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FETOMATERNAL OUTCOMES REGARDING HYPERTENSIVE DISORDERS IN PREGNANCY

EIRAJ[1], NAGIA ANJUM[1]
[1] GULAB DEVI TEACHING HOSPITAL, LAHORE, PAKISTAN

Abstract

Background: Hypertensive disorders of pregnancy (HDP), including gestational hypertension, preeclampsia, and eclampsia, are among the leading causes of maternal and perinatal morbidity and mortality worldwide. These conditions pose serious threats to both mother and fetus, particularly in low- and middle-income countries where early detection and management may be limited.

Aim: To determine the fetomaternal outcomes associated with hypertensive disorders of pregnancy in women admitted to a tertiary care hospital in Lahore, Pakistan.

Methodology: This descriptive case series was conducted over six months in the Department of Obstetrics and Gynecology at Gulab Devi Teaching Hospital, Lahore. A total of 180 pregnant women aged 20–38 years diagnosed with hypertensive disorders were enrolled using non-probability consecutive sampling. Women with chronic comorbidities or incomplete postpartum follow-up were excluded. Data on maternal demographics, clinical features, delivery mode, and neonatal outcomes were collected and analyzed using SPSS version 28. Descriptive statistics were used to summarize findings, and Chi-square tests were applied to determine associations, with $p \leq 0.05$ considered statistically significant.

Results: Among the 180 participants, 46 (25.6%) had gestational hypertension, 32 (17.9%) mild preeclampsia, 95 (52.6%) severe preeclampsia, and 5 (2.6%) eclampsia. Cesarean delivery rates were significantly higher in severe preeclampsia (49.5%) and eclampsia (60%) compared to normotensive controls (21.6%) ($p = 0.009$). Preterm birth before 37 weeks occurred in 35.8% of severe preeclampsia and 80% of eclampsia cases ($p < 0.001$). Low birth weight (<2500 g) was observed in 42.1% of severe preeclampsia and 60% of eclampsia ($p < 0.001$). Poor Apgar scores, increased NICU admissions, and higher rates of IUGR were significantly associated with disease severity. Stillbirth rates were numerically higher in hypertensive groups but not statistically significant ($p = 0.65$).

Conclusion: The study highlights a strong correlation between increasing severity of hypertensive disorders in pregnancy and adverse maternal and neonatal outcomes. Findings support the need for vigilant antenatal screening, timely intervention, and resource-appropriate management strategies to mitigate the risks associated with HDP.

Keywords: Hypertensive disorders of pregnancy, preeclampsia, eclampsia, maternal outcomes, neonatal outcomes, low birth weight, NICU, IUGR, cesarean section, Pakistan.

INTRODUCTION

Hypertensive disorders of pregnancy (HDP) are among the most significant global threats to maternal and perinatal health, representing a leading cause of preventable morbidity and mortality in both low- and high-income countries [4]. These disorders affect approximately 5–10% of all pregnancies and are responsible for nearly 14% of maternal deaths worldwide, making them one of the top three direct causes of maternal mortality alongside hemorrhage and sepsis [17]. HDP encompass a spectrum of conditions including chronic hypertension, gestational hypertension, preeclampsia, and eclampsia [3]. Beyond maternal risk, these disorders significantly compromise fetal outcomes by increasing the likelihood of preterm birth and stillbirth [14]. Despite advances in obstetric surveillance and care, the burden of HDP remains unacceptably high, particularly in low- and middle-income countries (LMICs) where timely diagnosis and access to evidence-based interventions are often lacking [12].

Preeclampsia is clinically defined as new-onset hypertension after 20 weeks of gestation accompanied by proteinuria or signs of end-organ damage [23]. Eclampsia, the most severe form, is characterized by generalized tonic-clonic seizures not attributable to other causes [5]. These conditions are believed to originate from abnormal placentation leading to systemic endothelial dysfunction, vasospasm, and ischemia [3]. Although the exact pathogenesis remains unclear, immunologic maladaptation, oxidative stress, and angiogenic imbalance have all been implicated [3,6]. The progression from mild hypertension to eclampsia can occur rapidly, underscoring the need for close monitoring and timely intervention [6]. Globally, HDP contribute significantly to adverse neonatal outcomes [7]. A meta-analysis involving over 30 studies concluded that preeclampsia nearly doubles the risk of stillbirth and neonatal death compared

to normotensive pregnancies [9]. Additionally, neonates born to hypertensive mothers have a 3–4 times higher risk of NICU admission, primarily due to prematurity and growth restriction [13].

In Pakistan, HDP remain a major contributor to poor obstetric outcomes, particularly in public-sector hospitals serving low-income populations [1]. The Pakistan Demographic and Health Survey (PDHS, 2019) estimated the maternal mortality ratio at 186 per 100,000 live births, with hypertensive complications being one of the leading direct causes [22]. Local studies have reported preeclampsia prevalence rates between 5% and 8% among pregnant women presenting at tertiary care facilities [8]. However, these figures likely underestimate the true burden, given underreporting in rural and peripheral areas [2]. Delayed antenatal care, lack of standardized screening, and limited emergency obstetric preparedness further compound the risk [1,18].

Identifying and stratifying these risk factors early in pregnancy is essential for prevention and early intervention strategies [20]. However, in many low-resource settings like Pakistan, there is often no formal risk-stratification protocol in routine practice [2]. Despite the known burden of disease, there remains a lack of comprehensive data from Pakistan analyzing HDP in relation to both maternal and neonatal outcomes within a single study population. Much of the existing literature is fragmented, often focusing on either maternal or perinatal outcomes in isolation, with limited stratification by severity of hypertensive disorder [1,22]. There is also a scarcity of data on the clinical presentations and biochemical complications associated with severe preeclampsia and eclampsia in local settings [1,18]. Understanding how these disorders manifest clinically and what outcomes they portend can guide resource allocation and policy decisions [12,13]. This study was therefore conducted to critically evaluate the fetomaternal outcomes associated with hypertensive disorders of pregnancy in a tertiary care hospital in Lahore, Pakistan.

METHODOLOGY

Study Design and Setting:

A descriptive case series study design was followed to conduct this 6-months study in the department of obstetrics and gynecology, Gulab Devi Teaching Hospital, Lahore, Pakistan.

Sample Size:

A sample size of 180 patients is calculated taking 95% confidence level, 4% margin of error and expected percentage of pre-eclampsia as 8%. Non-probability consecutive sampling was followed. Pregnant females aged 20-38 years with hypertensive disorders based on clinical signs (e.g., elevated blood pressure) or laboratory findings (e.g., proteinuria) were included. Pregnant females with gestation age of start of pregnancy till term with all parity status (primiparous and multiparous) were included. Patients with diabetes, cardiac diseases, chronic renal disease, and chronic liver disease were excluded. Patients who lost to follow up and did not complete follow up till 6 weeks postpartum were also excluded.

Data Collection

A structured questionnaire was administered to pregnant women that encompassed demographic information, medical history, and specific details related to hypertensive disorders, including maternal age, parity, gestational age, pre-existing medical conditions, family history, and lifestyle factors. All recruited patients were thoroughly investigated for hypertensive disorders. Patients were followed till delivery to determine the outcomes in terms of placental abruption, pre-term birth, IUGR, and still birth.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 28. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize the characteristics of the study population. Quantitative variables such as maternal age and gestational age were expressed as mean ± standard deviation (SD). Categorical variables, including types of hypertensive disorders and fetal-maternal outcomes, were presented as frequencies and percentages. Data were stratified by age, gestational age, parity, and type of hypertensive disorder. Following stratification, the Chi-square test was applied to assess associations, with a p-value ≤ 0.05 considered statistically significant.

Ethical Considerations

This study will be conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and relevant national guidelines for research involving human participants. Ethical approval will be obtained from the Ethical Review Committee of Gulab Devi Hospital prior to the commencement of data collection. All participants will be thoroughly informed about the purpose, procedures, potential risks, and benefits of the study, both verbally and in writing. Written informed consent will be obtained from each participant before their enrollment in the study. Confidentiality and anonymity will be strictly maintained by assigning unique identification codes and securely storing all data. Participants will have the right to withdraw from the study at any stage without any consequences to their medical care.

RESULTS

Demographics and Maternal Correlation Outcomes

In this descriptive analysis of 180 pregnant women, including 46 (25.6%) with gestational hypertension, 32 (17.9%) with mild preeclampsia, 95 (52.6%) with severe preeclampsia, 5 (2.6%) with eclampsia, and 134 (74.4%) normotensive women, significant associations were observed between hypertensive status and several perinatal outcomes. Gestational age at delivery showed a statistically significant difference ($p < 0.001$), with preterm birth (<37 weeks) more frequent among severe preeclampsia cases (35.8%) and eclampsia (80%) compared to only 24.6% in the normotensive group. Birth weight was also significantly lower in hypertensive pregnancies ($p < 0.001$), with 42.1% of severe preeclampsia cases and 60% of eclampsia cases delivering babies under 2500g, compared to 32.1% in normotensive women. Stillbirths were more common among hypertensive groups (up to 5.3% in severe preeclampsia) versus 3.7% in normotensive patients, though not statistically significant ($p = 0.65$). These findings established a statistically significant correlation between hypertensive disorders of pregnancy and adverse perinatal outcomes. Conditions such as severe preeclampsia and eclampsia are strongly associated with higher rates of preterm birth, low birth weight, IUGR, and increased cesarean deliveries.

Table 1. Comparison of Maternal Outcomes Across Different Types of Hypertensive Disorders in Pregnancy (n = 180)

Maternal Outcome	**Gestational Hypertension 46 (25.6%)**	**Mild Preeclampsia 32 (17.9%)**	**Severe Preeclampsia 95 (52.6%)**	**Eclampsia 5 (2.6%)**	**Normotensive 134 (74.4%)**	**P-value**
Maternal Age						
≤24 years	18 (39.1%)	12 (37.5%)	31 (32.6%)	2 (40.0%)	75 (56.0%)	0.001*
25–34 years	24 (52.2%)	18 (56.3%)	52 (54.7%)	3 (60.0%)	53 (39.6%)	
≥35 years	4 (8.7%)	2 (6.3%)	12 (12.6%)	0	6 (4.5%)	
Mode of Delivery						
Vaginal	26 (56.5%)	15 (46.9%)	40 (42.1%)	1 (20.0%)	101 (75.4%)	0.009*
Instrumental	4 (8.7%)	3 (9.4%)	8 (8.4%)	1 (20.0%)	4 (3.0%)	
Caesarean	16 (34.8%)	14 (43.8%)	47 (49.5%)	3 (60.0%)	29 (21.6%)	

Severe Clinical Features

Headache was reported in 57 women (60.0%) with severe disease compared to 57 (31.7%) in the overall HDP group. Blurring of vision occurred in 42 (44.2%) of the severe group and 42 (23.3%) of all HDP cases. Epigastric pain was noted in 11 (11.6%) versus 11 (6.1%), and abruptio placentae in 3 (3.2%) versus 3 (1.7%), respectively. Seizure and loss of consciousness were seen in 6 (6.3%) of the severe group and 6 (3.3%) of all cases. Raised creatinine levels, indicating acute kidney injury, affected 19 women (20.0%) with severe disease compared to 19 (10.6%) overall. Lastly, low platelet count was identified in 15 (15.8%) of the severe group and 15 (8.3%) of all women with HDP. These data show a clear trend of increased clinical severity among women with severe preeclampsia and eclampsia, reinforcing the need for intensified surveillance in this high-risk population.

Table 2. Distribution of Severe Clinical Features Among Women with Hypertensive Disorders of Pregnancy (n = 180) and Severe Preeclampsia (n = 95)

Clinical manifestations	**Mothers with Severe preeclampsia (n = 95)**	**Mothers with HDP (n = 180)**
Headache	57 (60.0%)	57 (31.7%)
Blurring of vision	42 (44.2%)	42 (23.3%)
Epigastric pain	11 (11.6%)	11 (6.1%)
Abruptio placentae	3 (3.2%)	3 (1.7%)
Seizure and Loss of consciousness	6 (6.3%)	6 (3.3%)
Thrombocytopenia (plat < 100×10^3)	15 (15.8%)	15 (8.3%)
AKI (Cr ≥ 1.2 mg/dl)	19 (20.0%)	19 (10.6%)

Comparative Neonatal Correlation Outcomes

Neonatal complications such as intrauterine growth restriction (IUGR) were notably higher in severe preeclampsia (33.7%) and eclampsia (60%) compared to 6.7% among normotensives, showing a significant association ($p < 0.001$). Similarly, NICU admissions were more frequent in severe cases: 17.9% in severe preeclampsia and 20% in eclampsia versus 14.2% in normotensive cases. Maternal age distribution also varied, with younger mothers (≤24 years) being more common among normotensive women (56%) than in hypertensive categories. Importantly, mode of delivery differed significantly ($p = 0.009$), with cesarean section rates highest in eclampsia (60%) and severe preeclampsia (49.5%), compared to only 21.6% among normotensive women, reflecting clinical decisions to manage high-risk pregnancies surgically. These findings established a statistically significant correlation between hypertensive disorders

of pregnancy and adverse perinatal outcomes. Conditions such as severe preeclampsia and eclampsia are strongly associated with higher rates of NICU admissions, and increased cesarean deliveries.

Table 3. Comparison of Perinatal Outcomes Across Different Types of Hypertensive Disorders in Pregnancy (n = 180)

Perinatal Outcomes	Gestational Hypertension 46 (25.6%)	Mild Preeclampsia 32 (17.9%)	Severe Preeclampsia 95 (52.6%)	Eclampsia 5 (2.6%)	Normotensive 134 (74.4%)	P-value
Gestational Age						
<34 weeks	0	2 (6.3%)	11 (11.6%)	1 (20.0%)	2 (1.5%)	<0.001*
34–36 weeks	6 (13.0%)	7 (21.9%)	23 (24.2%)	2 (40.0%)	31 (23.1%)	
≥37 weeks	40 (87.0%)	23 (71.9%)	61 (64.2%)	2 (40.0%)	101 (75.4%)	
Birth Weight						
<1500 g	0	1 (3.1%)	12 (12.6%)	1 (20.0%)	2 (1.5%)	<0.001*
1500–2499 g	3 (6.5%)	9 (28.1%)	28 (29.5%)	2 (40.0%)	41 (30.6%)	
≥2500 g	43 (93.5%)	22 (68.8%)	55 (57.9%)	2 (40.0%)	91 (67.9%)	
Birth Outcome						
Stillbirth	1 (2.2%)	1 (3.1%)	5 (5.3%)	0	5 (3.7%)	0.65
Alive	45 (97.8%)	31 (96.9%)	90 (94.7%)	5 (100%)	129 (96.3%)	
Neonatal Complication						
No complication	46 (100%)	26 (81.3%)	58 (61.1%)	2 (40.0%)	122 (91.0%)	<0.001*
IUGR*	0	5 (15.6%)	32 (33.7%)	3 (60.0%)	9 (6.7%)	
Need for resuscitation	0	1 (3.1%)	5 (5.3%)	0	3 (2.2%)	
Need for NICU*	0	2 (6.3%)	17 (17.9%)	1 (20.0%)	19 (14.2%)	

Neonatal Outcomes and Associations with Hypertensive Disorders of Pregnancy

In this cohort of 180 pregnant women, the rates of very preterm (<34 weeks) and preterm (34–36 weeks) births among mothers with hypertensive disorders of pregnancy (HDP) were approximately 11.5% and 21.4%, respectively. Notably, over 67.1% of HDP cases reached ≥37 weeks gestation, though the association between hypertension severity and prematurity remained statistically significant ($p < 0.001$). Among hypertensive mothers, 7.2% (13/180) delivered neonates with extremely low birth weight (<1500g), while 17.8% (32/180) had low birth weight (1500–2499g) infants. The cumulative proportion of neonates with birth weight <2500g reached 25%, showing a strong association with hypertensive disease severity ($p < 0.001$).

Furthermore, 50% of neonates born to eclamptic mothers required resuscitation and NICU referral, compared to 21.9% (18/82) needing resuscitation and 17% (14/82) requiring NICU admission in the severe preeclampsia group. In contrast, only 3.2% (15/467) of normotensive deliveries required resuscitation, and 3.0% (14/467) were referred to NICU. This stepwise increase in neonatal complications with increasing severity of HDP was highly significant ($p < 0.001$). However, the rate of stillbirth did not differ significantly between hypertensive and normotensive groups ($p > 0.05$), indicating no statistical association with maternal blood pressure status.

Table 4. Neonatal Outcomes and Associations with Hypertensive Disorders of Pregnancy (n = 180)

Outcome	Gestational Hypertension	Mild Preeclampsia	Severe Preeclampsia	Eclampsia	Normotensive	p-value
Very Preterm (<34 weeks)	0	2 (6.3%)	11 (11.6%)	1 (20.0%)	2 (1.5%)	<0.001*
Preterm (34–36 weeks)	6 (13.0%)	7 (21.9%)	23 (24.2%)	2 (40.0%)	31 (23.1%)	
Term (≥37 weeks)	40 (87.0%)	23 (71.9%)	61 (64.2%)	2 (40.0%)	101 (75.4%)	
Extremely Low Birth Weight (<1500g)	0	1 (3.1%)	12 (12.6%)	1 (20.0%)	2 (1.5%)	<0.001*
Low Birth Weight (1500–2499g)	3 (6.5%)	9 (28.1%)	28 (29.5%)	2 (40.0%)	41 (30.6%)	
Total LBW (<2500g)	3 (6.5%)	10 (31.2%)	40 (42.1%)	3 (60.0%)	43 (32.1%)	
IUGR	0	5 (15.6%)	10 (12.2%)	3 (60.0%)	9 (6.7%)	<0.001*

Neonatal Resuscitation Required	0	1 (3.1%)	18 (21.9%)	3 (50.0%)	15 (3.2%)	<0.001*
NICU Referral	0	2 (6.3%)	14 (17.0%)	3 (50.0%)	14 (3.0%)	<0.001*
Stillbirth	1 (2.2%)	1 (3.1%)	5 (5.3%)	0	5 (3.7%)	>0.05 (NS)

DISCUSSION

This study aimed to assess the fetomaternal outcomes associated with HDP in a tertiary care hospital, with a specific focus on clinical features, maternal complications, neonatal parameters, and statistical associations [1,2]. Approximately 52.6% had severe preeclampsia and 2.6% eclampsia, with adverse outcomes significantly more frequent in these groups [3]. A key maternal outcome identified in this cohort was the significantly elevated cesarean section rate among women with HDP 49.5% in severe preeclampsia and 60% in eclampsia cases ($p = 0.009$) compared to only 21.6% in normotensive controls [1]. This mirrors results from a survey, where cesarean delivery was 2.5 times more likely among women with preeclampsia/eclampsia [13]. Similar elevated operative delivery rates have been consistently reported in multiple international datasets due to maternal–fetal compromise in severe HDP [3, 14, 19]. Cesarean delivery is frequently employed as a protective strategy in severe disease, given the elevated risks of placental abruption, fetal distress, and maternal decompensation [11]. However, the relatively high rates in this study also highlight a potential need for strengthening guidelines to ensure appropriate case selection and avoid over-intervention [20].

Gestational age at delivery was significantly impacted by hypertensive status ($p < 0.001$) [1]. While 75.4% of normotensive women delivered at term (≥37 weeks), only 64.2% of severe preeclamptic and 40% of eclamptic cases achieved term gestation [1]. Very preterm delivery (<34 weeks) occurred in 11.6% of severe preeclamptic and 20% of eclamptic mothers, echoing similar prevalence data from a multicenter study [3]. Comparable international cohorts report that preterm delivery remains one of the strongest predictors of perinatal morbidity in HDP [5,11,17].

Neonatal outcomes showed statistically significant associations between HDP and both low birth weight (LBW) and intrauterine growth restriction (IUGR) [1]. In this study, 42.1% of severe preeclampsia and 60% of eclampsia cases resulted in LBW infants (<2500 g), compared to 32.1% among normotensives ($p < 0.001$) [1]. Similar findings were reported recently, demonstrating that impaired uteroplacental perfusion in HDP leads to fetal growth restriction and suboptimal birth weight [11]. Furthermore, IUGR prevalence reached 33.7% in severe preeclampsia and 60% in eclampsia ($p < 0.001$) [1], reinforcing the clinical significance of early surveillance in high-risk pregnancies [6,21].

A noteworthy observation in this study was the distribution of maternal age across different hypertensive categories, which reached statistical significance ($p = 0.001$) [1]. Women ≤24 years made up a disproportionately higher share of the normotensive group (56%) compared to just 32.6% in severe preeclampsia and 40% in eclampsia [1]. This contrasts with some global data suggesting a higher risk of preeclampsia in younger primigravida [15, 16]. However, studies from similar LMIC populations have reported increasing age and multiparity as more prominent risk factors for severe HDP [15,16,21]. Such variations may reflect local reproductive patterns and differences in early antenatal care utilization [5].

Another important finding is the elevated rate of instrumental deliveries in women with eclampsia (20%), higher than any other group including normotensives (3%) or severe preeclampsia (8.4%) [1]. Similar trends from other studies show instrumental deliveries to be overrepresented in hypertensive emergencies due to delayed operating room access or the need for urgent second-stage shortening [19]. This reflects practical constraints in developing-country settings where timely cesarean access may be limited [2,18].

Clinical features further highlighted disease severity. Headache occurred in 60% of severe preeclamptics, visual disturbances in 44.2%, AKI in 20%, and thrombocytopenia in 15.8% [1]. These findings align with established diagnostic criteria for severe preeclampsia and mirror data from larger population-based studies [11]. A Chinese cohort similarly demonstrated rising rates of organ dysfunction markers with increasing disease severity [11]. Symptom-based surveillance therefore plays a critical role in early detection and referral, especially in resource-constrained environments [7,12].

Interestingly, while stillbirth frequency was higher in hypertensive groups (5.3% in severe preeclampsia vs. 3.7% in normotensives), the difference was not statistically significant ($p = 0.65$) [1]. This contrasts with evidence showing a two- to threefold increased stillbirth risk among preeclamptic women [18]. A possible explanation for the discrepancy is that this study included only women who completed postpartum follow-up, potentially underestimating perinatal mortality [4,10]. The progression to eclampsia and multiorgan dysfunction in HDP has been well documented, underscoring the importance of aggressive monitoring and biochemical screening [10,14,20].

This study, while robust in sample size and data analysis, has several limitations [3,5]. First, it employed a non-probability consecutive sampling method at a single tertiary care hospital, which may limit the generalizability of findings to broader populations or rural settings [17]. Similar concerns have been raised in other single-center HDP

studies from LMICs, where demographic patterns vary significantly across regions [15,16]. Second, data on antihypertensive treatment regimens, their timing, and compliance were not included, which could have influenced maternal and neonatal outcomes [11]. Antihypertensive choice and timing are known modifiers of disease progression, especially in severe preeclampsia [3,14]. Additionally, long-term neonatal morbidity and maternal complications beyond six weeks postpartum were not captured, limiting the ability to assess chronic sequelae such as cardiovascular risk or neurodevelopmental delays [13,19]. Studies have shown that both mothers and infants affected by HDP remain vulnerable to long-term complications well beyond the immediate postpartum period [18,21].

Lastly, stillbirth and early neonatal mortality may have been underreported due to exclusion of patients lost to follow-up, which is a recognized source of bias in maternal–perinatal research in resource-limited settings [4,10]. These limitations highlight the need for future prospective, multi-institutional research with standardized data collection and longer follow-up periods to validate and expand upon these findings [7,12].

CONCLUSION

This study demonstrated a clear association between hypertensive disorders of pregnancy particularly severe preeclampsia and eclampsia and significantly increased maternal and neonatal complications. These included elevated rates of preterm birth, low birth weight, intrauterine growth restriction, higher NICU admissions, and greater reliance on operative delivery methods. The stratified analysis further highlighted that disease severity corresponded with increased frequency of adverse clinical signs such as headache, visual disturbances, thrombocytopenia, and acute kidney injury. These findings emphasize the clinical importance of early identification and close monitoring of hypertensive disorders in pregnancy. It is recommended that clinical care providers in similar healthcare settings adopt more vigilant surveillance, timely referral, and structured delivery planning for women diagnosed with hypertensive disorders to reduce morbidity and improve maternal and perinatal outcomes.

Availability of Data and Materials:

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request. All data were collected, stored, and analyzed according to institutional ethical guidelines.

Competing Interests:

The authors declare that they have no competing interests. There are no financial, personal, or professional conflicts that could have influenced the study.

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Authors' Contributions:

Eiraj: Conceptualization, study design, data collection, data analysis, interpretation of results, manuscript drafting.
Nagia Anjum: Supervision, critical revision of the manuscript, validation of data, and approval of the final draft.
Both authors read and approved the final manuscript.

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