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Cesarean Section Can Be Related With Postpartum Depression: A Cross-sectional Study

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Abstract

Objectives: Depression is highly prevalent during pregnancy and after childbirth, and many factors, including the type of delivery, can contribute to developing this condition. Considering the increased use of remifentanil in painless labor and the need for conducting more studies on the consequences of this method this study aimed to determine the mean score of postpartum depression in women giving birth by either remifentanil-induced painless delivery or elective cesarean section.

Materials and Methods: The present study was a longitudinal investigation conducted on140 women referred to private hospitals, Tabriz, Iran, between 2020 and 2021 in two groups: women with elective cesarean delivery and women with vaginal delivery with remifentanil analgesia (n=70/each). Depression during pregnancy was assessed at 35-37th weeks' gestation, and postpartum depression was determined four weeks after childbirth using the Edinburgh Postnatal Depression Scale (EPDS). Independent *t* test and paired *t* test were used to compare depression scores.

Results: Postpartum depression was significantly higher in women who had undergone a cesarean section than in those giving birth by remifentanil-induced painless vaginal delivery ($P = 0.009$).

Conclusions: The prevalence of postpartum depression was higher in women who underwent elective cesarean section than women who underwent painless vaginal delivery with remifentanil. Considering the steady rise in worldwide cesarean section rate and the health burden and consequences of postpartum depression on mothers and children, health legislators should take measures to reduce women's tendency towards the cesarean section in the long run.

Keywords: Postpartum, Depression, Remifentanil, Cesarean section

Introduction

Postpartum depression is one of the most common mental disorders after labor, which affects the mother and family. A significant proportion of women experience postpartum depression after the birth of their baby (1,2). The incidence of depression in the postpartum period can reach more than twice its incidence in other stages of a woman's life (2). The symptoms of postpartum depression include a depressive mood, a lack of interest in daily activities, and the four related symptoms of sleep and appetite disorders, psychomotor restlessness, feelings of worthlessness, and suicidal ideation (3). The prevalence of postpartum depression has been reported between 0.5 and 60% globally and 25% in Iran (4,5). Postpartum depression negatively affects the mother's quality of life, leading to failure in fulfilling maternal and marital duties (6). The delayed diagnosis of the disorder causes ineffective adaptation of the mother to the infant, spouse, and family, and in case of exacerbation, it can lead to maternal suicide or child murder tragedies. Postpartum depression in women can cause the recurrence of the condition as chronic depression and subsequently lead to behavioral, emotional, and cognitive problems in later stages of the infants' life. The risk of suicide is higher in women with postpartum depression than in healthy women (7,8).

It seems that the type of delivery influences the incidence of these psychological and physical consequences, including postpartum depression (9). Studies in this field have reported different and sometimes contradictory results. For example, a study by Xu et al showed that the women giving birth by cesarean section had a higher chance of developing postpartum depression (10), while Cirik et al declared that cesarean section could not play a role in postpartum depression (11).

Remifentanil is a highly potent painkiller, identified in the early 1990s. The effect of remifentanil starts about one minute after administration, and the drug has a short half-life of about three minutes. It passes through the placenta quickly, however is metabolized and does not reach the fetus rapidly. Remifentanil can be injected intermittently through a pump in a patient-controlled manner, delivering it an appropriate systemic opioid to relieve labor pain in women (12).

Our literature review found no studies on the incidence rate of depression after remifentanil-induced painless delivery, which was addressed here for the first time.

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Key Messages

- Considering the increased use of remifentanil in painless labor and the need for conducting more studies on the consequences of this method this study aimed to determine the mean score of postpartum depression. In this study depression during pregnancy was assessed at 35-37th weeks' gestation, and postpartum depression was determined four weeks after childbirth. Results show the prevalence of postpartum depression was higher in women who underwent elective cesarean section than women who underwent painless vaginal delivery with remifentanil.

Considering the increased use of remifentanil as an analgesic for painless delivery in Iran and worldwide, a systematic review by Cochrane recommended further studies on maternal consequences in the women receiving remifentanil during labor (13). Therefore, the present study aimed to determine the mean score of postpartum depression in women giving birth by either remifentanil-induced painless delivery or elective cesarean section.

Materials and Methods

A cross-sectional was conducted on 140 women referred to private hospitals (Shams, Shariar, Noor Nejat and Vliasr), Tabriz, Iran, between 2021 and 2020 in two groups: women with remifentanil-induced painless vaginal delivery and women with elective cesarean section (n=70/each).

Our inclusion criteria were living in Tabriz, experiencing the first or the second childbirth, giving birth through either remifentanil-induced painless vaginal delivery or elective cesarean section and the gestational age between 37 and 42 weeks. Our exclusion criteria were multiple pregnancies, having severe diseases, such as cardiovascular diseases, diabetes, chronic hypertension, preeclampsia, etc, obstetric problems, such as placenta previa, fetal distress, placental abruption, a self-reporting history of depression needing pharmaceutical treatment, experiencing a major familial stressful event during the past six months (such as the death of a loved one, marital divorce, etc.), and obtaining a score higher than 13 in the Edinburgh Postnatal Depression Scale (EPDS) questionnaire at 35-37 weeks' pregnancy.

The sample size was estimated to be 63 in each group by considering the variables of m1 (SD1) = 49.1 (10.1), m2 (SD2) = 50 (8.7), $\alpha = 0.05$, power of 95%, based on the study by Barber et al and used the following formula:

$$n = (Z_{\alpha/2}+Z_{\beta})^2 * 2 * \sigma^2/d^2$$

Regarding a drop-out rate of 10%, the final sample size was determined to be 70 in each group (i.e., a total of 140 people) (14).

Sampling

After obtaining an ethics code, the researchers collected quantitative data by determining the prevalence of remifentanil-induced vaginal delivery and elective cesarean section in each private hospital. Then, the researcher went to the midwifery clinics of the hospitals and selected eligible women who were at the gestational age of 35-37 weeks using convenience sampling. Eligible individuals, were invited to participate in the study, after providing the necessary explanations. The sampling process continued until the sample size was reached.

The objectives and methods of the study were fully explained when eligible participants were identified. For illiterate people, the researcher read the items of the consent form in her own dialect, and in the case of expressing willingness; she was requested to sign the form with her fingerprint. During an in-person visit, a socio-demographic information checklist and a midwifery data questionnaire as well as EPDS were completed in a relatively quiet place. The researcher asked the participants to complete the EPDS again four weeks after delivery. In the elective cesarean section group, epidural anesthesia was used in all participants. In the vaginal delivery group, the mothers received 0.01 to 0.03 mg/kg remifentanil during the active phase of labor using a pump. A gynecologist delivered babies in both groups.

Data Collection

A checklist for the inclusion/exclusion criteria, a questionnaire for socio-demographic and midwifery data, and EPDS were used to collect data. The EPDS questionnaire was designed by Cox in 1987 which is considered the most valid tools for measuring depression in men and women. The questionnaire consists of ten four-option multiple-choice questions that are scored from 0 to 3, and the respondent must choose the option representing his/her feelings best during recent days. The minimum and maximum scores of the questionnaire are 0 and 30, respectively. It should be noted that questions No. 1, 2, and 4 are scored in reverse (13). The cut-off point for severe depression in this questionnaire is 13. This questionnaire has been used in many clinical studies to assess postpartum depression in Iran. Researchers have validated the Persian version of this questionnaire through the test-retest (0.8) and Cronbach's alpha (0.77) methods (14).

Statistical Analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences software (SPSS, version 21.0 for Windows; SPSS Inc., Chicago, IL). Descriptive statistics, including frequency (percentage) and mean (standard deviation), were used to describe socio-demographic and midwifery characteristics. The socio-demographic characteristics of the participants were compared between the two groups using the chi-square test (for qualitative variables) and the independent Students *t* test (for quantitative variables). After adjusting

for intervening variables, a general linear model was used to compare postpartum depression between the study groups. Binary logistic regression was used to identify the risk factors of severe postpartum depression (according to EPDS cut off point). *P* value less than 0.05 was considered significant.

Results

The present study was conducted on 140 mothers from July 2020 to February 2021. The participants' mean age (standard deviation) was 28.41 years in the two groups (n=70/each) (6.49). Comparing the participants' socio-demographic characteristics between the two groups showed that income level and the parents' education levels were significantly higher in the cesarean section group than in the natural delivery group. Mothers in none of the groups had a history of alcohol or drug use; Also, the two groups did not differ significantly in terms of gravida (*P*=0.389) (Tables 1 and 2).

Data analysis showed that after adjusting for the baseline EPDS score and the income level, the postpartum depression score was significantly higher in the elective cesarean section group than in the remifentanil-induced painless vaginal delivery group (Tables 3 and 4).

Discussion

The present study aimed to compare the prevalence of postpartum depression among the women giving birth by either remifentanil-induced painless delivery or elective cesarean section. After adjusting for intervening variables (the depression score during pregnancy and income level), the postpartum EPDS score was significantly higher in women undergoing cesarean section than in those giving birth by remifentanil-induced painless vaginal delivery. Although the prevalence of mild postpartum depression (i.e., the Edinburgh questionnaire score above 10) was not significantly different between the two groups, the prevalence of severe depression (a score above 13) was significantly higher in the cesarean section group compared to the remifentanil-induced painless vaginal delivery group (20% vs. 14%, respectively). In the present study, there was a significant difference between the two groups in terms of income level and education, with the ratio of people with more income and education was

Table 1. Comparison of the Frequency of Socio-demographic Characteristics Between the Two Groups of Natural Delivery and Cesarean Section (n=70/each)

Variables		Delivery Mode		*P* Value[a]
		Natural Delivery, No. (%)	Cesarean Section, No. (%)	
Residency	One's own house	44 (62.86)	47 (67.14)	0.248
	Tenant	26 (36.14)	23 (32.86)	
Income status	Adequate	12 (17.14)	36(51.43)	<0.001
	Relatively adequate	46 (65.71)	30 (42.86)	
	Inadequate	12 (17.14)	4 (5.71)	
Maternal education	Lower than diploma	24 (34.29)	8 (11.43)	<0.001
	Diploma	28 (40.00)	24 (34.29)	
	Academic	18 (25.71)	38 (54.29)	
Husband's education	Lower than diploma	25 (35.71)	8 (11.43)	<0.001
	Diploma	24 (34.29)	21 (30.00)	
	Academic	21 (30.00)	41 (58.57)	
Mother's job	Housewife	63 (90.00)	62 (88.57)	0.577
	Employed	7 (10.00)	8 (11.43)	
Gravida	1	21(30.00)	24(34.29)	0.389
	2	49(70.00)	46(65.71)	

[a] Chi-square test.

Table 2. Comparison of Neonates' Characteristics Between the Natural Delivery and Cesarean Section Groups (n=70/each)

Variables		Delivery Route		*P* Value[a]
		Natural Delivery, No. (%)	Cesarean Section, No. (%)	
Gestational age (wk)	37	4 (5.71)	6 (8.57)	<0.001*
	37-39	36 (51.43)	60 (85.71)	
	40-41	29 (41.43)	4 (5.71)	
Neonate's gender	Boy	35 (50.00)	39 (55.71)	0.338
Birth weight (g)	<2500	1 (1.43)	3 (4.29)	0.234
	2500-3500	40 (57.14)	44 (62.86)	
	3501-4500	25 (35.71)	23 (32.86)	
	>4500	3 (4.29)	0 (0)	
Pregnancy intention	Planned	57 (81.43)	55 (78.57)	0.118

[a] Chi-square test. * *P* value less than 0.05 was considered significant.

Table 3. Comparison of the Postpartum Depression Score Between the Elective Cesarean Section and Vaginal Delivery Groups (n=70/each)

Variables		Delivery Mode		Adjusted Mean Difference	*P* Value
		Natural Delivery, No. (%)	Cesarean Section, No. (%)		
Postpartum Depression	Depression Absent (score <13)	60 (85.7)	55 (78.6)		0.001[a]
	Depression present (score ≥13)	10 (14.3)	15 (21.4)		
Depression score during pregnancy (0-30)		7.5 (2.60)	6.6 (2.9)	0.89 (-0.1:12.97)	0.06[b,*]
Postpartum depression score		6.76 (3.7)	8.08 (3.4)	1.32 (0.32: 2.31)	0.009[a]

[a] Chi-square test; [b] t-test. **P* value less than 0.05 was considered significant.

Table 4. Risk Factors for Postpartum Depression (EPDS ≥13)

Variable	Odd Ratio	95% Confidence Interval	*P* Value[a]
Type of delivery			
Vaginal with remifentanil analgesia (reference)	-		0.041
Cesarean section	1.3	1.1-1.7	
Income			
Adequate income (reference)	-		0.021
Insufficient income	1.2	1.0-1.8	

[a] Binary logistic regression.

higher in the cesarean section group. Because our results suggested that level pf income were possibly associated with depression (15,16), we included 2 variables as interveners into the model to adjust the effects of income, and the baseline depression score. Severe depression was more prevalent in the cesarean section group than in the natural delivery group.

The logistic regression results showed that the type of delivery was one of the predictors of postpartum depression. Several studies have investigated the relationship between the delivery route and postpartum depression, some of which have supported such a relationship. For example, a meta-analysis by Moameri et al on 1 710 494 participants, showed that cesarean section could lead to postpartum depression (17). However, the results of another study did not show such a relationship (18).

Studies have shown a decrease in prolactin and an increase in interleukin 6 levels in maternal blood following labor pain, both of which are known to be definite risk factors for depression (19). In addition, there is a possibility of losing up to one liter of blood following cesarean section (20,21), and excessive bleeding has been identified as a risk factor for postpartum depression (22,23).

Postpartum depression is a serious health problem associated with negative physical and psychological consequences, including decreased quality of mothers' life. Depressed mothers experience more problems in their social and marital relationships (24) and are more likely to perpetrate high-risk behaviors, including suicide (25,26). Studies have shown that the mother's depression can be related to poor infant weight gain (27). Many studies have also revealed that maternal depression is negatively associated with the infant's cognitive development, language development, and sleep quality (28,29).

Postpartum depression, especially during the first year after delivery, is one of the most common public health problems in low- and middle-income countries. This condition can occur at any time from two weeks to one year after delivery. Fear of childbirth, taking care of the baby, feeling unattractive to the spouse, the delivery route, pain intensity during labor and postpartum, and a history of depression can lead to anxiety in mothers and make people susceptible to various types of mental disorders, such as depression in the postpartum period (30,31).

Logtenberg et al compared the effects of remifentanil anesthesia and epidural anesthesia and showed that remifentanil, based on the patient's request, did not prolong the active phase of labor or increase the tendency for instrumental delivery (32). Remifentanil is a safe drug with effectively induce analgesia during labor (30,32).

Limitations of the Study

The most important limitation of our study was the inclusion of patients who underwent caesarean section only in private centers (with favorable economic conditions/effect on depression); It is recommended to remove this limitation in future studies.

Conclusions

For the first time, this study compared the prevalence of postpartum depression between the women undergoing remifentanil-induced painless delivery and those giving birth via elective cesarean section. The present study results showed that women who underwent elective cesarean section were more likely to experience postpartum depression than those who underwent remifentanil-induced painless vaginal delivery. Considering the steadily increasing rate of the use of cesarean section in the world and its devastating effects on the health of mothers and

children, health legislators should implement measures to reduce the social tendency towards the cesarean section in the long run.

Authors' Contribution

RD and NS designed the study and conducted the research. HP, SH, and RN monitored, evaluated, and analyzed the result of the study. Further, RD and NS reviewed the article. All authors approved the final manuscript and take responsibility for the integrity of the data.

Conflict of Interests

Authors declare that they have no conflict of interests.

Ethical Issues

This study was approved by the Ethics Committee of Tabriz University of Medical Sciences, Tabriz, Iran (Code: IR.TBZMED.REC.1399. 521). The written informed consent was obtained when the participants expressed their willingness to participate and the participants were assured about the confidentiality of their names and information and reporting the results anonymously.

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