

A simple model for prediction postpartum PTSD in high-risk pregnancies

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Abstract This study aimed to examine the prevalence and possible antepartum risk factors of complete and partial post-traumatic stress disorder (PTSD) among women with complicated pregnancies and to define a predictive model for postpartum PTSD in this population. Women attending the high-risk pregnancy outpatient clinics at Sheba Medical Center completed the Edinburgh Postnatal Depression Scale (EPDS) and a questionnaire regarding demographic variables, history of psychological and psychiatric treatment, previous trauma, previous childbirth, current pregnancy medical and emotional complications, fears from childbirth, and expected pain. One month after delivery, women were requested to repeat the EPDS and complete the Post-traumatic Stress Diagnostic Scale (PDS) via telephone interview. The prevalence rates of postpartum PTSD (9.9 %) and partial PTSD (11.9 %) were relatively high. PTSD and partial PTSD were associated with sadness or anxiety during past pregnancy or childbirth, previous very difficult birth experiences, preference for cesarean section in future childbirth, emotional crises during pregnancy, increased fear of childbirth, higher

expected intensity of pain, and depression during pregnancy. We created a prediction model for postpartum PTSD which shows a linear growth in the probability for developing postpartum PTSD when summing these seven antenatal risk factors. Postpartum PTSD is extremely prevalent after complicated pregnancies. A simple questionnaire may aid in identifying at-risk women before childbirth. This presents a potential for preventing or minimizing postpartum PTSD in this population.

Keywords Postpartum PTSD · High-risk pregnancy · Questionnaire · Postpartum depression

Introduction

Post-traumatic stress disorder (PTSD) is defined as a disorder that develops after an event associated with a real or perceived threat of death or threat to physical integrity of the person or others.

Post-traumatic stress was first identified in relation to war experiences. According to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders V (DSM-V), there are four clusters of symptoms:

- (1) Re-experiencing the event
- (2) Persistent avoidance of any stimuli associated with the event
- (3) Negative alteration in cognition and mood
- (4) Increased arousal

The duration of the symptoms should be at least 1 month, with a negative impact on daily life (American Psychiatric Association 2013).

Key message Postpartum PTSD is extremely prevalent after complicated pregnancies. It is associated with previous difficult experience during pregnancy or childbirth and emotional difficulties during the index pregnancy. We offer a simple questionnaire that may aid in identifying at-risk women before childbirth.

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While unlike other traumatic events, childbirth has characteristics that could be traumatic. During childbirth, many women fulfill the first PTSD criteria while experiencing real threat regarding physical harm or death to themselves or their baby (Moleman et al. 1992; Grimes 1994).

Recent studies based on large populations showed that the incidence of post-traumatic stress disorder range from 1.3 to 2.4 % 1–2 months postpartum and from 0.9 to 4.6 % 3–12 months postpartum (Soderquist et al. 2006, 2009; Alcorn et al. 2010; Polachek et al. 2012). Partial diagnosis of PTSD was found in 6–24 % of pregnancies (Menage 1993; Wijma et al. 1997).

Several risk factors have been shown to be associated with postpartum PTSD. These include factors prior to childbirth such as previous traumatic life events (Ford et al. 2010; Lev-Wiesel 2009; Cohen et al. 2004; Zaers et al. 2008), sexual abuse (Cigoli et al. 2006), previous depression, anxiety trait (Soderquist et al. 2009; Slade 2006; Cigoli et al. 2006), psychiatric treatment (Czarnocka and Slade 2000; Wijma et al. 1997), and previous traumatic births (Polachek et al. 2012; Turton et al. 2001; Olde et al. 2006); factors during pregnancy such as depression and anxiety (Soderquist et al. 2009; Lev-Wiesel 2009; Zaers et al. 2008; Cohen et al. 2004; Grekin and O'Hara 2014), negative expectations of birth (Edworthy et al. 2008), and maternal antepartum complications (Baecke et al. 2009; Engelhard et al. 2002); and traumatic experiences during the birth process itself (Alcorn et al. 2010; van Son et al. 2005).

The impact of maternal postpartum PTSD is substantial. Studies show that postpartum PTSD has a negative impact on marital and parent–infant relationships and future reproductive choices (Ayers et al. 2006; Gottvall and Waldenstrom 2002). Studies have shown that maternal postpartum PTSD and depression strongly affect infant behavior and development (Shaw et al. 2009). Furthermore, PTSD is known to have comorbidity with depression and other anxiety disorders (Polachek et al. 2014; Grekin and O'Hara 2014) and the risk of suicide is significantly increased (Kessler 2000).

Our aims in this study were several. First, we aimed to examine the prevalence of PTSD, both complete and partial, among women with complicated (high-risk) pregnancies. Our second objective was to explore possible antepartum risk factors for developing the disorder. Since there is paucity of evidence on antepartum associations of postpartum PTSD in this group, identifying such associations may be important in targeting early intervention. To this day, no tool has been developed as a screening tool for high-risk populations. Therefore, the third objective of this study was to search for a predictive model for postpartum PTSD in this population.

Materials and methods

Study population

Pregnant women attending the high-risk pregnancy outpatient clinics at Sheba Medical Center were eligible for inclusion in the study. The high-risk pregnancy antenatal clinics administer antenatal care to women with complicated obstetrical histories, various maternal medical conditions that may affect pregnancy outcome (cardiac, renal, cardiovascular, endocrine diseases, etc), and ongoing pregnancy complications such as pregnancy-induced hypertension, multifetal pregnancies, threatened premature labor, gestational diabetes, etc.

All consenting women gave their written informed consent. Exclusion criteria included language barriers to understanding questionnaires and inability to be approached by phone 1 month after delivery. The study was approved by the Helsinki Committee Ethical Review Board of Sheba Medical Center.

Study design and study measurements

The study was two phased.

In the first phase, women were recruited at the high-risk pregnancy clinic. Women were approached for participation in the study and recruited by the clinic nurses while awaiting their antenatal clinic appointment.

Women who agreed to participate in the study answered the study questionnaire and the Edinburgh Postnatal Depression Scale (EPDS) with the assistance of the clinic nurses. The study inventory inquired about demographic variables, history of psychological and psychiatric treatment, history of trauma, previous childbirth, current pregnancy medical and emotional complications, fears from childbirth, and expected pain.

The second phase consisted of contacting the recruited women via telephone a month after delivery. Women were requested to repeat the EPDS and complete the Post-traumatic Stress Diagnostic Scale (PDS).

Background for study questionnaires is as follows:

1. The EPDS was developed as a screening test for postnatal women. It has been validated (as has its Hebrew version; Glasser and Barell 1999) and is widely used around the world for the diagnosis of postpartum depressive symptoms. A score >10 indicates symptoms of depression, and a score >12 indicates significant depressive symptoms (Cox et al. 1987; Murray and Carothers 1990). In our analysis, we referred to EPDS >10 as clinically meaningful.

- The PDS provides an indication of whether DSM-IV criteria for PTSD have been met: the severity of the symptoms, the number of symptoms, and the severity of dysfunction. It has been validated in those who have undergone a traumatic event in the previous month using the test (Foa 1997).

Statistical analysis

Comparison of the study variables by PTSD category (non-PTSD, partial PTSD, and PTSD) was performed using chi-square test for categorical variables or Fisher's exact test, when needed. For continuous variables such as woman's age and EPDS before and after birth, one-way analysis of variance was used for the comparison between the three categories of PTSD and unpaired *t* test when partial PTSD and PTSD were combined. Median levels of EPDS tests between the PTSD study groups were compared using the non-parametric Kruskal–Wallis test. Risk factors associated with PTSD were assessed through logistic regression analysis with the dependent variable defined as partial PTSD and PTSD versus non-PTSD. Variables that were found to be associated with the dependent variable in univariate analyses were considered as potential covariates in the multivariate model, and a backward elimination procedure was applied. Additional logistic model was performed considering the number of risk factors as independent variable. Analyses were performed using the SPSS software (version 21).

Results

Study sample

During a 14-month period between 1 January 2013 and 1 February 2014, 105 women with complicated (high-risk) pregnancies agreed to participate in the study and fulfilled the initial questionnaires. One hundred one women completed the follow-up interview via telephone call a month after delivery. Therefore, the results are presented for the 101 women who completed both phases of the study.

The mean maternal age was 33.5 ± 4.2 years (range 24–47 years). Eighty-nine of the women were married, seven had steady partners, three were single parents, and one was divorced. No relationship was found between postpartum PTSD and maternal age or marital status.

Reasons for high-risk pregnancy antenatal care included hypertension or diabetes mellitus in pregnancy, thrombophilia, previous adverse pregnancy outcome, and various maternal chronic conditions that warranted more intensive antenatal care. For 46 of the 101 women in our study, it was the first birth; 39 had miscarriages in the past. Sixty-one

women reported antenatal complications, and 19 were hospitalized during pregnancy.

Post-traumatic symptomatology

Of the 101 women available for analysis, eight women showed evidence of full PTSD DSM-IV criteria in the postpartum questionnaire and two additional women lacked one or two DSM-IV criteria with significant functional impairment and with symptomatology of more than 1-month duration. These 10 women (9.9 %) were grouped together as *PTSD group*.

Women who experienced significant symptoms from at least two groups of symptoms with or without 1-month duration of symptomatology or functional impairment were classified as *partial PTSD group*. This group consisted of 12 women (11.9 %). The remaining 79 women (78.3 %), without significant PTSD symptoms postpartum, were classified as *non-PTSD group*.

Depression 1 month postpartum

Postpartum depression (evaluated 1 month postpartum) was significantly associated with postpartum PTSD.

Risk factors

Prior history

We found a trend for a higher incidence of previous psychological treatment in the PTSD subgroup (% PTSD group versus % in the non-PTSD group, $p=0.18$). There was no increased prevalence of previous psychiatric treatments, previous traumatic events, or past sexual abuse reported by the women who developed postpartum PTSD.

Previous pregnancies and childbirths

The number of previous live births or abortions was similar among the three groups. Although not statistically significant, a higher proportion of women who developed PTSD or partial PTSD reported feeling of sadness or anxiety during past pregnancy or childbirth ($p=0.09$).

The women were asked to describe previous birth experiences on a Likert scale of 1–5, where 1 reflects very good experience and 5 reflects a very difficult experience. Although not significant, a higher proportion of women who developed PTSD defined their previous birth experience as particularly difficult (traumatic), compared with the non-PTSD group ($p=0.18$).

As can be seen from Table 1, although not statistically significant, there was a trend for a greater percentage of women in the PTSD group to express no desire for more children

Table 1 PTSD and future childbirth

	Non-PTSD ($n=43$), % (N)	Partial PTSD ($n=7$), % (N)	PTSD ($n=5$), % (N)
No desire for more children because of childbirth experience	9.3 (4)	(0)	20 (1)
Prefer to postpone future childbirth because of childbirth experience	14.3 (6)	14.3 (1)	20 (1)
Prefer/request cesarean section for future childbirth because of childbirth experience	19 (8)	50 (4)	40 (2)

PTSD post-traumatic stress disorder

($p=0.5$). These women preferred to postpone future childbirth ($p=0.9$) after previous childbirth experience. A significant association was found between the preference for cesarean section in future childbirth and PTSD+partial PTSD groups compared with the non-PTSD group ($p=0.03$).

Current pregnancy

There was no significant difference in the incidence of medical complications or hospitalizations during pregnancy between women who later developed PTSD and partial PTSD or those who did not. Nevertheless, as shown in Table 2, a significant association was found between emotional crises during pregnancy and postpartum PTSD ($p=0.03$). Although this group suffered more from emotional crises, there was no association with psychological or psychiatric treatment.

Birth expectations

The women were asked to report their intensity of fear from childbirth on a Likert scale of 1–5, where 1 reflects very mild fear and 5 reflects severe fear. The women were also asked to report the expected intensity of pain on a Likert scale of 1–5, where 1 reflects very mild pain and 5 reflects severe pain. As shown in Table 3, the PTSD group was significantly associated with both a higher fear of childbirth ($p=0.01$) and higher expected intensity of pain ($p=0.02$).

Table 2 PTSD and history of emotional crises

	Non-PTSD ($n=79$), % (N)	Partial PTSD ($n=12$), % (N)	PTSD ($n=10$), % (N)
Emotional crises during pregnancy	9 (7)	27.3 (3)	50 (5)
Psychological treatment	2.6 (2)	9.1 (1)	0 (0)
Psychiatric treatment	2.6 (2)	0 (0)	0 (0)

PTSD post-traumatic stress disorder

Depression during pregnancy

As can be seen from Table 4, depression during pregnancy was significantly associated with postpartum PTSD. Using a logistic regression analysis, emotional crises during pregnancy and severe expected intensity of pain were each found to independently and significantly increase the risk for postpartum PTSD (odds ratios (ORs)=7.75 and 4.65, respectively). Moreover, the combination of both emotional crises and severe expected intensity of pain were found to increase the risk of postpartum PTSD 15-fold (OR 15.5, 95 % CI 1.26–190.89, $p=0.03$).

Association of the number of risk factors and the development of PTSD or partial PTSD—logistic regression model

Based on the univariate analysis, several factors were found to be significantly associated with PTSD or partial PTSD: sadness or anxiety during past pregnancy or childbirth, previous very difficult birth experiences, preference for cesarean section in future childbirth, emotional crises during this pregnancy, severe fear from childbirth, expectation for severe pain, and EPDS >10. The number of risk factors was defined as the sum of these factors.

As can be seen from Table 5, the more risk factors were present, the higher is the overall risk of developing PTSD postpartum (9.3, 23.4, and 63.6 % for 0, 1 to 2, and 3+ risk factors, respectively; $p=0.001$). Similar results were observed for the subgroup of women who are multiparae or multigravidae ($p<0.01$) (who may have more risk factors than women in their first pregnancy). In the subgroup of women in their first pregnancy, the results were in the same direction but not statistically significant ($p=0.15$).

Discussion

The results from this study indicate a relatively high prevalence rate of postpartum PTSD in women with complicated (high-risk) pregnancies. Of the women in the study, 7.9 % fulfilled full PTSD criteria and 2 % lacked one or two

Table 3 Fear of childbirth and PTSD

	Non-PTSD (n=79), % (N)	Partial PTSD (n=12), % (N)	PTSD (n=10), % (N)
Intensity of fear from childbirth			
1–4	98.7 (78)	91.7 (11)	80 (8)
5	1.3 (1)	8.3 (1)	20 (2)
Mean±SD	2.8±0.99	3.42±1.0	3.5±0.97
Expected intensity of pain			
1–4	86 (68)	75 (9)	50 (5)
5	14 (11)	25 (3)	50 (5)
Mean±SD	3.51±0.98	4±0.85	4.5±0.70

PTSD post-traumatic stress disorder, SD standard deviation

symptoms with significant functional impairment and with symptomatology of more than 1-month duration. These 10 women (9.9 %) were grouped together as PTSD group. In a previous study in the same hospital, evaluating postpartum PTSD in the general population, only 3.4 % of the women fulfilled the full PTSD criteria and 7.8 % fulfilled the PTSD group criteria as mentioned (Polachek et al. 2012).

Previous studies have shown that pregnancy-associated PTSD rates are higher in high-risk groups such as women after second- or third-trimester termination of pregnancy due to fetal anomalies (Kersting et al. 2009). Turton et al. (2001) found a 20 % rate of PTSD after stillbirth in the subsequent pregnancy. Elklit et al. (2007) found within a 3-year period, 20 % rate of PTSD, and an additional 10 % rate of subclinical PTSD in mothers of very-low-birth-weight and extremely low-birth-weight infants. Giannandrea et al. (2013) found 8.8 % of PTSD among women with past pregnancy loss. Grekin and O’Hara (2014), in a meta-analysis from 2014, found 15.7 % prevalence rate of postpartum PTSD in at-risk samples.

The wide variation in the reported prevalence lies in the diverse nature of complications and stressors. Our study group is less homogeneous than in these previous studies, including mild to severe antenatal complications, which can explain our lower prevalence.

As in prior studies, we found a significant percentage of women who suffered partial symptoms. We included in this group women who had symptoms from at least two groups of symptoms of the disorder, with or without dysfunction and not necessarily of 1-month duration. With this definition of partial

Table 4 Depression during pregnancy

	Non-PTSD (n=79), % (N)	Partial PTSD (n=12), % (N)	PTSD (n=10), % (N)	<i>p</i>
EPDS>10	8.9 (7)	16.7 (2)	20 (2)	0.25
EPDS>12	2.5 (2)	16.7 (2)	20 (2)	0.02
Mean EPDS	4.82±3.58	6.5±4.27	8.6±4.38	0.08

PTSD post-traumatic stress disorder

postpartum PTSD, it appears that in our population, 11.9 % of the women suffered from some aspect of PTSD after childbirth. We chose to analyze these three groups: PTSD, partial PTSD, and non-PTSD groups in order to emphasize the continuum of the phenomena and the need to prevent and address partial symptoms as well.

Emotional crises during pregnancy, intense fear of childbirth, and high expected pain were found to be significantly associated with postpartum PTSD. Previous studies have also shown that fear of childbirth was associated with the development of postpartum PTSD (Soderquist et al. 2009; Slade 2006) and occurs in 7–26 % of pregnant women (Fenwick et al. 2009; Laursen et al. 2009), although in one study done by Fairbrothers, this association was not significant.

As in other studies of postpartum PTSD, we found no relationship with marital status and number of children. However, unlike Maggoni et al. (2006), we did not find an increased predisposition to postpartum PTSD in first-time mothers.

While no relationship was found with sexual abuse or past trauma, we did find an association between previous psychological treatment, previous traumatic birth experiences, and postpartum PTSD in subsequent births. The association was not significant possibly due to the small sample size.

A greater proportion of women in the PTSD and partial PTSD groups expressed no desire for more children and

Table 5 Risk of developing postpartum PTSD

Number of risk factors	All	PTSD+partial PTSD (N)	The risk of developing postpartum PTSD (%)
0	43	4	9.3
1	29	5	17.2
2	18	6	33.3
3	8	4	50
4	2	2	100
5	1	1	100
Total	101	22	21.8

PTSD post-traumatic stress disorder

preferred to postpone childbirth because of previous childbirth experience. Tan et al. (2013) compared women who had a history of severe preeclampsia, eclampsia, or major hemorrhage with control subjects. They showed a significant decline in the desire for more children, higher PTSD scores, and fear of new pregnancy. A significant association was also found between the preference or request for cesarean section because of previous childbirth experience and PTSD or partial PTSD (Tan et al. 2013). Ryding et al. (2000) showed in a study of 28 women requesting cesarean section that all had memories of previous traumatic birth. An inquiry regarding the above issues in several simple questions may point out previous post-traumatic symptomatology that increases the risk for postpartum PTSD in future deliveries.

Of the pregnant women, 10.9 % had a score of at least 10 on the EPDS, indicating possible depression ($EPDS > 10$). There was significant association between depression during pregnancy and PTSD ($EPDS > 10$), and this stepwise increases in the mean values from non-PTSD, partial PTSD, and PTSD groups. The relation between depression in pregnancy and post-traumatic stress postpartum is well established (Soderquist et al. 2006, 2009; Lev-Wiesel 2009; Zaers et al. 2008; van Son et al. 2005; Cohen et al. 2004).

Postpartum depression is a better-studied psychological disorder with a prevalence of approximately 10 % (Harding 1989). The comorbidity of postpartum PTSD and depression is well known (Soderquist et al. 2009; Grekin and O'Hara 2014; Shlomi et al. 2014). In our study, 4 % of the postpartum women had a score of at least 10 on the EPDS, indicating possible depression ($EPDS > 10$) with a significant association between postpartum depression and postpartum PTSD. The mean score of EPDS was significantly higher in the partial PTSD group than the non-PTSD group and in the PTSD group than the partial PTSD group. This finding indicates the continuum of the phenomena and, therefore, the importance of noticing the partial PTSD group which, while not suffering from a clinical disorder, does have more depressive and post-traumatic symptoms.

A few studies have examined predictive factors for postpartum PTSD. Ayers et al. (2006) found that 60 % of PTSD cases were identified on the basis of first delivery, assisted or cesarean delivery, numbing, arousal, re-experience, and avoidance symptoms and the interaction between sexual trauma and delivery type (Susan et al. 2009). Boorman et al. (2014) found that the predictors of postpartum PTSD were being a first-time mother, pre-existing psychiatric history, and an emergency cesarean section. Soderquist et al. (2006, 2009) found that the most important risk factors for postpartum PTSD in pregnancy were early pregnancy depression ($OR = 16.3$), stress in late pregnancy ($OR = 12.5$), severe fear of childbirth ($OR = 6.2$), and previous pregnancy and childbirth psychological counseling ($OR = 5.6$) (Zaers et al. 2008).

In our study, we identified two significant predictive factors for postpartum PTSD during pregnancy: emotional crises during pregnancy ($OR = 7.75$) and severe expected intensity of pain ($OR = 4.65$) with a stronger prediction when experienced together ($OR = 15.5$). Our study offers a simple model for the prediction of postpartum PTSD and partial PTSD in high-risk pregnancies. We identified seven antenatal risk factors which have a support in our study as well as in the literature. When summing the risk factors, we found a linear growth in the probability for developing postpartum PTSD. Although the numbers are small, 100 % probability was found when four or five risk factors were reported. We created a simple seven-line questionnaire (Table 6) that together with the EPDS questionnaire can be handed by nurses to pregnant women in high-risk pregnancy clinics while waiting for doctor's appointment.

The effort to locate at-risk population during pregnancy for postpartum PTSD is important because very little is known about the treatment for postpartum PTSD. Therefore, attention should focus on identifying risk groups, prevention and reduction of severity of PTSD through changes to maternity care (Ayers 2014). A substantial body of literature that shows continuous support during delivery is associated with better obstetric outcomes (Hodnett et al. 2011). Lack of supportive care was found to be associated with postnatal PTSD (Wijma et al. 1997; Creedy et al. 2000; Czarnocka and Slade 2000; Soet et al. 2003).

Study limitations include the relatively small sample size, as possibly a larger sample could yield to more generalized findings. Future large population studies could validate this questionnaire and make specific recommendations for the number of risk factors needed in nulliparous and multiparous women. In addition, conducting the follow-up in person rather

Table 6 Predictive questionnaire for postpartum PTSD among women with complicated pregnancies

Risk factors	
Did you experience sadness or anxiety during previous pregnancy or postpartum?	Yes/no
Describe your previous birth experience on a Likert scale of 1–5, where 1 reflects very good experience and 5 reflects a very difficult experience. (If there is more than one, choose the worst experience)	0 1 2 3 4 5
Do you prefer cesarean section due to experiences in previous deliveries?	Yes/no
Did you have emotional crises during this pregnancy?	Yes/no
Describe your fear from childbirth on a Likert scale of 1–5, where 1 reflects very mild fear and 5 reflects a very severe fear	0 1 2 3 4 5
Describe your expectation for pain during childbirth on a Likert scale of 1–5, where 1 reflects mild pain and 5 reflects a very mild pain	0 1 2 3 4 5
EPDS > 10	Yes/no
Sum	

than telephonically could probably increase the sensitivity of the evaluation.

In conclusion, we have shown that a remarkable percentage of women with high-risk pregnancies develop postpartum PTSD. According to the present study, high-risk women can be located in this population using seven brief questions. We believe that these findings are highly important because there is clear potential to prevent or minimize postpartum PTSD in this population, through changing antenatal care and services. Moreover, this study indicates the importance of further research of this population and increased resources and attention to the issue.

Conflict of interest The authors declare that they have no competing interests.

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