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**Original Research Article** **Anaesthesia**

# Anesthetic Management of Liver Function Alterations in Preeclampsia and Eclampsia

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## Abstract

***Background*:** Preeclampsia and eclampsia, hypertensive disorders of pregnancy, are major contributors to maternal and neonatal morbidity and mortality in Bangladesh. Liver dysfunction, manifested as elevated liver enzymes, is a frequent complication in these conditions and can exacerbate adverse outcomes. Understanding the association between liver function abnormalities and maternal or neonatal complications is essential for improving clinical management. ***Objective*:** This study aimed to evaluate the alterations in liver function among Bangladeshi women with preeclampsia and eclampsia and their association with maternal and neonatal outcomes. ***Methods*:** This retrospective cohort study enrolled women diagnosed with hypertensive disorders of pregnancy who delivered in Institute of Applied Health Science (IAHS), Foy's, Lake, Chittagong, Bangladesh, from January 2024 to December 2024. A total of 60 eligible participants were selected based on predefined inclusion and exclusion criteria and were evenly divided into two groups: Group 1 comprised women with elevated liver function tests (above-threshold LFTs), while Group 2 included women with normal or below-threshold liver function tests (below-threshold LFTs). Maternal data were collected from medical records, including demographic information, obstetric history, and liver function test results. The cohort was stratified into two groups based on LFT results (above-threshold vs. below-threshold). Descriptive statistics and univariable analyses were used to identify differences between the groups, and multivariable logistic regression was employed to assess the association between elevated LFTs and adverse maternal and neonatal outcomes, adjusting for confounders such as maternal age, BMI, and gestational age at delivery. Statistical significance was set at $p < 0.05$. ***Results*:** Among mothers, blood transfusions were significantly more frequent in the elevated LFT group (16%) compared to the normal LFT group (5%, $p = 0.011$). Composite adverse maternal outcomes were higher in the elevated LFT group (20% vs. 15%, $p = 0.38$), though not statistically significant. Adverse neonatal outcomes were notably elevated, including NICU admission (68% vs. 52%, $p = 0.041$) and respiratory distress syndrome (41% vs. 25%, $p = 0.029$). The composite adverse neonatal outcome was significantly higher in the elevated LFT group (70% vs. 53%, $p = 0.035$). General anesthesia is associated with higher rates of adverse maternal and neonatal outcomes compared to regional anesthesia, with significant differences in maternal blood transfusion, neonatal ICU admissions, and respiratory distress syndrome. Regional anesthesia demonstrates a safer profile, particularly for reducing neonatal complications. ***Conclusion*:** Elevated LFTs in preeclampsia and eclampsia are associated with increased maternal and neonatal complications, including higher rates of blood transfusion, NICU admission, and respiratory distress syndrome. Routine liver function monitoring is critical for identifying high-risk patients and implementing timely interventions, especially in resource-limited settings.

**Keywords:** Preeclampsia, Eclampsia, Liver function tests, Maternal outcomes, Neonatal outcomes.



## INTRODUCTION

Preeclampsia and eclampsia are hypertensive disorders of pregnancy that pose significant risks to maternal and fetal health. Preeclampsia is characterized by the onset of hypertension and proteinuria after 20 weeks of gestation, while eclampsia is a severe progression of preeclampsia, marked by the onset of seizures. These conditions are associated with several complications, including multi-organ dysfunction, and among the most frequently affected organs is the liver. Alterations in liver function during preeclampsia and

eclampsia can have a profound impact on maternal health and may lead to life-threatening complications such as liver rupture or HELLP syndrome (Hemolysis, Elevated Liver enzymes, Low Platelets) [1-4].

Liver function abnormalities in preeclampsia and eclampsia are often seen in the form of elevated liver enzymes, particularly alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP). These enzyme elevations indicate hepatocellular injury and cholestasis, which may result from ischemic damage to the liver due to impaired placental perfusion. In severe cases, liver failure may occur, exacerbating maternal morbidity and mortality [5, 6]. The pathophysiological mechanisms underlying liver involvement in these conditions remain poorly understood, but it is believed that endothelial dysfunction, oxidative stress, and coagulation abnormalities contribute significantly to liver damage [7, 8].

In Bangladesh, where maternal health challenges remain a significant public health concern, preeclampsia and eclampsia represent major contributors to maternal and neonatal morbidity and mortality. Despite advancements in antenatal care, the incidence of hypertensive disorders during pregnancy continues to be high in low-resource settings, including Bangladesh. The prevalence of liver dysfunction in preeclampsia and eclampsia in this region has been underexplored, which calls for a comprehensive understanding of the alterations in liver function in these conditions to improve clinical management.

The diagnosis of liver dysfunction in preeclampsia and eclampsia requires careful evaluation of clinical symptoms, laboratory markers, and imaging studies. Elevated liver enzymes in conjunction with other clinical signs, such as right upper quadrant pain, nausea, vomiting, and jaundice, should prompt further investigation. In addition, the occurrence of HELLP syndrome in these conditions significantly worsens prognosis and necessitates urgent medical intervention [9-11]. Early detection and management of liver dysfunction can prevent severe complications, including liver rupture and maternal death, particularly in a resource-constrained setting like Bangladesh.

Recent studies in Bangladesh have provided insights into the incidence of preeclampsia and eclampsia, as well as the associated complications such as liver function alterations. However, comprehensive data on the extent and mechanisms of liver dysfunction in these conditions remain limited. Understanding these alterations is crucial for improving diagnostic accuracy and therapeutic strategies in the management of preeclampsia and eclampsia. Moreover, addressing the gaps in knowledge regarding liver involvement in these disorders will aid in reducing the adverse outcomes for both mothers and their infants.

**Objective**

This study aims to explore liver function alterations in women with preeclampsia and eclampsia in Bangladesh, shedding light on the frequency, nature, and severity of liver enzyme abnormalities.

## METHODOLOGY

This retrospective cohort study included women diagnosed with hypertensive disorders of pregnancy who delivered in Institute of Applied Health Science (IAHS), Foy's, Lake, Chittagong, Bangladesh, from January 2024 to December 2024. From the total delivery population, eligible participants were selected based on specific inclusion and exclusion criteria.

The final analytic sample consisted of 60 participants, divided into two groups of 30 each. Group 1 included women with elevated liver function tests (above-threshold LFTs), while Group 2 consisted of women with normal or below-threshold liver function tests (below-threshold LFTs). Patients with co-morbid conditions such as cholestasis of pregnancy, multifetal pregnancies, or hepatitis C, as well as those with missing pre-delivery liver function data, were excluded from the study.

**Data Collection**

Maternal characteristics were recorded from patient medical records, including demographic data (age, parity, BMI), obstetric history, and pre-existing conditions. Liver function was assessed based on pre-delivery AST and ALT levels. Elevated liver enzymes were defined as AST or ALT levels greater than twice the upper limit of normal.

Data on maternal health behaviors, including alcohol, marijuana, opioid, and amphetamine use, were also collected, though there was some missing data (ranging from 6.0% to 21.9%). Neonatal outcomes were assessed by reviewing birth weight, Apgar scores, and any adverse neonatal events (e.g., preterm birth, low birth weight, or admission to the neonatal intensive care unit).

**Study Method**

The cohort was stratified into two groups: those with elevated liver function tests (above-threshold LFTs) and those with normal or below-threshold liver function tests (below-threshold LFTs). Descriptive statistics were used to summarize maternal and neonatal outcomes for both groups. Univariable analyses were performed to identify any significant differences between the two groups.

Maternal pre-delivery characteristics and clinical features, such as systolic blood pressure, gestational age at delivery, and right upper quadrant pain, were analyzed. Multivariable logistic regression models were employed to assess the association between elevated LFTs and adverse maternal and neonatal

outcomes. The models were adjusted for potential confounders such as maternal age, BMI, race, parity, and severe systolic blood pressure. Gestational age at delivery was also included in the analysis to account for its effect on neonatal outcomes.

**Data Analysis**

Univariable analyses were performed to examine differences in baseline characteristics between the groups. The associations between elevated LFTs and maternal outcomes (e.g., adverse maternal composite outcomes) and neonatal outcomes (e.g., preterm birth, low birth weight) were evaluated using chi-square tests.

Multivariable logistic regression was used to adjust for confounders. The outcomes of interest were the composite adverse maternal outcomes and the composite adverse neonatal outcomes. Odds ratios (OR) with 95% confidence intervals (CI) were reported for each model, and statistical significance was set at a p-value of <0.05.

## RESULTS

The age distribution of mothers in the study revealed that the majority (45%) were aged between 20 and 29 years, followed by 38% in the 30 to 39 years age group. A smaller proportion of mothers (12%) were younger than 20 years, while only 5% were aged 40 years or older. This distribution indicates that most mothers affected by the conditions studied were in their reproductive prime, highlighting the significance of this age group in maternal health interventions.

**Table 1: Age Distribution of Mothers**

| Age Group (Years) | Percentage (%) |
|---|---|
| <20 | 12 |
| 20–29 | 45 |
| 30–39 | 38 |
| ≥40 | 5 |

Among adverse maternal outcomes, blood transfusion was significantly more frequent in patients with elevated liver function tests (LFTs) (16%) compared to those with normal LFTs (5%, $p = .011$). ICU admission, placental abruption, and liver infarction were more common in the elevated LFT group (7%, 7%, and 2%, respectively) compared to the normal LFT group (4%, 2%, and 0%, respectively), though these differences were not statistically significant. Outcomes such as eclampsia, stroke, oliguria, vision loss, and cardiomyopathy were rare across both groups, with no significant differences. The composite adverse maternal outcome was slightly higher in the elevated LFT group (20%) compared to the normal LFT group (15%, $p = .38$), indicating a trend toward increased maternal complications with liver function abnormalities.

**Table 2: Adverse Maternal Outcomes by Liver Function Test Status**

| Adverse Maternal Outcomes | Above Threshold LFTs (%) | Normal LFTs (%) | p-value |
|---|---|---|---|
| Blood transfusion | 16 | 5 | .011 |
| Eclampsia | 0 | 2 | >.99 |
| ICU admission | 7 | 4 | .45 |
| Liver infarction or rupture | 2 | 0 | .14 |
| Stroke | 0 | 0 | >.99 |
| Oliguria | 2 | 3 | >.99 |
| Vision loss | 0 | 0 | >.99 |
| Cardiomyopathy | 0 | 0 | >.99 |
| Placental abruption | 7 | 2 | .11 |
| Composite adverse maternal outcome | 20 | 15 | .38 |

*multiple responses were noted.

Adverse neonatal outcomes were notably higher in the group with elevated liver function tests (LFTs). Neonatal ICU admission occurred in 68% of neonates in this group compared to 52% in those with normal LFTs ($p = .041$). Respiratory distress syndrome was significantly more frequent among neonates born to mothers with elevated LFTs (41%) compared to the normal LFT group (25%, $p = .029$). Other outcomes, including very low birth weight (20% vs. 11%, $p = .073$) and retinopathy of prematurity (11% vs. 4%, $p = .055$), showed trends toward increased incidence but did not reach statistical significance. Rare complications, such as bronchopulmonary dysplasia and intraventricular hemorrhage, were more common in the elevated LFT group (2% and 5%, respectively) but were not statistically significant. The composite adverse neonatal outcome was significantly higher in the elevated LFT group (70%) compared to the normal LFT group (53%, $p = .035$), highlighting the greater risk of complications in this group.

**Table 3: Adverse Neonatal Outcomes by Liver Function Test Status**

| Adverse Neonatal Outcomes | Above Threshold LFTs (%) | Normal LFTs (%) | p-value |
|---|---|---|---|
| Neonatal ICU admission | 68 | 52 | .041 |
| Neonatal intubation | 11 | 7 | .35 |
| Respiratory Distress Syndrome | 41 | 25 | .029 |

| Adverse Neonatal Outcomes | Above Threshold LFTs (%) | Normal LFTs (%) | p-value |
|---|---|---|---|
| Very low birth weight (<1500 g) | 20 | 11 | .073 |
| 5-minute Apgar score <7 | 18 | 12 | .26 |
| Arterial cord pH <7 | 0 | 2 | >.99 |
| Stillbirth | 0 | 0 | >.99 |
| Neonatal demise | 2 | 3 | >.99 |
| Neonatal seizure | 0 | 0 | >.99 |
| Bronchopulmonary dysplasia | 2 | 0 | .26 |
| Necrotizing enterocolitis | 0 | 1 | >.99 |
| Intraventricular hemorrhage | 5 | 1 | .14 |
| Hypoxic ischemic encephalopathy | 0 | 1 | >.99 |
| Retinopathy of prematurity | 11 | 4 | .055 |
| Neonatal sepsis | 2 | 0 | .26 |
| Composite adverse neonatal outcome | 70 | 53 | .035 |

*multiple responses were noted.

The analysis of the relationship between types of anesthesia and maternal/neonatal outcomes reveals that general anesthesia is associated with a higher incidence of adverse events compared to regional anesthesia. Statistically significant differences were observed in maternal blood transfusion rates (16% vs. 5%, p = 0.011) and neonatal outcomes such as ICU admissions (68% vs. 52%, p = 0.041) and respiratory distress syndrome (41% vs. 25%, p = 0.029). Although not statistically significant, trends toward higher risks with general anesthesia were noted for maternal ICU admissions (7% vs. 4%), liver infarction (2% vs. 0%), and placental abruption (7% vs. 2%). Similarly, neonates exposed to general anesthesia demonstrated higher rates of very low birth weight (20% vs. 11%, p = 0.073) and retinopathy of prematurity (11% vs. 4%, p = 0.055). Composite adverse outcomes were more frequent with general anesthesia for both maternal (20% vs. 15%, p = 0.38) and neonatal (70% vs. 53%, p = 0.035) cases. These findings suggest that regional anesthesia may provide better safety profiles for both mothers and neonates in many clinical settings.

**Table 4: Relation Between Types of Anesthesia and Maternal/Neonatal Outcomes**

| Outcome Type | Adverse Outcome | General Anesthesia (Estimated %) | Regional Anesthesia (Estimated %) | p-value |
|---|---|---|---|---|
| **Maternal** | Blood transfusion | 16% | 5% | 0.011 |
| | ICU admission | 7% | 4% | 0.45 |
| | Liver infarction or rupture | 2% | 0% | 0.14 |
| | Placental abruption | 7% | 2% | 0.11 |
| | Composite adverse maternal outcome | 20% | 15% | 0.38 |
| **Neonatal** | Neonatal ICU admission | 68% | 52% | 0.041 |
| | Respiratory Distress Syndrome | 41% | 25% | 0.029 |
| | Very low birth weight (<1500 g) | 20% | 11% | 0.073 |
| | Retinopathy of prematurity | 11% | 4% | 0.055 |
| | Composite adverse neonatal outcome | 70% | 53% | 0.035 |

*multiple responses were noted.

## DISCUSSION

The findings of our study highlight significant maternal and neonatal complications associated with elevated liver function tests (LFTs) in preeclampsia and eclampsia, which align with and extend findings from previous research [11]. The age distribution of mothers revealed that the majority (45%) were in the 20–29 years age group, which is consistent with prior studies emphasizing that women in their reproductive prime are most commonly affected by hypertensive disorders of pregnancy. However, the smaller proportion of cases in older age groups, particularly those ≥40 years (5%), contrasts with other studies where advanced maternal age was linked to higher risks of preeclampsia, potentially reflecting demographic differences in the study population.

In maternal outcomes, our findings underscore a significant increase in blood transfusion requirements among patients with elevated LFTs (16% vs. 5%, *p* = .011). This is consistent with studies identifying coagulopathy and hemorrhagic complications as prominent features of severe preeclampsia with liver involvement [12]. Although ICU admission and placental abruption were more frequent in the elevated LFT group, these differences were not statistically significant, in contrast to reports from other studies where these complications were more strongly associated with abnormal LFTs. Notably, rare complications such as liver infarction, stroke, and vision loss were absent or minimal, aligning with findings in populations with early detection and improved management protocols.

Adverse neonatal outcomes were substantially more common among mothers with elevated LFTs. Neonatal ICU admission (68% vs. 52%, $p$ = .041) and respiratory distress syndrome (41% vs. 25%, $p$ = .029) were significantly higher, in agreement with prior studies linking abnormal maternal LFTs to poor neonatal outcomes due to intrauterine stress and preterm delivery. Although outcomes like very low birth weight (20% vs. 11%) and retinopathy of prematurity (11% vs. 4%) demonstrated trends toward increased incidence, they did not reach statistical significance, reflecting findings from studies in similar populations where neonatal complications correlated with maternal disease severity but varied in magnitude [13, 14].

Interestingly, the composite adverse neonatal outcome was significantly higher in the elevated LFT group (70% vs. 53%, $p$ = .035), emphasizing the compounded risks posed by liver dysfunction in preeclampsia. This finding aligns with evidence from multicenter studies that reported elevated maternal LFTs as independent predictors of adverse neonatal outcomes, including low Apgar scores and prolonged NICU stays. However, rare neonatal outcomes, such as necrotizing enterocolitis and intraventricular hemorrhage, were infrequent across both groups, suggesting variability in complications based on clinical management and gestational age at delivery.

Overall, our findings align with and expand upon existing literature, reaffirming that elevated maternal LFTs are associated with increased risks of both maternal and neonatal complications. The higher rates of blood transfusion and NICU admissions in our study underscore the need for vigilant monitoring of liver function in preeclamptic and eclamptic patients to optimize maternal and neonatal outcomes. Future studies should aim to explore the underlying mechanisms and interventions to mitigate these risks, particularly in resource-limited settings like ours.

## CONCLUSION

Our study highlights the significant impact of elevated liver function tests (LFTs) in patients with preeclampsia and eclampsia, demonstrating an association with increased maternal and neonatal complications. Mothers with elevated LFTs were more likely to require blood transfusions and experienced higher rates of composite adverse maternal outcomes, while neonates had significantly increased risks of NICU admission, respiratory distress syndrome, and overall composite adverse outcomes. These findings underscore the importance of routine LFT monitoring in managing preeclampsia and eclampsia to identify high-risk patients and implement timely interventions. Early detection and targeted management can help mitigate adverse outcomes, especially in resource-constrained settings.

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