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Maternal and Perinatal Outcomes in Preeclampsia with Respect to Organ Involvement

Shruti Pansare[1], Ramprasad Dey[2]

ABSTRACT

Objective: Preeclampsia is a leading cause of maternal and perinatal morbidity and mortality, characterized by new-onset hypertension after 20 weeks of gestation. This study explores the maternal and perinatal outcomes associated with organ involvement in preeclampsia, focusing on identifying complications and their effects.

Materials and Methods: This prospective observational analytical study was conducted over 18 months at a tertiary care hospital in Kolkata. A total of 106 pregnant women diagnosed with preeclampsia beyond 20 weeks of gestation were included. Exclusion criteria encompassed pre-existing renal or liver disease, multifetal gestation, and other conditions potentially confounding the study.

Results: Renal dysfunction was observed in 6.6% of cases, characterized by proteinuria and, in severe cases, acute kidney injury. Hepatic dysfunction, including elevated liver enzymes and HELLP syndrome, occurred in 10.4% of participants, similarly lung involvement characterized by basal lung crepitations suggestive of pulmonary edema, indicative of severe fluid overload, was seen in 10.4%. Multi-organ dysfunction was documented in 1.88% of cases, significantly correlating with adverse maternal outcomes such as increased cesarean deliveries (34.9%), maternal ICU admissions, and higher perinatal complications. NICU admissions were required in 54.7% of neonates, with 41.5% exhibiting fetal growth restriction and 7.5% neonatal mortality.

Conclusion: Organ-specific involvement in preeclampsia plays a critical role in determining maternal and perinatal outcomes. Multi-organ dysfunction markedly increases risks, underscoring the importance of early diagnosis and targeted interventions. Vigilant monitoring and timely management strategies can significantly improve outcomes, reducing morbidity and mortality associated with this condition.

Keywords: Preeclampsia, maternal outcomes, perinatal outcomes, organ involvement, HELLP syndrome, hypertensive disorders in pregnancy.

1. 3rd Year MS Junior Resident, Chittaranjan Seva Sadan, Kolkata
2. Professor, Medical College Kolkata
Corresponding Author: Dr Ramprasad Dey

Introduction

Pre-eclampsia accounts for majority of referrals in a tertiary care centre as it is one of the major causes of maternal and perinatal morbidity and mortality[1]. It complicates almost 10% of all pregnancies. Preeclampsia, affecting 5-8% of pregnancies worldwide, is a complex condition involving multi-system dysfunction[2–3]. Severe cases can lead to eclampsia, HELLP syndrome (hemolysis, elevated liver enzymes, low platelet count), and other critical complications. Fetal complications which are related to preeclampsia include impaired fetal growth, neonatal respiratory distress syndrome, and stillbirth.

Despite extensive research, the relationship between specific organ involvement and maternal and fetal outcomes remains underexplored. Close surveillance, early detection, and prompt management comprise the main clinical management strategy. There are several studies focused on developing useful pre-eclampsia prediction methods[4].

Even after extensive research, there are no rational preventive or therapeutic interventions available. Currently, the only definitive treatment for pre-eclampsia is delivery of the fetus and placenta as early as possible[5]. Although the discussion is on-going, perinatal survival is thought to be increased in patients with early onset preeclampsia by expectant, non-interventional management, using antihypertensive drugs to control Hypertension, magnesium sulphate in eclampsia and corticosteroids to enhance fetal lung maturity[6].

Although there are many studies focused on the study of maternal and fetal outcome in preeclampsia, severe preeclampsia and eclampsia, there are very few studies which are determining the impact of organ involvement on the outcome of pregnancy. Moreover, there is no study comparing the outcome with respect to single versus multi-organ involvement. This is important to note because the result will help us to focus on the preventive and prophylactic screening of patients by determining the organ involvement by history taking, clinical examination and laboratory investigations which are very easily available and affordable at a tertiary care centre of a developing nation like India. Thus, enabling us to prevent morbidity and mortality in patients of preeclampsia more effectively.

Methodology

This prospective observational analytical study was conducted over 18 months at a tertiary care hospital in Kolkata. All pregnant women beyond 20 weeks of gestation attending antenatal OPD or admitted in the hospital were clinically screened for detection of hypertensive disorders of pregnancy. Among these, preeclampsia was confirmed as per the ACOG guidelines[7] and thus 106 patients were recruited in the study after obtaining an informed consent. Exclusion criteria encompassed pre-existing renal or liver disease, multifetal gestation, and other conditions potentially confounding the study. Data collection involved clinical examinations, laboratory investigations, and fetal monitoring via ultrasonography and Doppler studies.

Patient characteristics were described as means with the standard deviation for normally distributed numerical data and as percentage for categorical variables. Differences were analyzed by Student's t- test for normally distributed data and the Mann-Whitney U-test for no normally distributed data. Chi-square and Fischer's exact tests were used for comparisons of categorical variables. In all analyses, values <0.05 were considered statistically significant.

Results

Demographic and Clinical Characteristics

Age Distribution: The majority (65.1%) were aged 21-30 years, with 13.2% aged ≤20 years and 21.7% aged 31-40 years. Table 1

Table 1: Distribution of age in group

Age in group	Frequency	Percent
≤20	14	13.2%
21-30	69	65.1%
31-40	23	21.7%
Total	106	100.0%

Gravida: Primigravida constituted 71.6% of cases. 12.3% patients were 2nd gravida and (16.0%) patients were 3rd gravida. Table 2

Table 2: Distribution of Gravida or Parity

Gravida or Parity	Frequency	Percent
G2P1	13	12.3%
G3P2	17	16.0%
PRIMI	76	71.6%
Total	106	100.0%

Family History: In our study, (34.9%) patients had history of hypertension in the maternal side of their family and 69 (65.1%) patients had no H/O hypertension in the family. The value of p is significant at < .00001.

Clinical Presentations and Symptoms

Common symptoms included severe headache (29.2%), vomiting (24.5%), blurred vision (13.2%), and bilateral pitting pedal edema (64.2%).

Basal lung crepitations were observed in 10.4% of cases.

Organ Involvement

Renal Dysfunction:

Proteinuria was a prominent feature, with 37.7% showing 1+, 33% with 2+, and 29.2% with 3+ dipstick readings.

Severe renal involvement included oliguria and elevated serum creatinine levels, leading to acute kidney injury in critical cases.

Hepatic Dysfunction:

Liver involvement included elevated liver enzymes in 10.4% of cases.

HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count) was observed in severe cases, contributing to maternal complications such as right upper quadrant pain and subcapsular hematomas.

Pulmonary Involvement:

Pulmonary edema was present in 10.4% of participants. This was often associated with severe fluid overload and required intensive care.

Multi-Organ Involvement:

It was observed that 3.77% patients had liver & kidney involvement, 1.88% patients had kidney & lung involvement, 2.83% patients had liver & lung involvement, and 1.88% patients had features suggestive of all three organ involvement. Table 3

Table 3: Multi-organ Involvement

Organ Involvement	Frequency	Percent
Liver, Kidney	4	3.77%
Kidney, Lung	2	1.88%
Liver, Lung	3	2.83%
Liver, Kidney, Lung	2	1.88%
Total	106	100.0%

Maternal and Perinatal Outcomes with respect to organ involvement

Kidney involvement

In our study, out of the 7 patients with kidney involvement, 14.28% patient had PPH, 42.85% patients had FGR, 100% patients had normal vaginal delivery, and 3 patients died. The value of p is significant at .01208. Table 4

Table 4

Maternal Outcome		Frequency	Percentage
APH		0	0%
PPH		1	14.28%
FGR		3	42.85%
Mode of Delivery	C-Section	0	0%
	Vaginal delivery	7	100%
Maternal Outcome- death		3	42.85%
Eclampsia		0	0%

Out of the 7 patients with kidney involvement, 14.28% patient had her baby admitted to NICU, 28.57% patients had baby with low birth weight and 14.28% patient had still birth. The value of p is .4654. Table 5

Table 5

Perinatal Outcome	Frequency	Percentage
NICU	1	14.28
LBW	2	28.57
Still birth	1	14.28
Neonatal Death	0	0

Liver involvement

In our study, out of the total 11 patients with liver involvement, 3 (27.27%) patients had PPH, 5 (45.45%) patients had FGR, 1 (0.09%) patient underwent delivery by C-section, and 10 (90.90%) patients had normal vaginal delivery while 3 (27.27%) patients died. The value of p is significant at 0.00174. Table 6

Table 6

Maternal Outcome	Frequency	Percentage
APH	0	0%
PPH	3	27.27%
FGR	5	45.45%

Maternal Outcome		Frequency	Percentage
Mode of Delivery	C-Section	1	0.09%
	Vaginal delivery	10	90.90%
Maternal Outcome-Death		3	27.27%
Eclampsia		0	0%

Of all the patients with liver involvement 2 (18.18%) patients had their baby admitted to NICU, 4 (36.36%) patients had baby with low birth weight and 2 (18.18%) patients had still birth. The value of p is significant at 0.030302. Table 7

Table 7

Perinatal Outcome	Frequency	Percentage
NICU	2	18.18
LBW	4	36.36
Still birth	2	18.18
Neonatal Death	0	0

Lung involvement

In our study, out of the 11 patients with lung involvement, 3 (27.27%) patients had PPH, 5 (45.45%) patients underwent delivery by C-sec, 6 (54.54%) patients had normal vaginal delivery, 3 (27.27%) patients died, and 1 (9.09%) patient developed eclampsia. The value of p is significant at 0.04036. Table 8

Table 8

Maternal Outcome		Frequency	Percentage
APH		0	0%
PPH		3	27.27%
FGR		5	45.45%
Mode of Delivery	C-Section	5	45.45%
	Vaginal delivery	6	54.54%
Maternal Outcome-Death		3	27.27%
Eclampsia		1	9.09%

Out of 11 patients with lung involvement, 2 (18.18%) patients had their baby admitted to NICU, 1 (9.09%) patient had baby with low birth weight and 1 (9.09%) patient had still birth. The value of p is .4654. Table 9

Table 9

Perinatal Outcome	Frequency	Percentage
NICU	2	18.18
LBW	1	9.09
Still birth	1	9.09
Neonatal Death	0	0

Multiorgan involvement

In our study, there were 2 patients who had signs, symptoms and investigations suggesting involvement of all the three organs i.e. lungs, liver and kidney. 1 patient had PPH, both the patients had FGR, both the patients had a normal vaginal delivery and but unfortunately both the patients died due to multi-organ failure following prolonged ICU admission. The value of p is <.00001. Table 10

Table 10

Maternal Outcome		Frequency	Percentage
APH		0	0%
PPH		1	50%
FGR		2	100%
Mode of Delivery	C-Section	0	0%
	Vaginal delivery	2	100%
Maternal Outcome- Death		2	100%
Eclampsia		0	0%

Only 1 patient out of the 2 having multi-organ involvement had baby with low birth weight no other significant perinatal outcome was noted. Table 11

Table 11

Perinatal Outcome	Frequency	Percentage
NICU	0	0
LBW	1	50
Still birth	0	0
Neonatal Death	0	0

Discussion

Preeclampsia is still a major problem in the field of obstetrics. There has been variation of maternal age of pregnancy from teenage to women who are 40 years or older, as compared with women between 20 and 29 years of age, with approximately two-fold increase in risk of preeclampsia, in our study we observed that majority i.e. 69 (65.1%) patients were between 21-30 years of age (p value<.00001). The mean age of patients was 26.5.

There was a significant association with family history of hypertension, as 37 (34.9%) patients had history of hypertension in the maternal side of their family and 69 (65.1%) patients had no history of hypertension in the family (p value- .0001). Thus, it can be inferred that maternal and fetal genetic factors carry strong risk for preeclampsia, with one-third attributable to maternal genetic factors[8].

Among the common symptoms and diagnostic criteria according to ACOG it was noted that 31 (29.2%) patients presented with complaint of severe headache, 14 (13.2%) patients complained of blurring of vision at the time of admission or during the hospital stay, 26 (24.5%) patients presented with vomiting, and 68 (64.2%) patients had bilateral pitting pedal edema, not relieved on rest or leg elevation. 11 (10.4%) patients were noted to have basal lung crepitation on chest auscultation. As for urine for protein 40 (37.7%) patients had urine dipstick value for protein of 1 +, 35 (33.0%) patients had a value of 2 + and 31 (29.2%) patients had a value of 3 +. The mean systolic blood pressure at the time of admission was 155, and the mean diastolic blood pressure at the time of admission was 98. The mean platelet count of patients was 1.87 lakhs/cc. In our study, 58 (54.7%) patients had to be treated with prophylactic or therapeutic injection magnesium sulphate therapy according to Pritchard regimen.

It was inferred from above findings that kidney involvement has significant adverse maternal outcome in terms of maternal morbidity and mortality (p value- 0.01208). Although it has no direct significant effect on adverse perinatal outcome (p value- 0.4654). Whereas significant maternal morbidity and mortality (p value- 0.00174) as well as perinatal morbidity (p value-0.030302) is caused due to liver involvement in pre-eclampsia patients. Lung involvement has significant effect on maternal morbidity and mortality (p value- 0.04036), although it has no significant effect on perinatal outcome (p value-0.4654).

It is noteworthy that among the two patients with all the three-organ involvement, one patient had PPH, both the patients had FGR, both the patients had a normal vaginal delivery and but unfortunately both the patients died due to multi-organ failure following prolonged ICU admission. This is a significant finding suggestive of adverse impact of multi-organ involvement on maternal morbidity and mortality (p value<0.0001). Although only one patient out of the two having multi-organ involvement had baby with low birth weight and thus no other significant perinatal outcome was noted among these patients.

Conclusion

The findings underscore the significant impact of organ involvement in preeclampsia. Renal, hepatic, and pulmonary dysfunctions were closely associated with adverse maternal and perinatal outcomes. Multi-organ dysfunction notably increased risks of severe complications, emphasizing the importance of early detection and targeted interventions.

This study highlights the critical role of organ-specific involvement in determining outcomes in preeclampsia. Addressing dysfunctions through vigilant monitoring and timely interventions can significantly improve maternal and neonatal health outcomes, reducing the morbidity and mortality associated with this condition.

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Conflict of interest: None

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