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Impact of Maternal Depression on Pregnancy and Neonatal Outcomes: A Prospective Analysis

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ABSTRACT

Antenatal depression was common in pregnant women and can cause adverse maternal and neonatal outcomes. **Objective:** This study was conducted to evaluate the incidence of antenatal depression in hospitalized pregnant women and its association with maternal and neonatal outcomes. **Methods:** A prospective observational study was conducted in the Gynecology and Obstetrics and Psychiatry Department of the Hospital from July 2023 to July 2024. A total of 300 pregnant women with gestation age 240/7 weeks or less, admitted to the OBGYN department as high-risk pregnancy patients were selected by consecutive sampling. Women were presented with the Edinburgh Post Natal Depression Scale questionnaire 2-4 times every week for the entire study period along with questionnaires to personal collect data. EPDS was generally used to assess post-partum depression but we used it to evaluate perinatal depression as it is also validated for antenatal depression measurement. Patients were divided into two groups based on EDPS score, the study group contained patients at high risk of antenatal depression with a score of 10 ≤, and the comparison group contained women at low risk of depression with a score <10. Data analysis was done by SPSS version 24.0. **Results:** The frequency of preterm delivery was significantly higher in the study group with 40% preterm births and 23.4% early preterm births as compared to 19.1% and 12.4% in the comparison group, respectively. Similarly, birthweight was lower in the study group (40%) and low 1-minute (20%) and 5-minute Apgar scores. Multivariate regression analysis revealed an independent and significant relationship between maternal depression and preterm delivery (aOR: 3.27, 95% CI: 1.23-9.47) (p=0.030). However, no independent association was found between NICU admission and antenatal depression (aOR: 3.1, 95% CI: 1.0-5.2) (p=0.087) and risk of C-section (aOR: 0.9, 95% CI: 0.9-1.9) (p=0.731). **Conclusions:** Antepartum depression was a frequent condition among hospitalized pregnant women independently correlated to preterm births. Depression screening of pregnant women was recommended to prevent adverse maternal and neonatal outcomes.

INTRODUCTION

Millions of women across the world suffer from mental illness and psychiatric disorders like depression and anxiety during pregnancy and after birth. The risk of depression is 7-20% in women of childbearing age which is two times higher as compared to men of the same age [1]. In pregnant women admitted to the obstetrics unit due to complications, the risk is elevated to 27-44% [2]. According to a study, 40% of pregnant women diagnosed with depression had a major depression disorder [3]. There are contrasting views regarding the degree of impact of depression on pregnancy but literature has suggested a negative effect [4]. An association between high pregnancy complications and antenatal depression has been reported with the latter leading to prolonged labor, miscarriages, C-sections, preeclampsia, and increased need for painkillers during delivery, preterm birth, and low birth weight of neonates [5, 6]. The possible causes of this correlation are the HPA dysfunction as a result of extreme stress that triggers increased levels of stress hormones including norepinephrine which leads to preterm birth, immunodeficiency, maternal self-medication, and insufficient prenatal care. Depression can also cause

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perinatal complications which lead to increased neonatal morbidity and mortality, anomalies, and delayed development. The Edinburgh Postnatal Depression Scale designed by Levis B et al., is a self-reported questionnaire used to diagnose antenatal depression [7]. A cut-off score of 10 or higher indicates high-risk depression and requires medical attention and treatment [8]. Several studies have used this scale to diagnose antenatal and postpartum depression [9, 10]. Early diagnosis and treatment of maternal depression are not common globally due to under-awareness and failure to diagnose because of atypical symptoms. There is a lack of awareness regarding maternal depression and postpartum depression in Pakistan. The research on antenatal depression during pregnancy and its impact on birth outcomes is scarce. There is need for elaborate research to clarify a clear association between maternal mental health and its effect on pregnancy outcomes and neonatal wellbeing.

This study was conducted to evaluate the incidence of antenatal depression in hospitalized pregnant women and its association with maternal and neonatal outcomes.

METHODS

A prospective observational study was conducted in the Gynecology and Obstetrics and Psychiatry Department of the Hospital from July 2023 to July 2024. A total of 300 pregnant women with gestation age 240/7 weeks or less, admitted to the OBGYN department as high-risk pregnancy patients were selected by consecutive sampling. The sample size was calculated by WinPepi software by keeping predicted values of 30% incidence of antenatal depression, power, 5% margin of error and 95% confidence interval [11]. All patients provided their informed consent to become a part of the study. Patients who did not provide consent to be included in the research and illiterate women were excluded as questionnaire was self-reported. The ethical committee of the hospital approved the study Ref No. SIMC/ET.C/10003/23. All women were asked to fill out the EPDS questionnaire during their hospital stay for depression screening. EPDS was generally used to assess post-partum depression but we used it to evaluate perinatal depression as it is also validated for antenatal depression measurement.[12] It contained 10 questions which could be responded from 0 to 3 with 0 being not at all and 3 being quite a lot. The maximum score range was 30. A cut-off score of 10 indicated depressive women. Women were presented with the questionnaire 2-4 times every week for the duration of the study along with questionnaires to collect data including socioeconomic information, medical history pregnancy data, and duration. The completed questionnaires were collected and computer-coded for analysis. Information about birth and neonate was also collected after birth for perinatal and neonatal outcomes (Apgar score, birth weight, and NICU admissions). Patients were divided into two groups based on EDPS score cut-off, the study group contained patients at high risk of antenatal depression with a score of 10 ≤, and the comparison group contained women at low risk of depression with a score <10. Data analysis was done by SPSS version 24.0. Independent sample t-test was performed to compare continuous variables presented by mean ± SD and categorical variables were presented by percentage and compared by chi-square test. The association between dependent and independent variables was assessed by multivariate analysis and adjusted for confounding variables from univariate analysis including preeclampsia, maternal age, gestation age at admission, gestational diabetes, and post preterm delivery. A p-value of 0.05 or less was considered significant.

RESULTS

The study participants were divided according to EPDS score into a study group with 90 women (30%) and a comparison group with 210 women (70%). Groups did not differ in terms of maternal age (27.3 ± 4.251 vs 28.43 ± 4.406 years) (p=0.050). 42.3% of women in the study group had asthma which was significantly higher than 9% in the comparison group. 73.4% of women in the study group were multiparous and 26.7% were nulliparous as compared to 62.7% and 36.2% in the comparison group (p=0.023) (Table 1).

Table 1: Socio-demographic and Clinical Features among study participants(n=300)

Variables	EPDS 10 ≥ Mean ± SD / N (%)	EPDS < 10 Mean ± SD / N (%)	OR (95% CI)	p-Value
Mean Age	27.3 ± 4.251	28.43 ± 4.406	-	0.050
Marital Status				
Married	87 (96.7%)	194 (92.4%)	-	0.522
Single/ Divorced	3 (3.3%)	16 (7.6%)	-	
Parity				
0	24 (26.7%)	76 (36.2%)	-	0.023
1-3	50 (55.6%)	116 (55.2%)	-	
≥4	16 (17.8%)	18 (8.5%)	-	
Mean BMI	27 ± 4	28 ± 4.5	-	0.4
Chronic Illness				
Chronic Hypertension	50 (55.6%)	53 (25.2%)	4.011 (0.805-20.583)	0.109
Diabetes Type I	-	26 (12.4%)	0.782 (0.536-0.925)	1
Diabetes Type II	9 (10%)	17 (8.1%)	1.610 (0.534-0.941)	1
Asthma	38 (42.3%)	19 (9%)	8.226 (1.066-49.134)	0.054
Thyroid Disorder	18 (20%)	63 (30%)	0.682 (0.122-4.010)	1
Autoimmune Disorder	11 (12.3%)	40 (19.1%)	0.632 (0.058-5.217)	1
Cardiac Illness	9 (10%)	42 (20%)	0.531 (0.049-5.210)	1
Mood Disorder	42 (46.7%)	21 (10%)	6.493 (3.997-13.252)	<0.001
Anti-depression Intake During Pregnancy	2 (2.3%)	2 (1%)	2.688 (0.167-44.224)	0.456
Past Preterm Delivery	27 (30%)	42 (20%)	1.459 (0.774-2.186)	0.252

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History of Antenatal or Postpartum Depression	16 (17.8%)	9 (4.3%)	1.459 (0.774-2.186)	0.001

Gestation age was shorter in women positively screened for depression (31.30 ± 4.98 weeks) than the comparison group (33.29 ± 5.05 weeks). Preterm cervical effacement was significantly more common in the study group than in the comparison group (17.8% vs 8.1%) (p=0.019). However, premature membrane rupture was common in the comparison group i.e. 7.1%. The information about pregnancies in both groups was showed in Table 2.

Table 2: Clinical presentation of the study participants

Features	EPDS 10 ≥ Mean ± SD / N (%)	EPDS < 10 Mean ± SD / N (%)	OR (95% CI)	p-Value
Average Gestation Age at Admission	31.30 ± 4.98	33.29 ± 5.05	-	0.005
Average Gestation Age during the Questionnaire	31.69 ± 3.77	33.46 ± 5.02	-	0.008
Cause of Admission				
Preterm Uterine Contractions	13 (14.5%)	21 (10%)	1.425 (0.588-3.290)	0.31
Preterm Cervical Effacement	16 (17.8%)	17 (8.1%)	2.520 (1.175-5.760)	0.019
Induction of Labor	4 (4.4%)	17 (8.1%)	0.493 (0.141-1.726)	0.422
Vaginal Bleeding	3 (3.3%)	13 (6.2%)	0.451 (0.1-1.998)	0.370
Placenta previa Related Bleeding	4 (4.4%)	9 (4.3%)	1.266 (0.297-4.225)	0.723
Oligohydramnios	8 (8.9%)	7 (3.4%)	3.033 (1.099-13.573)	0.028
Fetal Growth Restriction	12 (13.4%)	17 (8.1%)	1.503 (0.837-2.777)	0.245
Urinary tract infections (UTIs)	6 (6.7%)	7 (3.4%)	2.518 (0.742-8.224)	0.149
Hypertension/ Preeclampsia	2 (2.3%)	5 (2.4%)	0.49 (0.061-3.250)	1
Premature Rupture of Membranes	-	15 (7.1%)	0.695 (0.543-0.658)	0.018
Preterm premature rupture of membranes	6 (6.7%)	5 (2.4%)	3.207 (0.870-11.551)	0.117
Abdominal Pain	2 (2.5%)	7 (3.4%)	0.720 (0.150-3.429)	1
Others	14 (15.5%)	70 (33.3%)	0.718 (0.3-1.306)	0.309
In Vitro Fertilization	9 (10%)	21 (10%)	1.11 (0.39-2.66)	0.79
Nuchal-translucently > 3 mm	4 (4.4%)	5 (2.4%)	0.312 (0.051-2.147)	0.219
Abnormal First-trimester Screening	2 (2.3%)	5 (2.4%)	1.434 (0.158-11.791)	1
Abnormal Triple Test	8 (8.9%)	17 (8.1%)	0.1 (0.255-3.76)	1
Abnormal Early Sonographic Scan	-	1 (0.4%)	1.287 (1.270-1.502)	1
Abnormal Late Sonographic Scan	2 (2.3%)	5 (2.4%)	0.839 (0.165-3.476)	1
Amniocentesis Done	9 (10%)	21 (10%)	1.018 (0.430-2.350)	1
Gestational Diabetes	8 (8.9%)	21 (10%)	0.909 (0.372-2.275)	0.850
Insulin Use	39 (43.4%)	36 (17.1%)	3.81 (0.544-25.200)	0.302
Preeclampsia	6 (6.7%)	9 (4.3%)	1.561 (0.52-4.493)	0.505
Suspected Fetal Growth Restriction	9 (10%)	21 (10%)	1.177 (0.494-2.782)	0.822
Bleeding During Pregnancy	14 (15.6%)	40 (19.1%)	0.869 (0.428-1.647)	0.698

Both groups differ significantly with respect to gestation age at birth with 35.71 ± 4.0 weeks in the study group and 36.65 ± 3.0 weeks in the comparison group (p=0.029). The frequency of preterm delivery was significantly higher in the study group with 40% preterm births and 23.4% early preterm births as compared to 19.1% and 12.4% in the comparison group, respectively. Similarly, birthweight was lower in the study group (40%) and low 1-minute (20%) and 5-minute (6.7%) Apgar score was also noted in the study group. 24.5% of neonates were admitted to NICU in the study group and 10% in the comparison group (p=0.008). Low Apgar scores and NICU admissions imply the effect of maternal stress on neonatal outcomes (Table 3).

Table 3: Maternal and Neonatal Outcomes among study participants

Features	EPDS 10 ≥ Mean ± SD / N (%)	EPDS < 10 Mean ± SD / N (%)	OR (95% CI)	p-Value
Gestation Age at Birth	35.71 ± 4.0	36.65 ± 3.0	-	0.029
Preterm Delivery (<37 Weeks)	36 (40%)	40 (19.1%)	2.649 (1.447-3.890)	<0.001
Early Preterm Delivery	21 (23.4%)	26 (12.4%)	2.170 (1.3-3.265)	0.019
Mode of Delivery				
Vaginal	54 (60%)	143 (68.1%)	-	0.500
Cesarean	36 (40%)	67 (31.9%)	-	
Postpartum Hemorrhage	4 (4.4%)	5 (2.4%)	3.992 (0.548-22.637)	0.137
Blood Transfusion Requirement	2 (2.3%)	5 (2.4%)	1.022 (0.187-4.329)	1.0
Stillbirth	2 (2.3%)	-	0.279 (0.226-0.348)	0.279
Mean Birth Weight	2697 ± 890.87	2874 ± 694.31	-	0.15
Macrosomia	3 (3.3%)	9 (4.3%)	0.953 (0.251-3.558)	1.0
Low Birth Weight	36 (40%)	53 (25.2%)	0.990 (1.155-3.778)	0.010
Very Low Birth Weight (<2500g)	9 (10%)	17 (8.1%)	1.691 (0.710-3.132)	0.231
1 minute Apgar score <7	18 (20%)	17 (8.1%)	2.762 (1.330-5.185)	0.011
5-minute Apgar score <7	6 (6.7%)	1 (0.4%)	12.208 (1.429-114.740)	0.010
Mean Umbilical pH	7.30 ± 0.080	7.30 ± 0.083	-	0.70
Meconium-Stained Amniotic Fluid	4 (4.4%)	26 (12.4%)	0.345 (0.081-1.496)	0.22
Immediate Resuscitation	13 (14.5%)	9 (4.3%)	3.347 (1.524-7.218)	0.009
NICU Admission	22 (24.5%)	21 (10%)	2.492 (1.288-4.170)	0.008
Hypoglycemia During Hospitalization	5 (5.6%)	5 (2.4%)	1.803 (0.504-5.443)	0.466
Tachypnea During Hospitalization	13 (14.5%)	21 (10%)	1.427 (0.681-2.500)	0.368
Seizures During Hospitalization	-	1 (0.4%)	0.718 (0.664-0.785)	1.0
Neonatal Mortality	1 (1.1%)	-	0.281 (0.233-0.329)	0.281

When patients were stratified with respect to gestation age at

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birth, the difference between groups with regards to low birthweight (aOR: 0.41, 95% CI: 0.72-3.11), 1-minute Apgar score (aOR: 2.09, 95% CI: 0.88-5.0), NICU admission (aOR: 3.6, 95% CI: 0.83-14.2), 5-minute Apgar score (aOR: 7.67, 95% CI: 0.75-85.89), and meconium-stained amniotic fluid (aOR: 0.24, 95% CI: 0.10-1.56) was insignificant. Multivariate regression analysis revealed an independent and significant relationship between maternal depression and preterm delivery (aOR: 3.27, 95% CI: 1.23-9.47) (p=0.030). However, no independent association was found between NICU admission and antenatal depression (aOR: 3.1, 95% CI: 1.0-5.2) (p=0.087) and risk of C-section (aOR: 0.9, 95% CI: 0.9-1.9)(p=0.731).

DISCUSSION

This study was conducted to evaluate the incidence of antenatal depression in hospitalized pregnant women and its association with maternal and neonatal outcomes. The results revealed a 30% prevalence of high-risk antenatal depression which was independently related to preterm birth and other various adverse maternal neonatal outcomes. This indicated that 1/3rd of the pregnant women were depressed which was similar to previous studies. Sade S et al., reported a 25% frequency of depression in hospitalized pregnant women which remained significantly after adjustment of maternal age and mode disorder [13]. In Smorti M et al., also, women with high-risk pregnancies had a mean EDPS score of 10.93±5.82 which was significantly higher than 6.50 ±4.83 in women with low-risk pregnancies [14]. However, a high depression score of 33% was reported by Tsakiridis I et al., which included hospitalized pregnant women with intrauterine growth restriction [15]. A meta-analysis of 79 studies by Toscano M et al., also reported an estimated depression prevalence of 34% during antepartum hospitalization [16]. Poor management of antepartum depression can lead to postpartum depression and can affect the neonatal bond with the mother; hence depression screening has been recommended during pregnancy but this trend was not practiced globally [17]. Studies have only 0.5% referral to the psychiatry department through obstetrics which indicated a lack of awareness among physicians to treat this ailment [18]. It was noted a strong correlation between antepartum depression and preterm birth as reported by published literature [6, 19]. This association remained significant after adjustment of confounding factors indicating an independent relationship, however, the etiology of this link was still unclear but possible causes were uteroplacental hypoperfusion as a result of increased stress hormones, cervical ripening due to elevated corticotrophin-releasing hormone and decreased level of natural killer cells due to depression increases risk of inflammation and placental damage [10-22]. Maternal depression was also related to a high risk of c-section (40%) but this incidence was not significantly higher than the comparison group (31.9%). Hence, we contradict the previously reported association between antenatal depression and the likelihood of c-sections [23]. The maternal age and gestation age at arrival were less in the study group as they were 1.1 years younger than the comparison group and had gestation age 2 weeks early. Similarly, the study group was more likely to be multiparous which may be due to Pakistani ethnic background as women in this region often bear more than one child and feel worried about being hospitalized with often no one to look after their home. This study has some limitations. We relied on the results of a self-reported questionnaire whose results may not be accurate as they may be influenced by maternal mood, lack of privacy, presence of attendants of the women, or misinterpretation may have affected the responses. Nevertheless, we opted for a reliable and valid assessment tool that produced significant findings similar to previous data. This study was powered for c-section births as it was a frequent pregnancy outcome associated with antepartum depression but the sample size was small to assess all differences between groups. Neonatal outcomes such as mortality, very low birth weight and still births also did not reach significant level due to small sample size.

CONCLUSIONS

Antepartum depression was a frequent condition among hospitalized pregnant women independently correlated to preterm births. Depression screening of pregnant women was recommended to prevent adverse maternal and neonatal outcomes.

Authors Contribution

Conceptualization: NA
Methodology: JRS
Formal analysis: MIUH, JRS
Writing, review and editing: SF, NA

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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