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Brief original

Predictors of postpartum depression in threatened preterm labour: Importance of psychosocial factors

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ABSTRACT

Background: Postpartum depression (PPD) is more common in high-risk pregnancies. One of the main causes of high-risk pregnancy is threatened preterm labour (TPL), a stressful event which involves psychological consequences for the mother. The objective of this study was to identify those psychosocial factors that may imply a greater risk of PPD in TPL women.
Material and methods: A prospective cohort study was carried out, consisting of a sample of 149 pregnant women who suffered from a TPL during pregnancy, and 61 controls. At the time of inclusion, demographic, obstetric, biological, and psychosocial variables were collected. At 3 months postpartum, depressive symptoms were evaluated along with their predictive factors.
Results: Women who suffered TPL showed higher scores in depressive symptomatology ($F(1, 208) = 7.46$, $p = .007$), as well as higher probability of PPD diagnosis than controls ($\chi^2(1) = 8.05$, $p = 005$). Higher maternal age (+.335), lower educational level (−2.15), history of trauma (+.28) and higher trait anxiety scores (+.314) were the main predictors of PPD after TPL.
Conclusions: Experiencing TPL during pregnancy, carries a higher risk of PPD. This risk is mediated by sociodemographic and psychological factors related to chronic stress. The detection of these potentially modifiable risk factors in pregnant women after experiencing TPL would help prevent PPD and improve the maternal–infant prognosis.

Introduction

The World Health Organization has identified perinatal mental disorders as a first order health problem and has highlighted the need of specialized resources for their early detection and management.[1] Postpartum depression (PPD) is the most frequent, with an estimated incidence between 12.5 and 15%, and with suicide being one of the main causes of maternal deaths (5–20%) in high-income countries.[1] PPD is especially common in high-risk pregnancies, reaching rates of 54%.[2,3] In these cases, in addition to the biological disturbances that babies may present,[4] PPD affects mother–infant interaction, additionally contributing to neurodevelopmental disorders in the offspring.[5] Unfortunately, despite its potential dramatic consequences, PPD in high-risk pregnancies it is often underdiagnosed, and its associated risk factors are still unknown.[3,5]

One of the main causes of high-risk pregnancy and the most frequent reason for obstetric admission is threatened preterm labour (TPL), which elicits an acute emotional distress, even if it is not followed by preterm birth.[6] Although antenatal depression after TPL has been demonstrated,[7] there is only one longitudinal retrospective study focused on postpartum depressive symptoms in this specific population.[2] This study found that 54.7% of women who experienced TPL presented PPD at early postpartum, regardless of premature delivery.[2]

Abbreviations: PD, postpartum depression; TPL, threatened preterm labour; IVF, *in vitro* fertilization.

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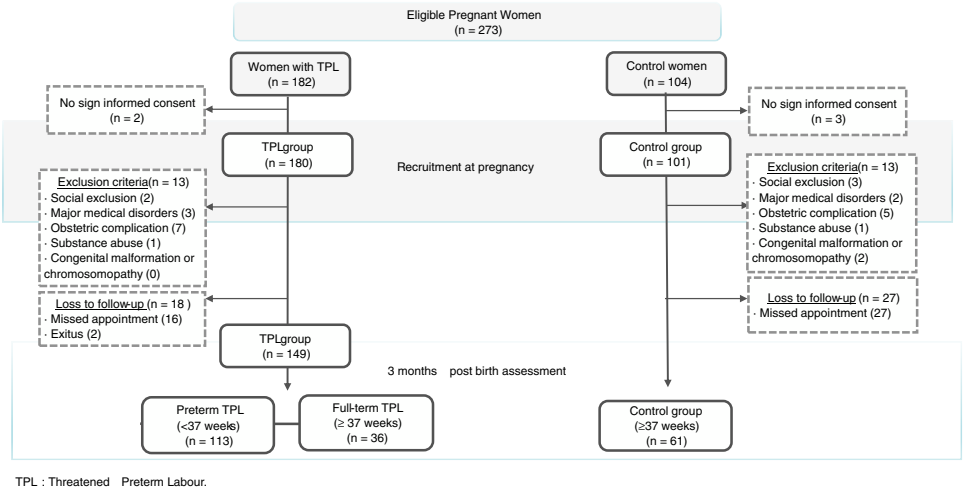

Fig. 1. Recruitment process flowchart. TPL: threatened preterm labour.

Accordingly, the available literature is scarce and not exempt of methodological limitations. Most studies correspond to cross-sectional designs,[2] with small sample sizes,[2] or retrospective measurements,[2] without a control group,[2,3] assessing diverse obstetric complications (caesarean delivery, instrumented labour, eclampsia and vaginal bleeding)[3] and do not distinguish between idiopathic TPL and those secondary to other medical conditions[2] that may independently impact on foetal development and maternal psychopathology.

Our study aimed to longitudinally examine if women with an idiopathic TPL suffer from higher PPD symptoms and discern its associated risk factors through a multidisciplinary approach. According to previous studies,[2,3] we predicted that women who experienced TPL will present greater postpartum depressive symptomatology compared to controls, even if they gave birth at term.[2] We expected to find a specific profile of PPD risk factors in this population, such as older maternal age,[2] lower social support,[2] lower educational level,[3] unemployment,[2,3] prenatal anxiety or depression symptoms[3] or caesarean delivery.[2]

Methods

This prospective study was composed of a cohort sample of pregnant women who experienced TPL (defined by regular and painful uterine contractions and cervical changes, with intact membranes), between 23 and 34 weeks of gestation (to ensure that they received a similar corticosteroid treatment protocol), recruited at Obstetrics Hospitalization Unit in a tertiary referral hospital. The cohort was divided depending on gestational age at birth: TPL Full-term (≥37 weeks) and TPL Preterm (<37 weeks). The control group included women who reached ≥37 gestational weeks without complications.

The exclusion criteria were: (i) mother with severe obstetric complications or major medical disorders; (ii) mothers of new-born who presented congenital malformations or chromosomopathy; (iii) current diagnosis of a DSM-V Axis I psychiatric disorder, based on medical records and structured interview; (iv) risk of social exclusion according to the Europe 2020 Strategy, or (v) significant language barriers. As represented in Fig. 1, a total of 149 TPL and 61 controls participated in the study.

The follow-up covered from inclusion (T1) at TPL diagnosis or from dynamic onset in controls, until 3 months postpartum (T2). At T1, demographic and obstetric variables were collected; psychological and socio-familiar status were assessed using standardized scales (see Table 1). Saliva sample was obtained to determine cortisol and α-amylase levels, as objective stress biomarkers of the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic-adrenal-medullary (SAM) axis, respectively.[8] At T2, data concerning neonatal variables were recorded, and maternal postpartum depressive symptoms were evaluated using the Edinburgh Postpartum Depression Scale (EPDS).[9]

Statistical analysis

First, differences in psychosocial, demographic, and antenatal data between TPL and control groups were examined using *t*-test or Chi-square statistics. Second, an ANOVA was conducted to detect differences between groups (Preterm TPL; Full-term TPL; and Control) on PPD symptomatology at 3 months post birth (EPDS total score). A Chi-square test was carried out to determine differences between groups regarding the number of depressed women (EPDS total score ≥10). Third, a linear regression model was run for the TPL group to predict EPDS total score at 3 months postpartum based on potential risk factors: demographic (maternal age, educational level, occupation, marital status), psychosocial (social support, family adaptability and cohesion, past maternal experience of post-traumatic stress symptoms, maternal trait anxiety, maternal state anxiety, maternal depression and maternal cortisol/α-amylase levels at TPL diagnosis), obstetric (multiparous, previous miscarriages, multiple pregnancy, *in vitro* fertilization, gestational age at TPL diagnosis), and neonatal data (gestational age at birth, caesarean, neonatal admission at neonatal intensive care unit). All the statistical analyses were performed using SPSS software (version 25.0).

Results

Final sample size, demographic, clinical, biological, and psychosocial variables are represented in Table 1.

Are women who suffered TPL at higher risk of PPD than controls, even if they gave birth at term?

The ANOVA revealed a Group effect, $F\,(1, 208) = 7.46$, $p = .007$, indicating that the TPL group showed higher depressive symptoms quantified by EPDS total score. Dunnett's multiple comparisons revealed that both women from Full-term TPL (7.27 ± 4.86) and Preterm TPL (6.35 ± 5.16) groups showed higher EPDS total score than the Control group (4.63 ± 3.39), $p = .015$ and $p = .041$, respectively. Similarly, Chi-square test showed that the proportion of

Table 1
Demographic, clinical, biological, and psychosocial variables represented for each group.

	TPL General (Preterm + Full-term) (n = 149)	TPL Preterm (n = 113)	TPL Full-term (n = 36)	Control (n = 61)	p value (TPL General *vs* Control)
Maternal age	32.85 (5.16)	32.92 (5.00)	32.63 (5.73)	32.34 (4.16)	.496
Educational level					
Primary	28 (20%)	21 (19%)	7 (22%)	10 (17%)	
Secondary	51 (36%)	41 (37%)	10 (31%)	24 (40%)	.815
University	63 (44%)	48 (44%)	15 (47%)	26 (43%)	
Occupation					
Employed	116 (79%)	85 (77%)	31 (86%)	40 (69%)	.111
Unemployed	30 (21%)	25 (23%)	5 (14%)	18 (31%)	
Marital status					
In a relationship	128 (93%)	102 (94%)	26 (90%)	51 (96%)	.459
Divorced/single/widow	9 (7%)	6 (6%)	3 (10%)	2 (4%)	
Multiparous	40 (27%)	30 (26%)	10 (28%)	29 (48%)	.004**
Previous miscarriages	34 (23%)	27 (24%)	7 (19%)	12 (20%)	.617
IVF	*56 (38%)*	44 (39%)	12 (33%)	2 (3%)	<.001**
Multiple pregnancy	*83 (56%)*	73 (64%)	10 (28%)	0 (0%)	<.001**
Gestational age at birth	33.74 (4.12)	32.20 (3.48)	38.51 (1.31)	39.83 (1.01)	<.001**
Caesarean	80 (54%)	67 (59%)	13 (36%)	16 (26%)	<.001**
Neonatal intensive care unit	42 (28%)	42 (39%)	0 (0%)	0 (0%)	<.001**
Breastfeeding (T2)					
Artificial	48 (36%)	13 (45%)	35 (34%)	11(18%)	
Natural	78 (59%)	14 (48%)	64 (62%)	50 (82%)	.005**
Mixed	6 (5%)	2 (7%)	4 (4%)	0 (0%)	
TQ	*3.23 (4.59)*	*3.50 (4.69)*	*2.80 (4.31)*	*1.78 (3.12)*	.018*
STAI-T	*17.78 (9.33)*	17.71 (9.47)	17.97 (9.05)	14.91 (7.10)	.034*
STAI-S	*20.87 (10.29)*	20.81 (10.05)	21.08 (11.18)	13.45 (8.01)	<.001**
BDI	2.71 (3.23)	2.67 (3.23)	2.86 (3.27)	1.97 (2.31)	.102
MPSS	78.72 (6.92)	78.95 (7.03)	78.05 (6.66)	79.45 (6.17)	.481
FACES: Adaptation	30.92 (7.22)	31.41 (6.60)	29.47 (8.76)	32.39 (4.77)	.146
FACES: Cohesion	32.45 (7.39)	32.82 (5.09)	31.36 (8.64)	32.80 (5.09)	.740
Cortisol	3.10 (5.27)	3.67 (5.76)	1.38 (2.88)	4.67 (4.94)	.050*
α-Amylase	70.73 (69.06)	75.85 (76.94)	55.69 (33.79)	92.50 (92.09)	.067

Note: Data represented by mean (standard deviations) and one-way ANOVA for continuous variables and absolute and relative frequencies [*n* (%)] and Chi-square test for categorical variables. IVF: *in vitro* fertilization; BDI: Beck's Depression Inventory; TQ: Trauma Questionnaire; STAI-T: State-Trait Anxiety Inventory (trait subscale); STAI-S: State-Trait Anxiety Inventory (state subscale); FACES: Family Adaptability and Cohesion Scale. The symbol "*" indicates p < 0.05, and "**" represents p < 0.01.

women with PPD (EPDS ≥ 10) showed differences among groups, χ^2 (1) = 8.05, p = .005. Specifically, an increased number of PPD diagnosis in both the Full-term TPL group (28%), χ^2 (1) = 10.19, p = .001, and the Preterm TPL group (18%), χ^2 (1) = 6.22, p = .013, was observed compared to the Control group (5%).

Risk factors of PPD symptoms in women who suffered TPL

A significant regression equation was found, F (4, 93) = 7.25, p < .001, R^2 = .25, R^2_{Adjusted} = .21. A regression model showed that EPDS total scores were predicted by: −2.89 + .28 (Traumatic Experiences Questionnaire score) − 2.15 (Educational level), +.335 (Maternal age), and +.314 (trait score of the State-Trait Anxiety Inventory). Thus, presenting history of trauma, lower educational level, older maternal age, and increased anxiety trait were the main predictors of higher PPD symptoms in TPL women at 3 months after birth.

Discussion

Our study found that experiencing an idiopathic episode of TPL led to more postpartum depressive symptoms and higher probability of PPD diagnosis, including the women who suffered TPL but gave birth at term. Consistent with prior research,[2,3] TPL women, regardless of preterm delivery, share a critical stressor in the pregnancy, which may influence on subsequently PDD. Of note, the influence of prenatal anxiety on PDD may be expected given the co-occurrence of anxiety and depression as distinct yet interconnected psychopathological constructs during the postpartum period. This co-occurrence is reflected in the EPDS, whose items capture symptoms related to anxiety. Thus, our findings add to previous literature that women suffering from an idiopathic TPL, that is without additional stressful factors, are also at-risk of PPD.

Regarding risk factors, demographic and psychological features were identified as the main predictors. These factors coincide with those found in the general population,[10] however in the population of our study, they converge with the precipitant that is TPL as a stressor, resulting in a heightened prevalence of postpartum depression compared to the general population. Whereas older maternal age has also been found as predictor of PPD after TPL, other predictors previously reported as lower social support or unemployment were not found in our study.[2] In this sense, the interrelation between lower educational level, unemployment and lower social support must be considered. Furthermore, note that women at-risk of social exclusion were not included. Thus, in low social risk populations, education level may be more relevant than socioeconomic level.

As for maternal psychological status, we found that history of trauma and increased trait anxiety were predictors for PPD rather than maternal mental health status at TPL diagnosis. This could be attributed to the fact that the diagnosis of TPL elicits significant stress in all women,[6] but those who are more vulnerable are more likely to later develop depressive symptoms. We consider that experiencing TPL in women who have history of trauma, could be a form of retraumatization, which would lead to a re-emergence of symptoms previously experienced.[11] Likewise, presenting anxiety

traits, marked by a tendency to develop worse coping strategies, may entail greater difficulty when coping with adverse situations, leading to a greater probability of developing PPD.[12]

Regarding the relationship between biological biomarkers and PPD, it is known that the pathophysiological process of idiopathic TPL involves inflammatory mechanisms. Thus, chronic stress causes deregulation of the immune system that can alter the SAM and HPA axis functioning, leading to the appearance of TPL[8] and the development of depression.[13] In our study, those psychosocial factors that predicted the development of PPD were related to chronic stress, while acute psychopathology and stress biomarkers at TPL diagnosis were not founded as predictors.

To the best of our knowledge, this is the first prospective longitudinal study with a biopsychosocial approach, carried by a multidisciplinary team, that includes both the stress inherent to TPL and the prior psychosocial vulnerability. As limitations, restricted inclusion criteria could limit the sample size and the generalization of the results. Although this study examined the effect of primary TPL, different distribution of obstetric and neonatal factors between TPL and control groups should be considered, but this difference is hardly avoidable, since the TPL is associated with higher rates of IVF, multiple pregnancy, preterm birth and longer NICU. Nonetheless, these variables were not found to be predictors of DPP. Additionally, we consider that the results reflect significant differences in both the quantitative and qualitative interpretation of the EPDS scores, which makes it necessary to deepen the psychopathological evaluation of these women. Finally, the lack of stress biomarkers levels from early pregnancy or pregestational period, makes unable to define women's basal profile.

In conclusion, experiencing complications such as TPL during pregnancy may conform a population at-risk of PPD. This risk is mediated by sociodemographic and psychological factors related to chronic stress. Early detection of these potentially modifiable risk factors in vulnerable pregnant women would help prevent PPD and improve the maternal–infant prognosis.

Ethical approval

The Research Ethics Committee of the La Fe Health Research Institute approved the study protocol (Ref. 2015/0086). Informed consent was obtained from all participants.

Authors' contributions

We confirm that this manuscript has been read and approved by all authors whose names are listed below, and that no other persons who meet the authorship criteria are not listed.

JB: Research, Methodology, Validation, Resources, Formal analysis, Writing – Preparation of the original draft, Writing – Review and editing.

LCB: Research, Methodology, Validation, Resources, Formal analysis, Writing – Preparation of original draft.

ML: Research, Data curation.

BA: Software, Formal analysis, Visualization.

FG: Research, Writing – Preparation of the original draft.

PD: Methodology, Supervision.

JA: Software, Data curation.

MV: Conceptualization, Methodology.

VD: Conceptualization, Resources.

AGB: Conceptualization, Fundraising, Supervision, Writing – Review and editing.

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Conflict of interest

The authors declare no conflict of interest. The funders had no role in the study design; in the collection, analysis or interpretation of data; nor in the writing of the manuscript, or in the decision to publish the results.

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