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Original Article

Relationship between a high Edinburgh Postnatal Depression Scale score and premenstrual syndrome: A prospective, observational study

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ABSTRACT

Objective: This study aimed to evaluate whether the Edinburgh Postnatal Depression Scale (EPDS) score predicts the occurrence of premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD) after delivery.

Materials and methods: The women in this study were registered at 35–36 weeks of pregnancy at Mie University Hospital from 2013 to 2015. We prospectively divided the puerperants into those with an EPDS score ≥9 (the high-EPDS group) and those with an EPDS score <9 (the low-EPDS group) at 1 month postpartum. We compared the incidence rate of severe PMS and PMDD between both groups at 1 year after delivery.

Results: Of 200 registered cases, 178 (89.0%) did not experience severe PMS or PMDD before pregnancy. Among them, 21 were in the high-EPDS group, and 89 in the low-EPDS group. Four of the 21 women (19.0%) in the high-EPDS group and five of the 89 (5.6%) in the low-EPDS group had severe PMS or PMDD at 1 year after delivery. The incidence rate of severe PMS or PMDD in the high-EPDS group was higher than that in the low-EPDS group ($p = 0.07$).

Conclusions: The novel finding of this study is that the EPDS may predict the occurrence of severe PMS/PMDD after delivery. The EPDS will contribute to the early detection of these diseases and to improving the quality of life of the patients by allowing treatment initiation at an early stage.

Introduction

Premenstrual syndrome (PMS) has many emotional and physical symptoms, such as irritability, depression, anxiety, tiredness, and mood swings. Premenstrual dysphoric disorder (PMDD) is a severe form of this phenomenon that manifests mainly as emotional symptoms of mood lability, depressed mood, increased irritability, and tension [1], and PMDD has been listed as a psychiatric disorder since 2013 in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*.

PMS and PMDD have common symptoms depending on the phase of the menstrual cycle. These symptoms generally begin to occur during the late luteal phase of the menstrual cycle and continue until the first few days of the subsequent follicular phase [2]. Several studies have reported that many women of reproductive age experience symptoms of PMS or PMDD. The prevalence of PMS is 18.6%–20.7% [3,4], and that of PMDD is from 3% to 8% in women of reproductive age [5–7]. Importantly, these symptoms affect women's daily and social life.

The peak age of onset for PMS and PMDD is the same as the reproductive age. Some studies have reported that PMDD or both PMS and PMDD, which develop before pregnancy, are risk factors for postpartum depression (PPD) [8,9]. On the other hand, one study shows that PMDD and PPD do not frequently co-occur, so they do not share a similar pathophysiology [10].

However, few studies have investigated women's susceptibility to PMS/PMDD after delivery. We conducted the present study to: (1) prospectively investigate the prevalence of newly developed

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episodes of severe PMS and PMDD at 1 year after delivery, and (2) evaluate the relationship between PPD and PMS/PMDD.

We used the EPDS to assess the women at 1 month after their deliveries. The EPDS is a 10-items questionnaire and the most widely used and researched screening tool for PPD [11].

Methods

This study was conducted at Mie University Hospital from 2013 to 2015. This trial was approved by the Mie University Faculty of Medicine ethics committee (approval number: 1313). Consent was obtained from all recruited participants prior to trial commencement. This study was registered with the University Hospital Medical Information Network. Women over 20 years old at 35–36 weeks of pregnancy were recruited to the study. They had no severe physical, mental, or perinatal complications, including depression. A questionnaire that we compiled was submitted to eligible participants, and it was answered by 218 pregnant women; 18 of these questionnaires were not completed, leaving a final total of 200 women. They retrospectively responded to the items of the questionnaire about their menstrual history and premenstrual symptoms before pregnancy. The participants also completed a questionnaire about living conditions and EPDS at 1 month and about menses at 1 year after delivery. We analyzed their sociodemographic data, menstrual history, and premenstrual symptoms before and after their pregnancies.

The presence and severity of premenstrual symptoms were assessed by using the Premenstrual Symptoms Screening Tool (PSST) [3]. The PSST is a reliable and fast screening tool that translates categorical *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria, and it consists of 19 questions about premenstrual symptoms and five functional items. Each question on the PSST can be answered as 'not at all,' 'mild,' 'moderate,' or 'severe.' The PSST also provides scoring guidelines for moderate to severe PMS and PMDD [9].

At 35–36 weeks of pregnancy, the participants were asked to retrospectively assess their premenstrual symptoms (e.g., irritability, affective lability, decreased interest in usual activities, and concentration difficulties) and functional impairment symptoms (e.g., symptoms interfering with interpersonal, social activities, and work domains), based on their menstrual cycle before pregnancy. After the resumption of their menstrual cycle at 1 year after delivery, they were asked to complete the same questionnaire again.

One study reported that an EPDS score $\geq$9 indicates PPD with a high sensitivity and specificity [12]. In the present study, we considered an EPDS score $\geq$9 at 1 month after delivery as a high risk of PPD.

We retrospectively divided the 200 participants into two groups according to the presence/absence of a history of severe PMS or PMDD. We then prospectively observed the development and recurrence of severe PMS and PMDD and the relationship between severe PMS and PMDD in the EPDS score $\geq$9 group (high-EPDS group) or EPDS score <9 group (low-EPDS group) at 1 month after delivery. Some women developed severe PMS/PMDD before the following pregnancy, and we considered them as having "severe PMS/PMDD before pregnancy".

Statistical analysis

In each group, we have analyzed the relationship of the EPDS score, whether $\geq$9 or <9, and the occurrence of severe PMS/PMDD at 1 year after delivery using the Fisher's exact test. Both EPDS groups were cross-tabulated with the maternal background characteristics (parity, medical history, undesired pregnancy, marital life, family type, insomnia, nutrition of baby, and poor physical health of themselves or their family members) using the Chi-square tests. To analyze the age of the maternal background, we have used the Student's t-test. Statistical significance was set at a p-value of <0.05. The statistical analyses were performed using SPSS ver. 24 software (SPSS, Chicago, IL).

Results

Before pregnancy, the prevalence of severe PMS was 9.5% (19 of the 200 participants), and that of PMDD was 1.5% (3/200). At 1 year after delivery, 29 women dropped out in all cases. We defined the group of patients who had already developed severe PMS/PMDD before the following pregnancy as "severe PMS/PMDD before pregnancy". The menstrual cycle of 48 women (42 women in the group that did not have severe PMS/PMDD before pregnancy and six women who had severe PMS/PMDD before pregnancy) did not resume at 1 year after delivery. At 1 year postdelivery, among the 123 women whose menstrual cycle resumed, the prevalence of severe PMS was 8.1% (n = 10) and that of PMDD was 6.5% (n = 8).

The women with no severe PMS/PMDD before pregnancy

The number of women who did not have severe PMS/PMDD before pregnancy was 178/200 (the No severe PMS/PMDD group; 89.0%). The proportions of severe PMS/PMDD at 1 year after delivery among the No severe PMS/PMDD group are shown in Fig. 1. There were 32 women in the high-EPDS group, 138 women in the low-EPDS group and eight women without data. Among the 21 women in the high-EPDS group except three women without data and eight women who had not resumed menstrual cycle, three (14.2%) women had severe PMS and one (4.8%) woman had PMDD at 1 year after delivery.

Among the 89 women in the low-EPDS group except 15 women without data and 34 women had not resumed menstrual cycle, three (3.4%) had severe PMS and two (2.2%) had PMDD at 1 year after delivery (Fig. 1). Among the 110 women in the No severe PMS/PMDD group, more of the women classified as high-EPDS (19.0%) developed severe PMS/PMDD compared to those classified as low-EPDS (5.6%) ($p = 0.07$) (Table 1). In short, six out of 110 women developed newly severe PMS and three out of 110 newly developed PMDD.

The maternal background characteristics in the No severe PMS/PMDD group are shown in Table 2. None of the maternal background characteristics were significantly different between the two groups (low-EPDS group and high-EPDS) except for insomnia at 1 month after delivery: 33.0% (29/88) in the low-EPDS group and 71.4% (15/21) in the high-EPDS group ($p < 0.05$). A few women in the low-EPDS group did not provide responses in the questionnaire.

The women with severe PMS/PMDD before pregnancy

The proportions of severe PMS/PMDD at 1 year after delivery among the women who reported having severe PMS or PMDD before pregnancy are shown in Fig. 2(a) and (b). Of the three women with PMDD before pregnancy, two had PMDD at 1 year after delivery and menstrual cycle did not resume for the third woman. Among the 19 women with severe PMS before their pregnancies, 3/6 (50%) women in the low-EPDS group and 4/5 (80%) women in the high-EPDS group had severe PMS or PMDD at 1 year after delivery.

The incidence of severe PMS/PMDD at 1 year after delivery among the 13 women with severe PMS/PMDD before pregnancy is shown in Table 3. The rates of severe PMS/PMDD at 1 year after delivery were higher in the high-EPDS group compared to those in

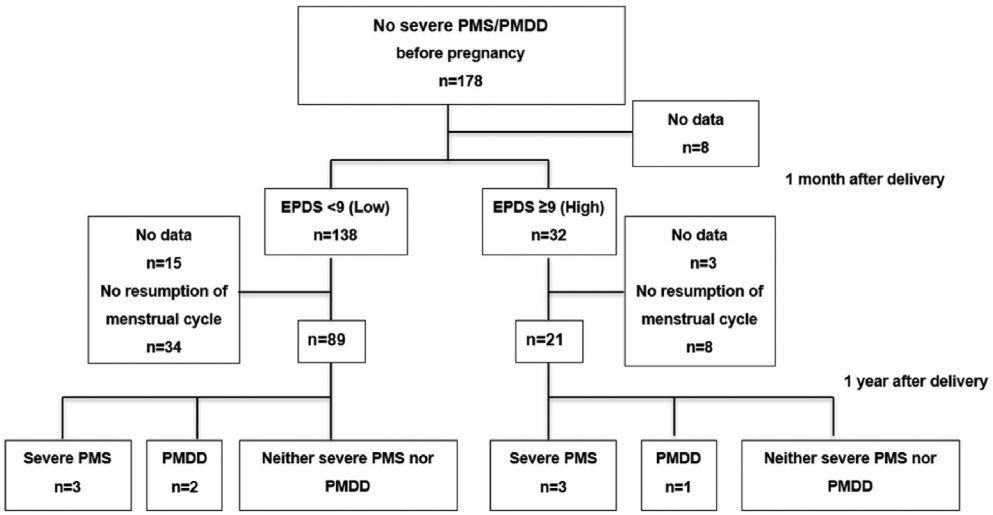

Fig. 1. The proportions of severe PMS/PMDD at 1 year after delivery in the women without severe PMS/PMDD before pregnancy. EPDS, Edinburgh Postnatal Depression Scale; PMS, premenstrual syndrome; PMDD, premenstrual dysphoric disorder.

Table 1
Incidence of severe PMS and PMDD at 1 year after delivery among the 110 women with no severe PMS/PMDD before pregnancy.

	EPDS score < 9 (low) (n = 89)	EPDS score ≥ 9 (high) (n = 21)	p-value
PMDD	2/89 (2.2%)	1/21 (4.8%)	1.00
Severe PMS	3/89 (3.4%)	3/21 (14.2%)	0.08
Total (severe PMS/PMDD)	5/89 (5.6%)	4/21 (19.0%)	0.07

EPDS, Edinburgh Postnatal Depression Scale; PMS, premenstrual syndrome; PMDD, premenstrual dysphoric disorder.

Table 2
Maternal background characteristics (no severe PMS/PMDD before pregnancy group).

	EPDS score < 9 (low) (n = 89)	EPDS score ≥ 9 (high) (n = 21)	p-value
Age, years	34.3 ± 4.7	34.3 ± 5.6	n.s.
Parity			
0	70/89 (78.7%)	16/21 (76.2%)	n.s.
≥1	19/89 (21.3%)	5/21 (23.8%)	n.s.
Medical history			
Yes	24/89 (27.0%)	6/21 (28.6%)	n.s.
No	65/89 (73.0%)	15/21 (71.4%)	n.s.
Undesired pregnancy	5/89 (5.6%)	1/21 (4.8%)	n.s.
Marital life			
Content	65/87 (74.7%)	13/21 (62.0%)	n.s.
Discontent	16/87 (18.4%)	4/21 (19.0%)	n.s.
Other	6/87 (6.9%)	4/21 (19.0%)	n.s.
Delivery method			
Vaginal delivery	45/89 (50.6%)	10/21 (47.6%)	n.s.
Caesarean section	44/89 (49.4%)	11/21 (52.4%)	n.s.
Family type			
Nuclear	78/89 (87.6%)	17/21 (81.0%)	n.s.
Extended	9/89 (10.1%)	4/21 (19.0%)	n.s.
Other	2/89 (2.3%)	0/21 (0%)	n.s.
Insomnia after delivery	29/88 (33.0%)	15/21 (71.4%)	<0.05
Nutrition of baby at 1 month after delivery			
Only breast milk	9/89 (10.1%)	3/21 (14.3%)	n.s.
Poor physical health of themselves or their family members	26/89 (29.2%)	3/21 (14.3%)	n.s.

the low-EPDS group, but the differences were not significant. Four of the 11 women (36.4%) with severe PMS before pregnancy reported improved PMS at 1 year after delivery. These four women were three of the six (50%) women in the low-EPDS group and one of the five (20%) women in the high-EPDS group. Maternal background characteristics in the severe PMS/PMDD before pregnancy group are shown in Table 4.

Discussion

A new finding was revealed in the present study. We can speculate that a high EPDS score (≥9) may be a risk factor of the development of PMS or PMDD after delivery, and the EPDS score may be a predictive factor in women who do not experience severe PMS or PMDD before pregnancy.

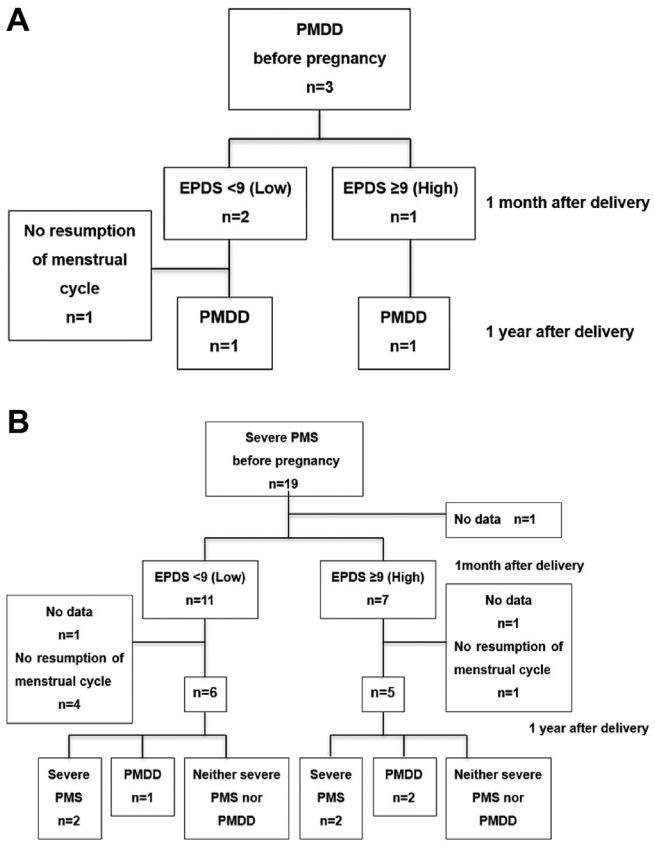

Fig. 2. (a). The proportions of severe PMS/PMDD at 1 year after delivery in the women with PMDD before pregnancy. (b) The proportions of severe PMS/PMDD at 1 year after delivery in the women with severe PMS before pregnancy. PMS, premenstrual syndrome; PMDD, premenstrual dysphoric disorder.

Previous studies have suggested that PMS and PMDD are important risk factors for PPD [9,13,14]. However, there is no research on whether PPD or high EPDS is related to PMS/PMDD, proactively. Women tend to experience mood disorders, including depression during intense hormonal fluctuations, that is, during the premenstrual period, postpartum, and menopausal transition [2]. By the end of a pregnancy, estradiol levels in women are as much as 50 times the maximum menstrual cycle level, and they decrease to early-follicular-phase levels within the first 3 days following childbirth. The rapid decrease in the estradiol level immediately following childbirth may interact with serotonin (5-HT) transmission, leading to a woman's increased susceptibility to experiencing depression in the postpartum period [9,15].

Studies of animal models suggest that a lower baseline level of serotonergic activity may lead to a greater risk of developing depressive symptoms [16]. Another investigation suggested that the participation of 5-HT receptor binding activity and the estrogen–serotonin interaction affects monoamine oxidase A (MAO-A) activity; thus, elevated MAO-A levels in the early postpartum period may contribute to the mood dysregulation [17]. The etiology of PMDD is unclear, but this estrogen-serotonin interaction model is supported in the literature regarding PMDD [18].

The etiology of PMS is also unclear, and several theories suggest that the causes are increased sensitivity to normal hormonal fluctuations and neurotransmitter abnormalities [19]. Selective serotonin reuptake inhibitors are used for the medical treatment of PMS and PMDD, and since the etiologies of PMS and PMDD involve serotonin, they are presumed to be similar. The role of estrogen–serotonin may be linked to a common etiologic biological mechanism of PMS/PMDD and PPD.

Prior psychiatric disorders have been found to be significant risk factors for PMDD [20]. In addition, a history of depression [21], post-traumatic stress disorder [4], smoking [21], nicotine dependence [4], and lower educational status are common in patients with PMDD [21]. A history of depression is also a risk factor for PPD [9]. Based on the aforementioned information, PPD may be a risk factor for PMS and PMDD. So the EPDS score may speculate the occurrence of severe PMS/PMDD after delivery.

In this study, all participants with PMDD before pregnancy developed PMDD after delivery regardless of their EPDS scores at 1 month after delivery. The women with severe PMS before pregnancy were likely to develop severe PMS or PMDD after delivery — especially those in the high-EPDS group. On the other hand, some of the women with severe PMS before pregnancy did not develop severe PMS or PMDD after delivery. The PMS of the women in the low-EPDS group was likely to improve compared to the women in the high-EPDS group. If women with severe PMS before pregnancy have a low EPDS score after their delivery, their premenstrual disorders may improve. Some of the women in the high-EPDS group did not develop severe PMS or PMDD at 1 year after delivery. However, premenstrual disorders may develop later than 1 year of delivery. Taken together, our findings speculate that women with a high EPDS score should be followed up strictly until the resumption of their menstrual cycle.

In this investigation, the prevalence of severe PMS and PMDD before pregnancy were 9.5% and 1.5%, respectively. These values are lower than previously reported rates. However, among the women whose menstrual cycles had resumed at 1 year after delivery, the prevalence of severe PMS was 8.1% (10/123), and that of PMDD was 6.5% (8/123), and these values are similar to the rates reported in other studies [5–7].

The increased prevalence of PMDD after delivery suggests that pregnancy and delivery themselves might be a risk factor for PMDD. However, there is no report on the relationship between delivery and PMDD. Experiencing hormonal fluctuation at the time of delivery might present a risk for premenstrual disorders. Further investigations are needed to clarify this relationship.

The present study has several critical limitations worth mentioning. This study had a small sample size. Our understanding of the causal link between PMDD/PMS and PPD is limited. In addition, we collected the data on preconceptional PMS/PMDD symptoms at 35–36 weeks of pregnancy using the PSST. This study protocol also suffered from recall bias as it was based on questionnaires. Most of the studies similar to the present investigation had a retrospective design. Although the design of the present study was prospective, the number of participants was small. The

Table 3
Incidence of severe PMS and PMDD at 1 year after delivery among the 13 women with severe PMS/PMDD before pregnancy.

	EPDS score < 9 (low) (n = 7)	EPDS score ≥ 9 (high) (n = 6)	p-value
PMDD	2/7 (28.6%)	3/6 (50.0%)	0.59
Severe PMS	2/7 (28.6%)	2/6 (33.3%)	1.00
Total (severe PMS/PMDD)	4/7 (57.1%)	5/6 (83.3%)	0.56

EPDS, Edinburgh Postnatal Depression Scale; PMS, premenstrual syndrome; PMDD, premenstrual dysphoric disorder.

Table 4
Maternal background characteristics (severe PMS/PMDD before pregnancy group).

	EPDS score < 9 (low) (n = 7)	EPDS score ≥ 9 (high) (n = 6)	p-value
Age, years	31.6 ± 2.8	35.0 ± 5.5	n.s.
Parity			
0	6/7 (85.7%)	6/6 (100%)	n.s.
≥1	1/7 (14.3%)	0/6 (0%)	n.s.
Medical history			
Yes	2/7 (28.6%)	2/6 (33.3%)	n.s.
No	5/7 (71.4%)	4/6 (66.7%)	n.s.
Undesired pregnancy	0/7 (0%)	1/6 (16.7%)	n.s.
Marital life			
Content	3/7 (42.8%)	3/6 (50.0%)	n.s.
Discontent	2/7 (28.6%)	1/6 (16.7%)	n.s.
Other	2/7 (28.6%)	2/6 (33.3%)	n.s.
Delivery method			
Vaginal delivery	3/7 (42.9%)	5/6 (83.3%)	n.s.
Caesarean section	4/7 (57.1%)	1/6 (16.7%)	n.s.
Family type			
Nuclear	4/7 (57.1%)	5/6 (83.3%)	n.s.
Extended	3/7 (42.9%)	1/6 (16.7%)	n.s.
Other	0/7 (0%)	0/6 (0%)	n.s.
Insomnia after delivery	4/7 (57.1%)	5/6 (83.3%)	n.s.
Nutrition of baby at 1 month after delivery			
Only breast milk	1/7 (14.3%)	1/6 (16.7%)	n.s.
Poor physical health of themselves or their family members	1/7 (14.3%)	3/6 (50.0%)	n.s.

number of cases who met the criteria of severe PMS and PMDD was low, and some data were missing at 1 year after delivery. A larger number of participants and more studies are required to investigate this topic further.

The elucidation of the mechanisms underlying the relationships among PMS/PMDD and PPD will help clinicians prevent and treat these diseases in women. PMS and PMDD affect women's daily and social life. The EPDS may contribute to the early detection of these diseases and initiation of treatment at an early stage. PMS and PMDD create serious problems in quality of life in women. Therefore, if EPDS can be used to predict the high risk of PMS and PMDD triggered by pregnancy and delivery, there is a possibility that women's quality of life can be improved.

Declaration of competing interest

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