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Incidence of Severe Acute Maternal Morbidity in Severe Preeclampsia

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Abstract

Background: Hypertensive disorders of pregnancy are among the most common complications, with an incidence ranging from 5 to 10%. It is the third leading cause of maternal mortality in India, contributing to 7% of all maternal deaths.

Aims: This study aims to determine the incidence of severe acute maternal morbidity in women with severe preeclampsia. The most affected organ and perinatal outcomes in women with severe preeclampsia were evaluated as secondary objectives. The association between severe preeclampsia and severe acute maternal morbidity which is indicated by dysfunction of cardiovascular, respiratory, renal, coagulation and neurological systems was observed. The perinatal outcomes such as fetal growth restriction, preterm birth, fetal distress, neonatal encephalopathy, still birth, NICU admission and neonatal death were assessed.

Methodology: This was a prospective observational study done at a tertiary care centre in India between May 2022 and July 2023. All antenatal and postnatal women i.e. up to 42 days from the day of delivery, diagnosed with severe preeclampsia were included in the study. Women without severe preeclampsia and those who were referred with Multiple Organ Dysfunction Syndrome (MODS) were excluded from the study.

Results: A total of 12,359 women delivered during the study period. Out of these, 360 women were diagnosed with severe preeclampsia with an incidence of 2.91%. Amongst 360 women who were diagnosed with severe preeclampsia severe acute maternal morbidity was seen in 68 women with an incidence of 19%. Women with severe preeclampsia had eclampsia as the most common serious complication followed by thrombocytopenia. Most of the women had preterm delivery by caesarean section and more than half of the babies required NICU admission. A considerable number of babies were low birth weight and stillborn.

Conclusion: This study has shown the adverse effects of severe preeclampsia on the mother and the fetus leading to morbid condition. Early diagnosis and referral to higher centre for early intervention can prevent the morbid condition.

Introduction

Hypertensive disorders of pregnancy are among the most common complications, with an incidence ranging from 5 to 10%.[1] It is the third leading cause of maternal mortality in India, contributing to 7% of all maternal deaths.[2] Hypertensive disorders can be either chronic hypertension or pregnancy related depending on the time of diagnosis. Chronic hypertension is diagnosed in the pre-conceptional period or before twenty weeks of gestational age whereas gestational hypertension or preeclampsia are diagnosed after twenty weeks of gestational age.

Gestational hypertension and preeclampsia are a spectrum of hypertensive disorders in pregnancy. Preeclampsia is a multiorgan disease of unknown aetiology. It is diagnosed when the blood pressure recorded is more than 140/90 mm Hg on two occasions, 4 hours apart after 20 weeks of gestation in the presence of proteinuria and/or multi-organ involvement.[3] A woman is diagnosed with severe preeclampsia (SPE) when the systolic blood pressure is 160 mm Hg or more and the diastolic blood pressure is 110 mm Hg or more that is confirmed within 15 minutes, in the presence of proteinuria and /or end-organ damage. End organ damage is indicated by a platelet count less than 100,000/cumm^3, impaired liver function as indicated by abnormally elevated blood concentrations of liver enzymes to more than twice the upper limit of normal concentrations in the absence of any other alternative diagnoses, or by severe persistent right upper quadrant or epigastric pain unresponsive to medications, a doubling of the serum creatinine concentration in the absence of other renal disease or a serum creatinine concentration more than 1.1 mg/dl, pulmonary oedema, new-onset headache unresponsive to medication in the absence of any other alternative diagnoses or visual disturbances.[4]

It is worth noting that traditional hypertension criteria may not always be seen in all patients who develop signs and symptoms or any other lab abnormalities of preeclampsia. The spectrum of the disease ranges from mildly elevated blood pressure with minimal clinical significance to severe hypertension and end-organ damage. Many pathological and circumstantial factors contribute to severe complications in pregnancy. While some of these women die, a proportion of them narrowly escape death. A woman who survives life-threatening conditions arising from complications related to pregnancy and childbirth has many common aspects with those who die of such complications. This similarity led to the development of the near-miss concept in maternal health.

As per the World Health Organization, a maternal near miss case, or Severe Acute Maternal Morbidity (SAMM) refers to a woman who nearly died but survived a complication that occurred during pregnancy, child birth or within 42 days of termination of pregnancy.[5] Severe preeclampsia is associated with increased risk of near-miss or SAMM cases.[6] This study aims to determine the incidence of severe acute maternal morbidity in women with severe preeclampsia. Additionally, it investigates the most commonly affected organ and perinatal outcomes in women with severe preeclampsia as secondary objectives.

Methods

This prospective observational study was conducted at Fernandez Hospital, a tertiary referral Centre, from May 2022 to July 2023. After the approval from the Institutional review board, all antenatal and postnatal women i.e. up to 42 days from the day of delivery, diagnosed with severe preeclampsia were included in the study. Women without severe preeclampsia and those who were referred with Multiple Organ Dysfunction Syndrome (MODS) were excluded from the study. The sample size was calculated assuming the incidence of severe acute maternal morbidity in severe preeclampsia as 8.8% as per the study by Sarah J et al.[7] The other parameters considered for sample size calculation were 5% absolute precision and 95% confidence level. The minimum required sample size as per the calculation based on the incidence was 129. However, in order to increase the precision of estimates in the study, all the possible samples were collected. Hence, the final number samples collected was 360.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, and frequency and proportion for categorical variables. The association between categorical explanatory variables and quantitative outcomes was assessed by comparing the mean values. The mean differences along with their 95% CI were presented. Independent sample t-test/ ANOVA was used to assess statistical

significance. The association between explanatory variables and categorical outcomes was assessed by cross-tabulation and comparison of percentages. The odds ratio along with 95% CI is presented. The chi-square test/Fisher was used to test statistical significance. Univariate Binary logistic regression analysis was performed to test the association between the explanatory variables and outcome variables. An unadjusted Odds ratio along with 95% CI is presented. Variables with statistical significance in univariate analysis were used to compute multivariate regression analysis. Adjusted odds ratio along with their 95% CI is presented. P value < 0.05 will be considered statistically significant. Data was analysed by using CoGuide (19) software, V.1.0[1].9

During the study period, the association between severe preeclampsia and severe acute maternal morbidity which is indicated by dysfunction of cardiovascular, respiratory, renal, coagulation and neurological systems was observed. The perinatal outcomes such as fetal growth restriction, preterm birth, fetal distress, neonatal encephalopathy, still birth, NICU admission and neonatal death were assessed.

Results

A total of 12,359 women delivered during the study period. Out of these, 360 women were diagnosed with severe preeclampsia with an incidence of 2.91%.

The mean age of the women included in the study was 29.33 ± 4.96 years. The mean body mass index was 29.43 ± 5.20 kg/m^2. The average gestational age at admission was approximately 34.2 weeks, with a standard deviation of approximately 3.49 weeks, indicating that most of them were diagnosed at with severe preeclampsia at around 34 weeks of gestation. (Table 1).

Table 1: Descriptive analysis of maternal characteristics in the study population (n=360)

Variable	Summary
Age (Mean ± SD)	29.33 ± 4.96
BMI (Mean ± SD)	29.43 ± 5.20

Among the 360 women included in the study, 75.6 % of women were booked for care and 23.9 % were referred to further management. Fifty six percent of women with severe preeclampsia were primigravida whereas 44% of them were multigravida. Around 88 % of them were singleton and 12 % were multifetal pregnancies The demographics of the study population are described in Table 2.

Table 2: Descriptive analysis of obstetrics in the study population (n=360)

Variable	Number	Percentage
Booked	272	75.6%
Referral	86	23.9%
Singleton	318	88.3%
Multifetal	42	11.7%
Primigravida	201	55.8%
Multigravida	159	44.2%

The most common cause of severe acute maternal morbidity in the study population is eclampsia and acidosis with an incidence of 3.33% followed by admission in to intensive care unit for various reasons, low platelet count of less than 50,000, need for transfusion of blood and blood products and jaundice in the presence of preeclampsia in around 2.5% of the women. The incidence of ventilatory support and

bilirubin more than 6 mg/dl was 0.55% and oliguria, need for inotropes, severe hypoxemia, failure to form clots was 0.27%.

Table 3: Descriptive analysis of severe acute maternal morbidity in the study population (n=360)

Maternal variables (n=360)	Number	Percentage
Eclampsia	12	3.33 %
Metabolic/Respiratory acidosis	12	3.33%
ICU	9	2.5%
Severe thrombocytopenia (<50,000 platelets)	9	2.5 %
Use of blood products	9	2.5%
Jaundice in the presence of preeclampsia	9	2.5%
Bilirubin more than 6	2	0.55%
Intubation/ventilation not related to anesthesia	2	0.55%
Oliguria is not responsive to fluids or diuretics	1	0.27%
Inotropes	1	0.27%
Severe hypoxemia	1	0.27%
Failure to form clots	1	0.27%

The most common system affected due to severe preeclampsia is central nervous system secondary to generalised tonic clonic seizures (3.33%). The other systems affected were haematological and hepatic with an incidence of 2.5% followed by respiratory (0.55%) and renal (0.27%) dysfunctions (Table 4).

Table 4: Descriptive analysis of organ dysfunction (n=360)

Organ dysfunction	Number	Percentage
Neurological dysfunction	12	3.33%
Hematological dysfunction	9	2.5%
Hepatic dysfunction	9	2.5%
Respiratory dysfunction	2	0.55%
Renal dysfunction	1	0.27%

Majority of the women with severe preeclampsia had lower segment caesarean section as mode of delivery (80.3%). Around 11% of them had partial HELLP syndrome and 8.3% had postpartum haemorrhage. The other outcomes noted are HELLP syndrome, abruption and PRES syndrome as shown in Table 5.

Table 5: Descriptive analysis of maternal outcomes (n=360)

Parameters	Number	Percentage
LSCS	289	80.27%
Partial HELLP syndrome	40	11.11%
Postpartum haemorrhage	30	8.33%
HELLP syndrome	19	5.27%
Abruption	13	3.61%
PRES syndrome	1	0.27%

Women included in the study population were diagnosed with severe preeclampsia based on the presence of severe features according to ACOG classification of hypertensive disorders in pregnancy (4). The most

common severe feature is severe hypertension (60.3%) followed by imminent symptoms and laboratory abnormalities indication HELLP or partial HELLP syndrome (10.6%).

Table 6: Descriptive analysis of the severe features of women with preeclampsia (n=360)

Severe features	Number	Percentage
Severe hypertension	217	60.27%
Imminent symptoms	72	20.0%
HELLP/Partial HELLP	38	10.55%
Eclampsia	12	3.33%
AKI	7	1.94%
Abruption	1	0.27%
Pulmonary edema	1	0.27%

Around 58% of the women diagnosed with severe preeclampsia also had a comorbid medical condition indicating. The most common comorbid condition was diabetes mellitus seen in 48% of women with comorbid conditions followed by hypothyroidism (27.8%), anaemia and connective tissue disorders (6.2%).

Table 7: Descriptive analysis of comorbid conditions in the study population (n=360)

Comorbid condition	Number	Percentage
Gestational diabetes/Diabetes mellitus	100	47.84%
Thyroid disorders	58	27.75%
Connective tissue disorders	13	6.22%
Anaemia	13	6.22%

About 74% of women included in the study delivered before 37 weeks, 34% of the babies required admission in Neonatal Intensive Care Unit, 32% of them had low birth weight babies, 8% were stillborn, 3% had low APGAR score at 5 minutes and 0.8% were neonatal deaths. The stillbirth rate was 2.26 per 1000 births. Perinatal mortality rate was 2.5 per 1000 births.

Table 6: Descriptive analysis of neonatal outcomes in the study population (n=360)

Outcomes	Total (n=360)	Percentage
Preterm	266 (73.88%)	73.88%
NICU admission	123 (34.16%)	34.16%
Low birth weight	115 (31.94%)	31.94%
Stillbirth	28 (7.77%)	7.77%
Low APGAR	10 (2.77%)	2.77%
NND	3 (0.83%)	0.83%

Placental histopathological examination was done in 126 (35%) cases of which 121 (96%) cases showed features of maternal vascular malperfusion confirming the severity of preeclampsia and the rest 5 (4%) cases had features of abruption confirming the antenatal diagnosis.

Discussion

This was a prospective observational study done at a tertiary care centre in India between May 2022 and

July 2023. The total number of deliveries during the study period was 12,359 and the incidence of severe preeclampsia was 2.91% during the study period. The study was conducted with the primary objective to evaluate the incidence of severe acute maternal morbidity in women with severe preeclampsia. The severe acute maternal morbidity was defined based on WHO criteria. The secondary objective was to evaluate the organ system that was commonly affected and perinatal outcomes in women with severe preeclampsia. Severe acute morbidity is a stage preceding mortality. Early recognition and intervention at this stage could prevent the progress of a disease condition. This helps in reducing permanent damage or death. Severe preeclampsia is a condition associated with end organ damage due to high blood pressures during pregnancy. This condition precedes eclampsia which is the most severe complication of hypertension in pregnancy. Hence, looking at the acute morbidity caused by severe preeclampsia gives an idea on the most common organ involved. Amongst 360 women who were diagnosed with severe preeclampsia, severe acute maternal morbidity was seen in 68 women with an incidence of 19%. This is similar to the results of a population cohort study which compared the incidence of severe maternal morbidity in women with and without hypertension in pregnancy.[8]

Women affected by severe preeclampsia had eclampsia and acidosis as the most common severe morbidity, with an incidence of around 3.3% followed by thrombocytopenia, jaundice and ICU admission with an incidence of 2.5%. Hence, the most common organ dysfunction was neurological followed by haematological. A cross sectional study looking at maternal complications associated with severe preeclampsia reported that the most frequent complication was coagulopathy.[9]

Eclampsia is associated with about 15% risk of maternal mortality in developing countries.[10] This high incidence of deaths due to eclampsia in developing countries is mainly attributed to delay in intervention. A woman with low platelet count caused by preeclampsia needs transfusion of blood products. Delay in transfusion of blood products may cause excessive haemorrhage during delivery and in turn lead to death of the woman. This emphasises on the need to transfer women with severe preeclampsia to tertiary centre for early intervention. Majority of the women in the study underwent caesarean section before term indicating the need for early delivery.

Perinatal outcomes: Looking at the perinatal outcomes, majority (74%) of the women had preterm delivery and 34% babies required NICU admission. Around 33% of babies had low birth weight and 8% were stillborn. This shows the adverse effect of severe preeclampsia on the perinatal outcomes too. A one year case-control study conducted in 2017 showed similar results of adverse perinatal outcomes in women with severe preeclampsia.[11]

The placental histopathological examination confirms the severity of the disease and features of abruption. This indicates the significance of placental examination to confirm the diagnosis and the recurrence in the future can be predicted which will help in preconception counselling before planning next pregnancy. A retrospective cohort study done to investigate the clinical correlation of placental pathology has shown a similar association of maternal vascular malperfusion with severe preeclampsia and fetal growth restriction.[12]

Conclusion

Women with severe preeclampsia had eclampsia as the most common serious complication followed by thrombocytopenia. Most of the women had preterm delivery by caesarean section and more than half of the babies required NICU admission. A considerable number of babies were low birth weight and stillborn. This study has shown the adverse effects of severe preeclampsia on the mother and the fetus leading to

morbid condition. Early diagnosis and referral to higher centre for early intervention can prevent the morbid condition.

Strengths of the study:

It is a prospective observational study conducted in a tertiary care hospital with most of the data being available on electronic medical records and with round-the-clock telephone triage facility, emergency operation theatre services, and ICU, neonatal, anaesthesia, and lab facilities available. In our study population, women with medical comorbidities were also included. The results of this study are compared with other studies.

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Conflict of interest: The authors declare that they have no conflicts of interest.

Ethical approval: This study was approved by the Institutional Review Board (IRB) EC Ref No38-2023. This study was conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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