Asian Journal of Psychiatry 17 (2015) 85–88

Contents lists available at ScienceDirect

Asian Journal of Psychiatry

journal homepage: www.elsevier.com/locate/ajp

High serum testosterone levels during postpartum period are associated with postpartum depression

A. Aswathi [a], Soundravally Rajendiren [a,*], Archana Nimesh [a], R. Ravi Philip [b], Shivanand Kattimani [b], D. Jayalakshmi [c], P.H. Ananthanarayanan [a], Pooja Dhiman [a]

[a] Department of Biochemistry, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry India
[b] Department of Psychiatry, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India
[c] Department of Obstetrics and Gynaecology, Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry, India

ARTICLE INFO

Article history:
Received 5 November 2014
Received in revised form 19 August 2015
Accepted 23 August 2015

Keywords:
Testosterone
Sex steroid hormones
Postpartum mood disorders
Etiology

ABSTRACT

In view of the reported cases of mood disorders that occur in mothers following childbirth and believing that sex steroid hormones contribute to mood and behavioral changes, this study has been aimed to explore the role of sex steroid hormones as an etiological factor for postpartum depression (PPD). This study was conducted at JIPMER, Puducherry, India between January 2010 and 2011. 103 women were recruited in the study after childbirth, out of which 62 women who were believed to be suffering from PPD were categorized as cases and the remaining 41 with no mood changes as controls, using Edinburgh Postpartum Depression Scale (EPDS) (cases had EPDS score $\geq$10 at 24–28 h, controls had score $<$10 at 24–48 h postpartum). The hormones estimated in these two groups included estradiol, progesterone and testosterone, and their levels were compared between these two groups. A significantly high testosterone levels were observed in cases with PPD at 24–28 h when compared to controls. Estradiol and progesterone levels did not show significant difference between cases and controls. ROC analysis done at 24–28 h showed that testosterone levels beyond 42.71 ng/mL predict the development of PPD with 79% sensitivity, 63% specificity, 68% positive predictive value, 74% negative predictive value with AUC being 0.708. This study shows that there is an association between persistent high serum testosterone level in women following childbirth and PPD.

1. Introduction

Postpartum partum period refers to the duration immediately after childbirth, during which the reproductive organs of a woman return back to the pre pregnancy state. This period lasts for about 6–7 weeks. Giving birth to a baby is a life changing experience for a woman, which is associated with emotional and physical stress of pregnancy, delivery and nursing of the baby. Therefore, it is not surprising that women face mood changes, ranging from mild symptoms to severe ones during the postpartum period. The symptoms experienced by the postpartum women may range from anxiety, loneliness, restlessness, fatigue, insomnia, change in eating habits, feeling of worthlessness, guilt, lack of interest or over interest in baby, to palpitations, hallucinations, delusions, delirium, mania, suicidal and homicidal thoughts and loss of touch with reality (Martin and Silverstein, 2009). The above symptoms in postpartum women are collectively called as postpartum mood disorders (PPMDs) and can further be categorized into baby blues, depression and psychosis depending upon the severity of the presentation. These symptoms can show up any time after the delivery until three months (US Department of Health and Human Services, 2002). PPMD affects not only mothers, but also affects overall family dynamics. PPMD can lead to conduct disorder, language, cognitive and emotional processing problems in children, along with depression in the partners of women with PPD (Tronick and Reck, 2009; Beck, 1999; Paulson and Bazemore, 2010).

Various factors including genetic makeup, environmental influences and hormonal imbalance have been proposed as the etiology behind these postpartum mood disorders (Flores and Hendrick, 2002).

* Corresponding author. Tel.: +91 9442214256.
E-mail addresses: aswathishylaja@gmail.com (A. Aswathi), soundy27@yahoo.co.in (S. Rajendiren), archana.akku.2010@gmail.com (A. Nimesh), raviphilip.r@jipmer.edu.in (R.R. Philip), drshivanand@gmail.com (S. Kattimani), jayalakshmi.d@jipmer.edu.in (D. Jayalakshmi), phananthanarayanan@gmail.com (P.H. Ananthanarayanan).

http://dx.doi.org/10.1016/j.ajp.2015.08.008
1876-2018/

It is also known that sex steroids influence human behavior, and are associated with conditions like premenstrual dysphoria, psychiatric disorders, and depressive symptoms during postmenopausal period (Hines, 2003). It is therefore believed that an intense fluctuation of these sex steroid hormones could interfere with mood and behavior by exerting a significant modulatory effect on brain functioning probably through interactions with various neurotransmitters (Numakawa et al., 2014). Thus, postpartum period being a physiological state of intense hormonal fluctuation might also be associated with mood changes. The prevalence of postpartum depression has been reported to be between 10% and 15% in different ethnic population (O'hara and Swain, 1996; Miller, 2002; Gavin et al., 2005).

So in view of the reported cases of mood disorders that occur in mothers following childbirth and believing that sex steroid hormones contribute to mood and behavioral changes, this study was conducted to explore any association of sex steroid hormones in postpartum depression.

2. Materials and methods

The present cross sectional study was carried out in JIPMER hospital, Puducherry, India in the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology and Department of Psychiatry, during January 2010–2011, after seeking approval from the institute's ethics committee and written informed consent from the subjects. Women who had a history of endocrinal dysfunction, neuropsychiatric illness like depression or complications in pregnancy were not included in the study. Women who had history of postpartum depression in the previous pregnancy or had been on antidepressant drugs were also not included in the study. 121 women were included who had delivered in JIPMER Hospital. Out of these 18 women were excluded due to preeclampsia, gestational diabetes mellitus and previous history of depression. Remaining 103 women were subjected to a questionnaire at 24–28 h postpartum using the Edinburgh Postpartum Depression Scale (EPDS) to assess their mood status (Cox et al., 1987). It was found that 45 women had score <10 and 58 had score more than ≥ 10. After the questionnaire, 5 mL blood sample was also collected from the subjects to carry out hormonal assay. These patients were then discharged from the hospital but were followed up again at 6 weeks of postpartum period using the same questionnaire to reassess the mood status using telephone interview. This time it was found 41 women had score <10 and 62 women had score more than ≥ 10. Thus, the study group was classified into controls and cases. Women who had score <10 at 24–28 h were believed to be suffering from no mood changes and were considered as normal and were placed into control group ($n = 41$). Women who had score more than ≥ 10 at 24–28 h were believed to be suffering from postpartum mood disorders and were placed into case group ($n = 62$). After categorizing the subjects, blood samples were again collected at 6 weeks but not all subjects turned up to the hospital after the telephone interview. Therefore, it was possible to collect blood from only 6 normal women and 19 postpartum mood disorder patients at 6 weeks. Blood samples were centrifuged at 5000 rpm for 10 min and seperated serum was preserved at $-80\ ^{\circ}C$ for subsequent hormonal assays (testosterone, progesterone, estradiol) using the competitive immuno assay by chemiluminescence technology (ADVIA Centaur, Siemens, Japan).

3. Statistical analysis

The continuous data was assessed for normality and accordingly appropriate parametric or non-parametric tests were used. To compare the variables that followed normal distribution, independent student's t test were used. To compare the first and follow up sample, paired t test was used. Association between sex hormones and PPD was carried out using logistic regression analysis. The performance of the sex steroid hormones for predicting PPD was assessed by using ROC analysis. p value <0.05 was considered statistically significant. All statistical work was carried out using SPSS version 19 for windows.

4. Results

A total of 121 women were recruited in the study who had delivered in JIPMER Hospital. Out of these 18 women were excluded due to preeclampsia, gestational diabetes mellitus and previous history of depression. Remaining 103 were categorized as PPD ($n = 62$) and control ($n = 41$) based on their EPDS score. The data pertaining to maternal and fetal characteristics in the Normal and PPD group is expressed as mean ± SD and is shown in Table 1. There is no significant difference seen between the maternal and fetal characteristics between the normal and PPD group. The hormonal assay shows that at 24–28 h postpartum, mean serum testosterone level was found to be significantly higher in the PPD group than in normal group (Table 2). The estradiol and progesterone levels were also higher in the PPD group in comparison to the normal group but the difference in their levels was not significant. After repeating the hormonal assays at 6 weeks postpartum, it was observed that mean serum testosterone levels remained higher in the PPD group than in normal group (Table 3). However, the mean serum estradiol and progesterone levels did not show a significant difference between the two groups. Testosterone levels at 24–28 h postpartum were found to associate positively with postpartum mood disorders by logistic regression analysis (Table 4). A receiver operating curve (ROC) analysis was done for testosterone levels at 24–28 h postpartum to define a cut off level beyond which the development of PPD could be predicted. It was observed that at 24–28 h postpartum, testosterone levels beyond 42.71 ng/mL predicts the development of postpartum depression with a sensitivity of 79%, specificity of 63%, positive predictive value of 68%, negative predictive value of 74%, AUC as 0.708 with p value = 0.000 (Table 5, Fig. 1).

Table 1
Comparison of maternal and fetal characteristics in the normal and PPMDs group expressed as mean ± SD.

S. no.	Parameter	Normal ($n = 41$)	PPMDs ($n = 62$)	p value
1	Maternal age (in years)	23.05 ± 2.81	23.00 ± 2.61	0.93
2	Maternal height (in cm)	152.88 ± 7.42	153.27 ± 7.13	0.79
3	Maternal weight (in kg)	51.80 ± 8.52	54.00 ± 10.01	0.25
4	Maternal BMI (kg/m^2)	22.11 ± 2.75	22.93 ± 3.60	0.21
5	Maternal hemoglobin (in g%)	10.81 ± 0.78	10.96 ± 1.05	0.42
6	Baby weight (in kg)	2.74 ± 0.43	2.77 ± 0.44	0.74
7	EPDS score at 24–28 h postpartum	7.20 ± 1.90	12.58 ± 2.78	0.00*
8	EPDS score at 6 weeks postpartum	6.54 ± 2.15	11.87 ± 3.21	0.00*
9	APGAR score at 1 min	7.95 ± 0.22	7.85 ± 0.45	0.23
10	APGAR score at 5 min	8.95 ± 0.22	8.84 ± 0.45	0.14

Note: * indicates $p < 0.05$.