subjects were initially approached by a member of the investigative team during the course of a routine prenatal visit. All participants provided informed consent. This research protocol was approved by the University Institutional Review Board.

Depression instrument

The study utilized the Beck Depression Inventory, Second Edition (BDI-II) [17]. The BDI-II is self-rated scale composed of 21 multiple-choice items to assess the severity of depressive symptoms including both cognitive (psychological) and somatic (physical) symptoms. The patient is asked to consider each question statement as it relates to how she has felt over the past two weeks. The 4-point scale ranges from 0 to 3, with a total scale score range of 0 to 63. Symptom severity was coded according to the scoring guideline: 0 to 13 is minimal depression, 14 to 19 is mild depression, 20 to 28 moderate depression and 29 and above is severe depression. The BDI has demonstrated good psychometric properties in pregnant populations [18,19]. According to the American College of Obstetricians and Gynecologists Committee Opinion No. 453, it is an appropriate screening tool in this patient population (ACOG 2010).

Data analysis

Presence of depressive symptoms in our sample, based on the BDI-II total scores, was reported in percentages. Descriptive statistics of the participants' demographics and characteristics were provided. Independent *t*-test or Wilcoxon rank-sum test, as appropriate, was used to determine the differences between the groups of pregnant women with or without diabetes mellitus in terms of the continuous measures such as maternal age, cognitive BDI scores, somatic BDI scores, and BDI total scores.

Additionally, a rank analysis of variance (ANCOVA - extension of the Wilcoxon rank sum test), was used to evaluate the differences in cognitive, somatic, and total BDI scores for these two groups of women while adjusting for maternal age and gestational age [20,21]. For ordinal outcomes, the Cochran-Mantel Haenszel (CMH) statistic based on mid-rank scores was used to assess the relationship between levels of depression and gestational age with diabetes. Differences of the BDI-II scores among groups (no diabetes, type 1 diabetes, type 2 diabetes, and gestational diabetes mellitus (GDM) were evaluated using the Kruskal-Wallis test. All statistical analyses were performed using SAS 9.2 (SAS Institute Inc., Cary, NC, USA) using a two-sided test with p-values < 0.05 considered statistically significant.

Results

A total of 100 pregnant women with Diabetes Mellitus (DM) and 100 pregnant women without diabetes mellitus (NDM) were screened using the BDI-II instrument over a 2.5 year period at the UWC. Baseline demographics and characteristics of the participants are presented in Table 1. The matched number for racial status between the two groups was unintentional. The mean age of participants in the DM group was higher than the NDM group (28.3 vs. 24.9 years, $p < 0.001$). The DM group had an earlier gestational age at the time of screening (1st and 2nd trimesters) while the NDM group had a later gestational age (3rd trimester). There were no differences between the DM and NDM groups regarding somatic, cognitive, or total BDI-II scores using the Wilcoxon rank-sum test. In addition, the results from the rank ANCOVA also suggested no statistical differences between the DM and NDM groups regarding somatic, cognitive, or total BDI-II scores while adjusting for maternal age and gestational age. History of depression was reported more frequently in the DM group (28% vs. 21%) but the difference is not statistically significant.

Forty participants in the DM group had GDM and 41 participants had type 2 diabetes (Table 1). The median hemoglobin A1C level was 7 with values ranging from 4.7 to 14.6. Although not statistically significant, the BDI-II total scores were slightly higher in the DM group when compared to the NDM 7 group (10.5 vs. 10.0, $p = 0.378$). Remarkably, few of women who participated in the study received treatment for depression. In participants with severity scores categorized as either moderate or severe, only 8 (17.8%) individuals received some form of depression treatment (Table 2).

Symptoms of depression were classified based on the BDI-II total scores and were similar in both groups. Twenty-two percent of participants with diabetes and 23% of participants without diabetes reported depressive symptoms in the moderate or severe categories. There were only 5% and 7% of the participants in the DM and NDM groups who were receiving treatment for depression (medication and/or psychotherapy) at the time of their participation in this study. Among the number of participants with diabetes, 11% (2/19) of individuals with type 1 diabetes reported moderate or severe symptoms, 24% (10/41) with type 2 diabetes reported moderate or severe symptoms, and 25% (10/40) with gestational diabetes reported moderate or severe symptoms (Figure 1).

In the subsequent analysis based on the Kruskal-Wallis test (Table 3), individuals with type 2 diabetes had a tendency to report higher scores of somatic, cognitive and BDI total; however, based on this sample, no statistical significance was achieved.

Discussion

In this cross-sectional, convenience sample of pregnant women, 22% of participants with diabetes and 23% of participants without diabetes reported moderate or severe symptoms of depression classified by the BDI-II. The percentage of women in our study who reported moderate or severe depression symptoms was similar to the upper end of the range reported in a previous study [11].

Depression in pregnancy is common and can have devastating consequences for the woman, the child, and the family. Risks of untreated depression during pregnancy include low-birth weight, preterm delivery, decreased maternal appetite with decreased weight gain, decreased participation in prenatal care, anxiety, premature delivery, lower Apgar scores and increased neonatal ICU admissions, and postpartum depression [22,23]. Infants of depressed mothers

Variable	Diabetes group (n=100)	Non-diabetes group (n=100)	*p*-value
Age (year) Mean ± SD, range	28.3 ± 6.6 18-43	24.9 ± 5.6 15-46	<0.001
Race (n) White, non-Hispanic African American Hispanic Other	 47 33 17 3	 47 33 17 3	1.00
Gestational age at time of BDI (n) First trimester Second trimester Third trimester	 20 47 32	 15 40 45	0.177
History of depression (n)	28	21	0.250
Received treatment (either medication or psychotherapy) (n)	5	7	0.552
Type of Diabetes (n) 1 2 Gestational	 19 41 40		
HbA1C : Median (25% - 75% percentile), range	7 (5.8-8.8) 4.7-14.6		
BDI Scores Total BDI scores: Median (25% - 75% percentile), range	10.5 (6 - 18) 1-43	10 (6 - 18) 0-43	0.378
Somatic BDI scores (items #s) : Median (25% - 75% percentile), range	6 (4 - 8.5) 1-17	6 (4 - 8) 0-18	0.385
Cognitive BDI scores (items #s): Median (25% - 75% percentile), range	4 (2 - 10) 0-30	4 (1 - 10) 0-26	0.370
Severity of depression according to total BDI scores No depression and minimal symptom (0 - 13) 60 Mild (14 - 19) Moderate (20 - 28) Severe (≥ 29)	 60 18 13 9	 65 12 14 9	0.11

Table 1: Baseline Characteristics of Patients.

	Current Treatment				
Severity of depression according to total BDI scores	**None**	**Antidepressant medication**	**Pschycotherapy**	**Both**	**N**
Minimal (0-13)	121	3	1	-	125
Mild (14-19)	30	-	-	-	30
Moderate (20-28)	24	3	-	-	27
Severe (≥ 29)	13	3	1	1	18

Table 2: BID Scores and Treatment Status among Participants.

	No DM (n = 100)	Type 1 DM (n = 19)	Type 2 DM (n = 41)	Gestational DM (n = 40)	p-values
Total BDI scores: Median (25% - 75% percentile)	10 (6 - 18)	10 (8 - 16)	13 (8 - 18)	9.5 (4 - 18.5)	0.354
Somatic BDI scores: Median (25% - 75% percentile)	6 (4 - 8)	6 (5 - 7)	8 (4 - 10)	6 (3.5 - 8)	0.354
Cognitive BDI scores: Median (25% - 75% percentile)	4 (1 - 10)	3 (3 - 10)	6 (2 - 10)	4 (1 - 10.5)	0.435

*Note: Results from the Kruskal-Wallis test showed no statistical significance across the four groups

Table 3: Reported BDI scores*.

display delayed psychologic, cognitive, neurologic, and motor development [24].

For many women in lower socio-economic groups, health care during pregnancy represents a period of increased care with health care professionals and the opportunity to screen for other medical conditions such as depression. In the current study the BDI-II was well tolerated in the UWC setting and provided overall rates of depression similar to previous reports. Screening for antenatal depression, particularly in high risk populations such as those with a history of depression and/or diabetes, is an integral aspect of optimizing overall treatment outcomes. Identification and appropriate intervention of maternal depression in pregnancy has the potential to improve neonatal outcomes and decrease lost productivity and direct medical costs [25].

In contrast to our hypothesis and previous reports, we found no significant difference between women with diabetes and those without diabetes. Despite being a relatively small convenience sample, a recent study in women during the perinatal period suggested that a 5 point difference in the BDI score would imply a clinically relevant difference. To achieve an 80% power and a significance level (alpha) of 0.05 using a two-sided Wilcoxon rank sum test would require a minimum of 65 participants per cohort [26]. Therefore, given our sample size of 100

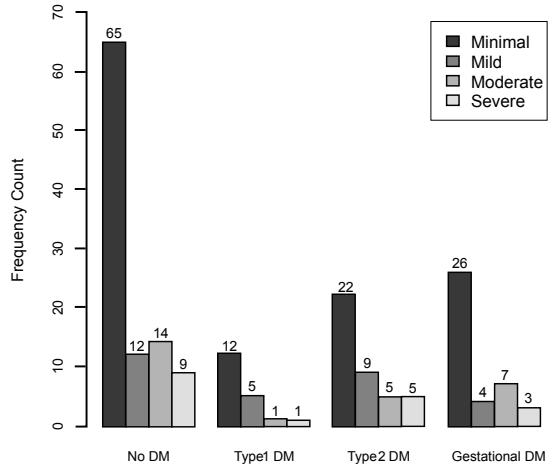

Figure 1: Classification of the symptoms of depression based on the BDI-II total scores.

women per group, our study had the necessary number of participants needed to detect a clinically meaningful group difference. It is feasible that in a population of lower-socioeconomic pregnant women those other factors significantly influence depressive symptoms precluding our ability to isolate the impact, if any, of diabetes. Closer scrutiny of psychosocial factors germane to this population such as income level, marital status, education level, and employment status will provide further insight into the relationship(s) of impaired glucose utilization/metabolism and depressive symptoms during pregnancy. The fact that moderate to severe depression symptoms appeared frequently in both groups and only 5% and 7% of the DM and NDM groups, respectively, were receiving any treatment for depression underscores the need for improved clinical awareness and identification of depression in all pregnant patients. ACOG Committee Opinion No. 453 states that there is insufficient evidence to support a firm recommendation regarding the frequency of antenatal and postnatal depression screening at this time but because of the potential benefit to a woman and her family, it should strongly be considered [27].

A joint consensus statement by the American Psychiatric Association and ACOG in 2009 evaluates and summarizes the risks of depression and antidepressant use during pregnancy. This publication also provides useful algorithms to aid in depression treatment decisions and management [25].

Limitations

The present study is limited by its cross sectional design, it is likely that repeated measures across pregnancy would have provided a better overall assessment of depressive symptoms between the two groups. The use of a clinic sample that is predominantly Medicaid recipients and represents lower socioeconomic status limits generalizability of our results. Further it is feasible that the myriad of psychosocial stressors often found in this population contributed to the relatively high rate of depressive symptoms and precluded our ability to detect the impact, if any, of co-morbid diabetes.

Another limitation of our study was lack of a confirmed depression diagnosis. Even though the BDI-II total score is one of the best screening tools for major depression diagnosis with high sensitivity (94%) and specificity (92%) when using BDI-II total score of 18 as the cut-off [28], confirming the diagnosis of depression would provide a more robust assessment of the prevalence of depression in our study.

Conclusions

In this study, we found that 22% of participants with diabetes and 23% of participants without diabetes reported moderate or severe symptoms of depression yet very few women were receiving treatment for depression in this population. The potential adverse effect of depression in pregnancy and contribution to later postnatal depression underscores the clinical need to incorporate such assessment in prenatal clinics.

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