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ORIGINAL ARTICLE

Unplanned Cesarean delivery is associated with risk for postpartum depressive symptoms in the immediate postpartum period

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ABSTRACT

Purpose: Postpartum depression (PPD) is a common pregnancy complication. The association between cesarean delivery (CD) and PPD has shown conflicting results in prior studies, although emergent CD appears to be a clear risk factor. Establishing PPD risk is critical and may, however, be related to the unplanned nature of the CD, rather than the surgery itself. Our objective was to determine whether women who underwent unplanned CD were more likely than those with vaginal delivery to have higher depressive symptoms and thus screen positive for PPD risk in the immediate postpartum period.

Materials and methods: This cohort study was conducted at a community medical center using data for deliveries between 8/2015–1/2016. Women were screened in the hospital for depressive symptoms (PPD risk) using the Edinburgh Postnatal Depression Scale (EPDS) within 4 days post-delivery. Logistic regression, adjusting for maternal race/ethnicity and parity, was performed to evaluate the association between delivery route (vaginal vs planned vs unplanned CD) and PPD risk (EPDS $\geq$ 10).

Results: A total of 2094 women had complete data for analysis. Overall, 44 women (2.1%) screened positive for PPD risk. Logistic regression results showed that unplanned CD was significantly associated with PPD risk (OR = 2.28, 95% CI 1.13–4.57, $p = .022$), after adjusting for parity and race/ethnicity. Planned CD was not associated with PPD risk.

Conclusion: Unplanned CD may be an independent risk factor for PPD risk in the immediate postpartum period. This finding might explain why some previous studies have demonstrated different results with regards to risk of CD where the unplanned nature of the delivery was not accounted for.

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Cesarean delivery; postpartum depression; postpartum depression screening

Introduction

Depression is one of the most common complications of pregnancy. The estimated prevalence of postpartum depression (PPD) has been demonstrated through multiple studies to be approximately 10–16% [1–3], with rates as high as 33% in ethnic minorities [4–7]. The effects of PPD decrease a mother's quality of life and potentially limit the intimate mother-newborn bonding experience, which can lead to poor infant and early childhood outcomes [8–16] and an increased need for psychiatric care among older children of mothers with untreated PPD [17,18]. Establishing obstetric risk factors for PPD, as well as timely depression screening, can enable early diagnosis and intervention. Route of delivery, specifically cesarean delivery (CD), has been implicated as an obstetric risk factor for PPD in the months following delivery [19–21]. Most studies, however, do not include routine screening for PPD using validated and reliable depression screening tools such as the Edinburgh Postnatal Depression Scale (EPDS) [22]. Exact timing of PPD diagnosis is also rarely specified, only that it was coded in the medical record within the first year postpartum. Therefore, identification of PPD early in the postpartum period with routine screening using a validated tool may facilitate more prompt referrals to psychiatric care and provide early interventions to minimize negative effects on families [18]. The present study was designed with these goals in mind.

The urgency of CD may also be a factor in the development of PPD. For a woman planning to deliver vaginally, the unexpected sudden change in plan in delivery route may contribute to her PPD risk, hypothetically through the increase in stress [19]. For example, in a recent study, women without prenatal

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depression were screened at 8 and 16 weeks postpartum and those who delivered vaginally had lower screening scores compared to women who delivered by CD. This relationship was even stronger for the emergent CD group [23]. In 7 of the 20 studies examined in a meta-analysis on the association between CD and PPD, a significant association between emergent (unplanned) CD and PPD [95% CI Pooled OR 1.47 (1.33–1.62)] was reported when CD was distinguished as elective versus emergent [24]. Another recent study examined the association between route of delivery and PPD risk [25] comparing EPDS scores at 6 weeks postpartum between three groups of women. There was no significant difference in PPD risk when comparing women who delivered by elective (planned) CD to vaginal delivery. Interestingly, women who reported a negative experience of delivery were found to be at increased risk of PPD regardless of delivery route [25]. These studies suggest a possible contribution of CD timing (planned/unplanned) and the unmet expectations of a vaginal delivery that may contribute to a woman's risk of PPD.

Since the planned/unplanned nature of CD is not always accounted for in most studies and may be an important contributing factor, it is not surprising that CD does not always correlate with PPD risk in the existing literature [26–28]. The question of whether CD (planned or unplanned) is associated with the development of PPD in the immediate postpartum period remains. This is an opportune time to compare risk for PPD between women who have had a CD compared to a vaginal delivery because depression interventions can begin while the patient is still admitted. Therefore, research using the EPDS in the immediate postpartum period is warranted. Our objective was to determine whether women who had CD were more likely to screen positive for PPD risk in the immediate postpartum period (0–4 days following delivery). We hypothesized that women who underwent CD, especially unplanned CD, would have higher risk for PPD in the immediate postpartum period.

Materials and methods

Participants

Data were collected from women who delivered within the study window (8/30/2015–1/31/2016) at a community medical center located in New Jersey with a yearly delivery rate of approximately 5000 births. This secondary data analysis included 2094 women who completed depression screening at 1 time point in the immediate postpartum period, defined as between 1–4 days following delivery. IRB approval was obtained.

Procedures

After delivery and prior to discharge, the EPDS was administered. While inpatient, the paper form was given to each patient by a member of the nursing staff. The EPDS is a 10-item scale that assesses the cognitive and affective components of depressive symptomatology, while excluding somatic symptoms specific to the perinatal period. Each answer is given a score of 0 to 3 and the maximum score is 30. The EPDS has been validated for use in pregnant and postpartum women and the sensitivity and specificity was 86% and 78%, respectively [22].

Scoring criteria

The EPDS score was used as a dichotomous variable (EPDS $\geq$ 10) in this study. This cutoff score is recommended as optimum for the properties of sensitivity and specificity for risk of moderate depression [22]. The analyses were then repeated with a lower cutoff (EPDS $\geq$ 8), to investigate whether a lower cutoff for risk of mild depression would increase sensitivity in the immediate postpartum period.

Outcomes

EPDS scores, demographic data including age, race/ethnicity, BMI, gravida and parity were collected by extraction from the electronic medical record. Route of delivery including the planned/unplanned nature of CD as it relates to patient expectation (planned vs unplanned vs planned but earlier than expected) were verified by indication for CD as described in the operative report.

Exposures

EPDS scores were compared across three groups: those who delivered vaginally, those with a planned CD, and those with an unplanned CD. The unplanned CD group includes both emergent, unexpected CD as well as those where a CD was anticipated but occurred earlier than expected (e.g. repeat CD performed at 33 weeks for preeclampsia). Designation of CD group was made by individual chart review.

Table 1. Demographic and clinical variables stratified by PPD risk (EPDS ≥ 10) for descriptive purposes for $N = 2094$ women.

	Screen negative for PPD risk (EPDS < 10) $N = 2050$ (97.8%)	Screen positive for PPD Risk (EPDS ≥ 10) $N = 44$ (2.1%)	p Value
Age			.18
< 35	1653 (80.6)	32 (72.7)	
≥ 35	397 (19.4)	12 (27.3)	
Race			**<.0001**
White	1661 (81.0)	19 (43.2)	
Black	88 (4.3)	3 (6.8)	
Hispanic	86 (4.2)	6 (13.6)	
Other	215 (10.5)	16 (36.4)	
BMI	29.87 ± 5.55	32.36 ± 6.64	**.003**
Parity			**.0005**
Nulliparous	597 (29.1)	22 (50.0)	
Multiparous	1043 (50.9)	21 (47.7)	
Grand multiparous (p ≥5)	410 (20.0)	1 (2.3)	
Delivery type			**.0005**
Vaginal	1680 (82.0)	26 (59.1)	
Cesarean	370 (18.0)	18 (40.9)	
Timing of Cesarean	$N = 370$	$N = 18$	.46
Unplanned	226 (61.1)	13 (72.2)	
Planned	144 (38.9)	5 (27.8)	

Values are Number (%) or mean ± standard deviation.
Comparison was tested with t-tests (BMI) or Fisher exact test. Statistically significant p values in bold.
[a]EPDS: Edinburgh Postnatal Depression Scale.

Statistical analysis

Numerical variables were summarized by mean and standard deviation and were compared across groups using the t test. Categorical variables were summarized by frequencies and percentages and were compared across groups using the Fisher exact test. PPD risk (EPDS ≥ 10) was compared between subjects who delivered vaginally versus planned CD versus unplanned CD. Multivariable logistic regression models were estimated to evaluate the association between delivery route and PPD risk, adjusting for race/ethnicity (white versus nonwhite) and parity.

To address a secondary question regarding mild PPD, an additional multivariable logistic regression evaluated the association between delivery route and mild PPD risk (EPDS ≥ 8), adjusting for race/ethnicity, parity, age (≥ 35 versus < 35), and BMI (≥ 35 versus < 35). Adjusted odds ratios (OR) and their 95% confidence intervals (CI) were reported for the logistic models. A two-sided 0.05 significance level was used throughout. Statistical calculations were made using SAS version 9.4 (SAS Institute, Cary, North Carolina).

Results

A total of 2100 women delivered within the study window and 2094 women had complete data for analysis (> 99% screening rate). The mean age was 29.31 years (SD = 5.72) and approximately 20% of women were advanced maternal age (≥ 35 years old). Approximately 80% of the women were White, 4% were Black, 4% were Hispanic and 11% self-reported as "other race/ethnicity." Approximately 30% were primiparous, 50% were multiparous, and 20% were grand multiparous (≥ 5 previous deliveries after 20 weeks gestational age). Mean BMI was 29.92 (SD = 5.59). Overall, 44 women (2.1%) screened positive for PPD risk (EPDS ≥ 10). The mean EPDS score was 2.1 (SD = 2.8). Screen positive frequencies by delivery type varied significantly ($p = .0009$): Of patients who had a vaginal delivery, the screen positive rate was 1.5%, which was significantly lower than the screen positive rate for CD of 4.6% ($p = .0005$). The screen positive rates for the CD group broken down into planned and unplanned categories were as follows: planned CD was 3.4% and unplanned CD was 5.7% ($p = .46$). All participant characteristics were stratified by PPD risk in Table 1.

Univariate analysis showed that mean PPD scores vary based on parity ($p < .0001$). Grand multiparous women ($N = 411$) and multiparous women ($N = 1064$) had significantly lower depression scores when compared to primiparous women ($N = 619$). White race was also found to be protective compared to nonwhite race/ethnicity ($p < .0001$) (Table 2). Logistic regression results showed that unplanned CD (including unplanned and planned but delivered earlier than expected) was significantly associated with PPD risk compared to vaginal delivery after adjusting for parity and race/ethnicity (OR = 2.28, 95% CI 1.13–4.57, $p = .022$) (Table 2). Planned CD was not significantly associated with PPD risk. Age was not associated with PPD risk in univariate analysis ($p > .15$) (Table 2) and therefore was not included as a covariate in the multivariable logistic model. Although BMI was significantly associated with PPD risk in univariable analysis, it was

Table 2. Logistic regression model results for depression risk (EPDS $\geq$ 10).

	OR	95% CI	*p* value
White race/ethnicity	0.24	0.13–0.44	<.0001
Parity:			
Primiparity	1.00 (Reference)		
Multiparity	0.56	0.30–1.04	.068
Grand multiparity	0.13	0.02–0.98	.048
Mode of delivery:			
Vaginal delivery	1.00 (Reference)		
Planned CD	1.96	0.72–5.30	.19
Unplanned CD	2.28	1.13–4.57	.022

not significant in the multivariable model and was not included in Table 2. The protective effects of grand multiparity and white race remained significantly associated with PPD risk in the multivariable logistic regression model.

In order to include additional covariates that are well known in the literature to be associated with PPD (maternal age, race, parity, and BMI), we conducted a secondary logistic regression analysis to investigate whether CD was associated with mild PPD risk (EPDS $\geq$ 8). A total of 100 women (4.8%) screened positive for mild PPD risk (EPDS $\geq$ 8) which allowed for more predictors in the logistic model. In this model with the lower cutoff, both planned CD and unplanned CD were associated with mild PPD risk (OR = 2.34, 95% CI 1.23–4.59, $p = .0084$, and OR = 1.92, 95% CI 1.14–3.22 $p = .014$ respectively), adjusting for maternal age, race, parity, and BMI. Grand multiparity and white race were again found to be protective (OR = 0.24, 95% CI 0.10–0.59, $p = .0019$, and OR = 0.34, 95% CI 0.22–0.52, $p < .0001$). Additionally, multiparity was also found to be protective (OR = 0.46, 95% CI 0.30–0.71, $p = .0005$). Age and BMI were not found to be significantly associated with mild PPD risk (EPDS $\geq$ 8).

Discussion

Principal findings

Unplanned CD may be an independent obstetric risk factor for PPD risk in the immediate postpartum period. This cohort had low rates of PPD risk (2.1%) compared to epidemiological rates [1–3]. Unplanned CD (including unplanned and planned but delivered earlier than expected) remained significantly associated with PPD risk after adjusting for parity and race/ethnicity, with white race and grand multiparity found to be protective against PPD risk.

Comparison with existing literature

There may be an effect of unanticipated outcomes on the risk of PPD. This is consistent with prior studies that show an increased risk of PPD with emergent deliveries [24,25]. The present study, however, examined planned and unplanned nature of CD to account for an unexpected outcome regardless of whether the CD was elective or not. For example, a patient who was planning to have a repeat CD at 39 weeks and is instead delivered at 34 weeks with preeclampsia with severe features may have been counted as "elective CD" in prior studies. We argue this patient may have a similar PPD risk as a woman who has an unexpected emergent CD at term for fetal indications. By separating planned from unplanned and planned but earlier than expected, we can separate risk of an unanticipated outcome rather than the route of delivery itself. This is consistent with a prior study demonstrating women who preferred a vaginal delivery but delivered by CD had significantly higher PPD screening scores [29]. Additionally, primiparous women in a separate study who had an unplanned CD were more likely to have negative feelings about their first childbirth [30]. Finally, a recent, large observational study reported increased risk of PPD with exposure to general anesthesia, versus regional anesthesia, at the time of CD [31]. We posit that the unplanned or emergent nature of the CD, which likely made up most of the group exposed to general anesthesia, is an independent risk factor.

Strengths, limitations and future directions

Compared to prior research, this prospective study utilized a relatively large, non-database, US sample which permitted control for important covariates including parity and race/ethnicity. Another strength is the high rate of screening in this medical center in the immediate postpartum period. The designation of CD, including "planned" and "unplanned" as we have defined it, appears to be original compared to prior studies which separate only elective from emergent CD. Our approach, obtaining CD designation *via* individual chart review, is novel because the unexpected nature of a planned CD that occurred early could be captured. A future study would elicit delivery preferences from the women in real time to evaluate whether delivery route versus the unplanned nature of delivery is the true risk factor for PPD. This study took place at a single community medical center with a high rate of white and multiparous/grand multiparous women and

therefore may not be generalizable to all populations, an important limitation.

Another limitation is that we only have screening data from the immediate postpartum period. Screening in the immediate postpartum period may be less sensitive than later in the postpartum period, as evidenced by the low screen positive rate in the current study. However, it remains a convenient time to screen for both providers and patients and allows for prompt intervention if necessary. Immediate postpartum screening also allows the opportunity to pick up previously undiagnosed prenatal depression, which would not be expected to resolve immediately following delivery. Ideal timing of depression screening has not been established and data are limited on screening in the immediate postpartum period [32–37]. Indeed, only one of the 28 studies included in the meta-analysis described above reported PPD scores collected prior to hospital discharge [24]. However, there are studies to suggest depressive symptoms found on screening within one week postpartum period are predictive of depressive symptoms up to four months postpartum [38,39]. Future research would benefit from assessing depressive symptoms, as well as anxiety and post-traumatic stress symptoms, repeatedly rather than only once. For example, a second screening at 4 weeks postpartum may also help to identify women with postpartum depression, especially for those that screened positive initially, since this has been noted as a peak for mental health symptoms in some studies [21]. Multiple screening timepoints may also yield more screen positives, which would not only identify women who may need intervention but also would allow control for more covariates in analysis, as we demonstrated in the mild PPD risk group. A personal history of depression (one of the main risk factors for PPD) could also be included, as it is possible we are identifying this subgroup by screening in the immediate postpartum period. Future research will include pre-pregnancy or prenatal history of depression in analyses, as well as socio-economic factors such as insurance type.

Clinical implications

This study demonstrates the clinical relevance of in-hospital immediate PPD screening as well as the importance of identifying additional obstetric risk factors for PPD. While there is a national effort toward lowering CD rate for various medical reasons, this is further evidence to its utility. A critical clinical implication of this research may be in counseling or, more specifically, managing expectations of the patient. Open and frequent communication from providers may mitigate some of the confusion, shock, or disbelief when an unplanned CD or earlier than planned CD is recommended. Obstetric providers should routinely screen for depression because mental health screening is the first step in the pathway to treatment [40,41]. Overall, mental health care might be most acceptable to patients if provided as part of routine obstetrical care [42]. The perinatal period, specifically the immediate postpartum period, is an opportune time for mental health screening, education and referral due to the frequency of contact with health care providers [34].

Conclusion

To our knowledge, this is one of the first studies to measure PPD risk in the immediate postpartum period and investigate association with unplanned CD. Obstetric providers may consider immediate PPD screening, patient education, close follow up, and referral for treatment, particularly for those who deliver *via* unplanned CD.

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Disclosure statement

The authors have no conflicts of interest to disclose.

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