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Original Article

Postpartum evaluation of the role of maternal characteristics and mode of delivery on maternal attachment, anxiety and depression; a study conducted in Turkey

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Abstract. *Background and aim:* The primary aim of this study was to compare mother-infant bonding (MIB) in patients who delivered vaginally and with cesarean section (C/S) using the Maternal Attachment Inventory (MAI), Edinburgh Postnatal Depression Scale (EPDS), and Postpartum Specific Anxiety Scale (PSAS) in the Turkish population. The secondary aim was to evaluate the correlations between the MAI, EPDS, and PSAS scores and their association with sociodemographic data. *Method:* A total of 200 patients were divided into two groups. One hundred women who delivered vaginally were included in the vaginal delivery (NVD) group, and 100 who delivered with C/S were included in the C/S group. The demographic data of the subjects, including age, gravidity, and parity, were recorded, and a detailed anamnesis was taken on the day of hospitalization for delivery. The newborns' sex were also taken into account. All patients were asked to complete the MAI, EPDS, and PSAS at the third-month postpartum control. *Results:* The PSAS score in the NVD group was calculated to be 68.9 ± 9.0, which was significantly higher than the score in the C/S group of 65.0 ± 9.6 (p = 0.005). However, the MAI and EPDS scores in both groups were calculated to be similar (p = 0.833 and p = 0.260, respectively). A significant negative correlation was observed between age and the MAI (r = -0.180, p = 0.011) and between the number of children and the MAI (r = -0.140, p = 0.048). *Conclusions*: The results of this study, which was conducted using a Turkish cohort, show that maternal age at delivery and the number of children at home had an effect on MIB. Conversely, mode of delivery did not influence MIB in this study population. Multicenter studies with a larger number of subjects are needed to reach a general conclusion regarding the Turkish population. (www.actabiomedica.it)

Key words: Mother-infant bonding; mode of delivery, postpartum depression; postpartum anxiety, Maternal Attachment Inventory; Edinburgh Postnatal Depression Scale; Postpartum Specific Anxiety Scale

Introduction

Mother-infant bonding (MIB) is an early emotional bond that develops between the mother and the infant and is associated with the development of strong and healthy relationships later in life (1–3). In the Spanish population, the prevalence of MIB disorders has been reported to be as high as 15.9% (4). However, population-based studies are limited on this topic. Current evidence indicates that MIB disorders have a negative impact on a child's cognitive development, including brain development, maturation, and language development (5,6).

Certain maternal factors arising during the postpartum period, such as anxiety and depression, are known to disrupt MIB. Becoming a mother entails drastic changes in a woman's life, including adapting to a new role and new responsibilities. Anxiety is very common if a woman fails to adapt or has difficulty in adapting to these changes. The prevalence of anxiety during the first six months following birth has been reported to be between 6.1% and 27.9% (7). It has also been demonstrated that anxiety has a negative impact on the clinical pregnancy rates of women receiving in vitro fertilization treatment (8). In mothers who have received anxiety treatments during the postpartum period, higher MIB scores have been reported (9), while postpartum depression has also been associated with poorer MIB (10).

In Turkey, more than 50% of deliveries are performed by cesarean section (C/S) (11). Cetisli et al. evaluated the impact of delivery type and breastfeeding on MIB among a Turkish cohort and reported that C/S had adverse effects on MIB when compared to vaginal delivery (12). The association between conception being natural or performed with assisted reproductive technologies and negative emotions, such as depression and anxiety, was also evaluated in the literature, but no significant impact on the pregnancy and neonate was reported (13). However, the data on the prenatal factors affecting MIB, such as the number of children the mother already has and her age at delivery, remains very limited in the literature. Whether these factors have adverse effects on MIB is a topic that still needs to be addressed.

The primary aim of this study was to compare MIB in patients who delivered vaginally and who delivered via C/S using the Maternal Attachment Inventory (MAI), Edinburgh Postnatal Depression Scale (EPDS), and Postpartum Specific Anxiety Scale (PSAS) in the Turkish population. The secondary aim was to evaluate the correlations between the MAI, EPDS and PSAS scores and their association with the sociodemographic data.

Materials and Methods

This prospective observational study was conducted at the University of Health Sciences Turkey, Istanbul Kanuni Sultan Suleyman Training and Research Hospital Department of Obstetrics and Gynecology, between September 2018 and August 2019. The study protocol was approved by the institution's ethics committee and registered to ClinicalTrials.gov (NCT04396509). Written informed consent was obtained from all subjects.

A total of 200 patients were divided into two groups. One hundred women who delivered vaginally were included in the normal vaginal delivery (NVD) group, and 100 who delivered via C/S were included in the C/S group. The women included in the study were between 18 and 45 years of age, had conceived spontaneously, had no adverse obstetric history, delivered at term, had no psychiatric disorders, were not prescribed with psychiatric drugs, had no known complications during pregnancy, and did not experience postpartum depression. Patients with a family history of violence or abuse, adolescent pregnancy, maternal comorbidities, or fetal anomalies diagnosed during the pregnancy as well as those in second marriages were excluded. All patients in the C/S group underwent their first C/S due to arrest of descent.

The demographic data of the subjects, including age, gravidity, and parity, were recorded, and a detailed anamnesis was taken on the day of hospitalization for delivery. Newborns' sex were also taken into consideration. All patients were asked to complete the MAI, EPDS, and PSAS at the third-month postpartum control.

The MAI was developed by Mary E. Muller in 1994 to measure maternal love attachment (14). The reliability coefficient of Cronbach alpha was found to be 0.85, and a positive correlation with the EPDS ($r = 0.31, p < 0.01$) was reported. Kavlak and Sirin performed the Turkish validation of the inventory (15). Each item of the inventory is evaluated by a four-way to 26-point Likert-type scale, compromising 'always' (4 points), 'often' (3 points), 'sometimes' (2 points) and 'never' has (1 point). The lowest score obtainable from the scale is 26, while the highest score is 104. A high score indicates a high maternal attachment.

The EPDS measures maternal postnatal depressive symptoms and consists of 10 items, each with answers scored from 0 to 3. The total score ranges from 0 to 30 where a higher score indicates higher levels of depressive symptoms. A cut-off score of ≥ 13 indicates a probable depression (16). However, the results of this scale alone are not sufficient enough for a clinical diagnosis. The Turkish validation was carried out by Aydin et al. (17).

The PSAS was developed by Fallon et al. to assess anxiety symptoms specific to the postpartum period (18). The scale consists of 51 items and has the following four sub-dimensions: maternal competence and attachment anxieties (items 1–15), infant safety and welfare anxieties (items 16–26), practical infant care anxieties (items 27–33), and psychosocial adjustment to motherhood (items 34–51). Responses to the items are rated on a 4-point Likert scale ranging from 1 to 4 (1 = never, 2 = sometimes, 3 = often, 4 = almost always). According to the PSAS, the postpartum anxiety levels of those who score 73 and below, between 74 and 100, and 101 and above are low, moderate and high, respectively. The Cronbach's alpha was determined as 0.91. Duran performed the Turkish validation of the inventory (19).

Statistical Analysis

The data analysis was performed using IBM SPSS Statistics version 17.0 software (IBM Corporation, Armonk, NY, USA). Whether the distributions of continuous variables were normal was determined using the Kolmogorov-Smirnov test. Descriptive statistics for continuous variables were expressed as mean ± standard deviation (SD). Frequency distributions were shown for categorical data. The continuous variables that were not normally distributed were evaluated by Mann Whitney U or Kruskal Wallis tests depending on the number of independent groups. Categorical data were analyzed using Pearson's χ^2 test. Degrees of association between continuous variables were obtained with Spearman's rank-order correlation analyses. Multiple linear regression analyses were applied to determine the best predictors that affect the MAI levels. Any variable whose univariable test had a p value < 0.10 was accepted as a candidate for the multivariable model along with all variables of known clinical importance. The coefficient of regression, 95% confidence interval, and t-statistic for each independent variable were also calculated. Due to non-normal distribution, logarithmic transformation was used for the MAI in regression analyses. A p-value of less than 0.05 was considered statistically significant.

Results

The sociodemographic data of the NVD and C/S groups are presented in Table 1. The mean age, gravidity, parity, and the number of children in the C/S group were significantly higher than those in the NVD group, with p-values of 0.009, 0.040, 0.011, and 0.009 respectively. Conversely, no significant differences in terms of length of marriage, abortion number, the infant's sex, the infant's birth weight, and the mother's education level were observed between the groups (p > 0.05). The PSAS score in the NVD group was calculated to be 68.9 ± 9.0, which was significantly higher than that in the C/S group at 65.0 ± 9.6 (p = 0.005) (Table 1). However, the MAI and EPDS scores in both groups were calculated to be similar (p = 0.833 and p = 0.260, respectively).

A correlation analysis was conducted between certain demographic characteristics, including age, length of marriage, number of children, gestational week at birth, and education level as well as between the MAI, EPDS, and PSAS scores of all the patients (Table 2a). A significant negative correlation was observed between age and MAI (r = -0.180, p = 0.011) and between number of children and MAI (r = -0.140, p = 0.048). Apart from these two characteristics, the rest of the parameters did not reveal any significant correlation with the MAI, EPDS, and PSAS (p > 0.05). The analysis between the different types of scales revealed that as the EPDS scores and PSAS scores increased, the MAI scores decreased significantly (r = -0.422, p < 0.001 and r = -0.472, p < 0.001, respectively) (Table 2a). However, a positive correlation was observed between the PSAS and EPDS (r = 0.251, p < 0.001).

In Table 2b, the effects of infant's sex, mother's working status, and mother's education level on the MAI, EPDS, and PSAS scores were analyzed. No significant effects of these characteristics on the scales were observed (p > 0.05).

A multiple linear regression analysis was performed using the characteristics that yielded significant results in the single variant analysis (Table 3). Because a multicollinearity was present between the age and number of children, age and length of marriage, and number children and length of marriage, and because number of children can be considered a secondary characteristic to age and length of marriage,

Table 1. Sociodemographic characteristics and comparison of the MAI, EPDS and PSAS scores

	NVD Group (n:100)	C/S Group (n:100)	*p*-value
Age (years)	27.3±6.0	29.5±5.7	**0.009**
Length of marriage (years)	6.6±5.3	7.2±5.1	0.265
Gravidity	2.4±1.5	2.8±1.6	**0.040**
Parity	1.1±1.1	1.5±1.2	**0.011**
Abortion	0.4±0.8	0.4±0.7	0.647
Number of Children	1.0±1.1	1.4±1.2	**0.009**
Infant's Sex (n)	Female: 55 Male: 45	Female: 52 Male: 48	0.671
Gestational age at birth (weeks)	38.6±1.8	37.6±2.5	**0.003**
Birth Weight (g)	3194.4±484.3	3158.3±723.6	0.713
Working status	Working: 4 Housewife: 96	Working: 8 Housewife: 92	0.234
Education level (n)	Illiterate: 13 Primary school: 38 Middle school: 25 High school: 20 University: 4	Illiterate: 18 Primary school: 43 Middle school: 20 High school: 15 University: 4	0.665
MAI	84.5±11.2	85.8±7.1	0.833
EPDS	6.8±2.8	6.2±1.7	0.260
PSAS	68.9±9.0	65.0±9.6	**0.005**

NVD: normal vaginal delivery, C/S: cesarean section, MAI: Maternal Attachment Inventory, EPDS: Edinburgh Postnatal Depression Scale, PSAS: Postpartum Specific Anxiety Scale

Table 2a. Correlation analysis between the MAI, EPDS, PSAS and clinical/sociodemographic parameters

	MAI		EPDS		PSAS	
	r	*p*	*r*	*p*	*r*	*p*
Age	-0.180	**0.011**	0.014	0.849	0.052	0.466
Length of marriage	-0.125	0.078	0.015	0.836	-0.016	0.820
Number of Children	-0.140	**0.048**	0.016	0.822	-0.008	0.915
Gestational age at birth (weeks)	0.077	0.281	0.014	0.841	0.026	0.713
Education level	0.027	0.703	-0.052	0.464	0.085	0.230
MAI	-	-	-0.422	**<0.001**	-0.472	**<0.001**
EPDS	-0.422	**<0.001**	-	-	0.251	**<0.001**
PSAS	-0.472	**<0.001**	0.251	**<0.001**	-	-

MAI: Maternal Attachment Inventory, EPDS: Edinburgh Postnatal Depression Scale

PSAS: Postpartum Specific Anxiety Scale

Table 2b. The comparisons of the MAI, EPDS, PSAS scores in terms of infant's sex, maternal education level and working status

	MAI	EPDS	PSAS
Infant's Sex			
Female	84.9±9.8	6.6±2.5	67.0±10.8
Male	85.3±8.8	6.3±2.2	67.0±7.8
p-value	0.685	0.518	0.875
Working status			
Housewife	85.0±9.5	6.5±2.4	66.9±9.7
Working	87.1±7.7	5.8±1.7	68.8±7.1
p-value	0.341	0.200	0.360
Education level			
Illiterate	85.8±7.1	6.4±1.8	66.3±7.6
Primary school	84.7±9.3	6.6±2.4	66.4±10.9
Middle school	85.6±9.1	6.4±2.4	66.4±8.8
High school	84.8±12.0	6.3±2.6	70.1±8.7
University	85.5±6.8	6.8±2.1	66.4±8.5
p-value	0.974	0.895	0.245

MAI: maternal attachment inventory, EPDS: Edinburgh Postnatal Depression Scale, PSAS: Postpartum Specific Anxiety Scale

the regression analysis included length of marriage and age. Furthermore, due to the non-normal distribution of the MAI scores a logarithmic transformation was performed in the regression analysis.

In Model 1, when the MAI scores were corrected according to the marriage length, EPDS, and PSAS, it was observed that the mode of delivery did not have a significant effect on the MAI scores (B = -0.013, 95% CI: -0.039 to 0.014, and p = 0.347) (Table 3). Conversely, an increase in the EPDS (B = -0.024, 95% CI: -0.030 to -0.019) and PSAS (B = -0.054, 95% CI: -0.069 to -0.040) independent of other factors was again associated with a decrease in the MAI scores (p < 0.001). A significant decrease in MAI scores (p < 0.001) was associated with every 10-point increase in PSAS scores in Model 2 and every one-point increase in EPDS scores in Model 3, independent of other factors. Delivery by C/S did not have a significant effect on the MAI scores. In Model 4, when the MAI scores were corrected according to age, EPDS, and PSAS, it was observed that the mode of delivery did not have a significant effect on the MAI scores (B = -0.011,

Table 3. Multiple linear regression analysis determining the best predictor(s) effecting maternal attachment inventory

	Coefficient of regression (B)	95% CI for B		t	*p*-value
		Lower Bound	*Upper Bound*		
Model 1					
C/S	-0.013	-0.039	0.014	-0.943	0.347
Length of marriage[¶]	-0.020	-0.045	0.005	-1.604	0.110
EPDS	-0.024	-0.030	-0.019	-8.219	**<0.001**
PSAS[†]	-0.054	-0.069	-0.040	-7.361	**<0.001**
Model 2					
C/S	-0.005	-0.036	0.026	-0.318	0.751
Length of marriage[¶]	-0.015	-0.043	0.014	-1.000	0.318
PSAS[†]	-0.073	-0.089	-0.056	-8.871	**<0.001**
Model 3					
C/S	0.005	-0.025	0.034	0.306	0.760
Length of marriage[¶]	-0.022	-0.050	0.006	-1.517	0.131
EPDS	-0.031	-0.037	-0.025	-9.666	**<0.001**

(*continued*)

Table 3. Multiple linear regression analysis determining the best predictor(s) effecting maternal attachment inventory (*continued*)

	Coefficient of regression (B)	95% CI for B		t	*p*-value
		Lower Bound	*Upper Bound*		
Model 4					
C/S	-0.011	-0.038	0.016	-0.813	0.417
Age‡	-0.012	-0.034	0.011	-1.017	0.311
EPDS	-0.024	-0.030	-0.018	-8.129	**<0.001**
PSAS†	-0.054	-0.069	-0.039	-7.275	**<0.001**
Model 5					
C/S	-0.004	-0.035	0.028	-0.222	0.824
Age‡	-0.010	-0.036	0.016	-0.757	0.450
PSAS†	-0.072	-0.088	-0.056	-8.795	**<0.001**
Model 6					
C/S	0.007	-0.023	0.037	0.466	0.642
Age‡	-0.017	-0.042	0.008	-1.325	0.187
EPDS	-0.031	-0.037	-0.024	-9.584	**<0.001**

CI: Confidence interval, C/S: cesarean section, EPDS: Edinburgh Postnatal Depression Scale, PSAS: Postpartum Specific Anxiety Scale

¶The effect of 10-years increase in the length of marriage on maternal attachment inventory. †The effect of every 10-points increase in PSAS on maternal attachment inventory. ‡The effect of 10-years increase in age on maternal attachment inventory.

95% CI: -0.038 to 0.016, and $p = 0.417$). (Table 3). However, an increase in the EPDS (B = -0.024, 95% CI: -0.030 to -0.018) and PSAS (B = -0.054, 95% CI: -0.069 to -0.039), independent of other factors, was still associated with a decrease in MAI scores ($p < 0.001$). A significant decrease in MAI scores ($p < 0.001$) was associated with every 10-point increase in PSAS scores in Model 5 and one-point increase in EPDS scores in Model 6, independent of other factors. Delivery by C/S did not have a significant effect on MAI scores.

Discussion

In this study, the effects of mode of delivery on MIB in a Turkish cohort were evaluated using the MAI, EPDS, and PSAS. The study results demonstrated that only the PSAS scores indicated that postpartum anxiety was affected by the mode of delivery. The mode of delivery did not have an impact on the MAI or EPDS in this study population. However, the results yielded negative correlations between maternal age at delivery, the number of existing children, and the MAI. Negative correlations between the EPDS and MAI and between the PSAS and MAI were also observed, showing that higher depression and anxiety levels among postpartum women affected MIB negatively.

Previous studies have already evinced the adverse effects of C/S, in comparison to vaginal birth on MIB (12). However, when C/S was performed under general anesthesia, the short-term positive effects of anesthetics on the MAI during the first week of the postpartum period have been reported as indicating that the effects of mode of delivery on MAI may be due to postpartum pain rather than the mode of delivery itself (20). Our results differed from the literature because we did not observe any significant effects of the delivery method on MIB, postpartum depression, or anxiety. This may be due to the role of postpartum pain, which needs to be evaluated in future studies.

Most of the studies have revealed no significant relationship between maternal age at delivery and MIB (21,22). In the present study, however, the increase in maternal age at delivery showed poorer bonding scores when assessed with the MAI. This may be caused by the mother's feeling of being "torn" between home and career, which may be more established in older mothers than younger ones. Our results suggest that psychological support may be beneficial to older mothers.

Rossen et al. pointed to the lack of research on the presence of other children on MIB and suggested this as a topic for future research (23). In our study, mothers with more than one child were more likely to have lower MAI assessment scores. This may be due to the division of attention among children or the possibility of unintended pregnancies though these factors were not investigated in this study.

Previous studies have also investigated other prenatal factors, such as the presence of chronic conditions, including endometriosis and endometriosis-related subfertility, that may play a key role in the mother's level of psychological stress, anxiety, and depression during pregnancy and the postpartum period. High levels of depression, and anxiety causing psychological stress have been reported among women with endometriosis (24,25). The stress experienced among women with endometriosis also has a negative impact on the treatment and management of the disease (26,27). Therefore, the presence of such chronic gynecological conditions in mothers may have an impact on MIB, which needs to be evaluated in a future study.

The present study had several limitations. The most significant weakness is the cross-sectional design of the research. The researchers had to read the questions to and write the answers for some mothers were not literate, which may have interfered with the mother's answers. Furthermore, as MIB is affected by multiple pre- and postnatal factors, attributing a single factor to it while factoring out the effects of the others was difficult. However, because mode of delivery is a prominent factor determining MIB, the results could still be interpreted accordingly. To the best of our knowledge, this is the first study to evaluate postpartum anxiety and depression along with MIB.

Conclusion

MIB is essential in the healthy development of an infant, making it important to avoid factors that affect it adversely. According to the results of this study, which was conducted with a Turkish cohort, maternal age at delivery and the number of children at home are the factors that have an effect on MIB. Conversely, mode of delivery did not play a role in MIB among this study population. Multicenter studies with larger numbers of subjects are needed to draw a general conclusion regarding the Turkish population.

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Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Ethical statement: The study protocol was approved by the institution's Ethics Committee and registered to ClinicalTrials.gov (NCT04396509). Written informed consent was obtained from all subjects.

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