Original Research Article

Descriptive study of clinical profile of severe preeclampsia

Nisha Gusain[1]*, Vidya Dinkar Mule[2], Swetha Sekar Lalgudi[3]

[1]Department of Obstetrics and Gynecology, B. J. Medical College and Sassoon General Hospital, Pune, Maharashtra, India
[2]Department of Obstetrics and Gynecology, Government Medical College, Miraj, Maharashtra, India
[3]Department of Obstetrics and Gynecology, Zynova Shalby Multispeciality Hospital, Ghatkopar, Mumbai, Maharashtra, India

*Correspondence:
Dr. Nisha Gusain,
E-mail: nishagusain93@gmail.com

ABSTRACT

Background: The study was conducted to find out the frequency, risk factors, maternal complications, fetal outcome, the early intervention and treatment in cases of severe preeclampsia in a tertiary care centre.
Methods: It was a descriptive observational study conducted at department of obstetrics and gynecology for the duration of 18 months. Severe preeclampsia diagnosed by clinical features, risk factors identified by history taking, treatment given according to institutional protocol, maternal and neonatal outcome was analysed.
Results: Frequency of severe preeclampsia was 1.3%. Majority of the patients belong to the age group of 20-30 years. Risk factors recorded- raised BMI, primiparity, previous preeclampsia history 56.7% patients underwent LSCS. Complications noted- eclampsia, abruption, PPH, renal failure and HELLP syndrome. 60.5% neonates were having low birth weight (<2.5 kg). Perinatal mortality was found in 14.9% of neonates. Most common reason for maternal ICU admission- ARF followed by DIC, eclampsia. There was no maternal mortality in our study.
Conclusions: Adequate antenatal visits, good antenatal care and NICU care can reduce the morbidity and mortality. For early detection of cases, regular blood pressure monitoring by family physician is essential in predisposed individuals. Early reporting to the institute on development of symptoms, timed termination of pregnancy, wider use of magnesium sulfate, availability and implementation of emergency obstetric care reduces the morbidity and mortality. Although the number of patients undergoing LSCS is more, a fair amount of induction trial can be given with proper monitoring services.

Keywords: Eclampsia, Magnesium sulfate, Severe preeclampsia

INTRODUCTION

Inspite of much development in medical sciences, hypertensive disorder is still an unsolved problem and complicate about 10% of all pregnancies worldwide. The deadly triad of hypertension, haemorrhage and infection account for a major share of maternal morbidity and mortality.[1] According to the review of the World Health Organisation, hypertensive disorders contribute 16% to maternal mortality worldwide and in developed countries.[2] According to the special bulletin on maternal mortality in India 2016-18, the maternal mortality ratio (MMR) is 113 in 2016-18. In India hypertensive disorders account for the third most important cause of maternal mortality.[3] Despite advances in research into preeclampsia, a clear understanding of the processes preceding the development of this serious vascular complication of pregnancy has not yet been achieved.

Severe preeclampsia/eclampsia has grave consequences for both maternal and neonatal health, associated with 50,000-100,000 annual deaths globally, as well as serious fetal and neonatal morbidity and mortality.[4] These disorders of pregnancy have a predominance in low and

middle income countries.[5] Postpartum haemorrhage is a common risk factor that is associated with hypertensive disorders contributing to maternal deaths indirectly.[6] Despite the severe health, social, and economic costs of preeclampsia, currently the only curative therapy is delivery of the baby and placenta, which itself carries the associated risks of premature birth. The rationale for delaying delivery in cases of preeclampsia, is to reduce perinatal morbidity and mortality by delivery of more mature fetus and to lesser degree to achieve more favourable cervix.[7-9] Even though there are many studies found in literature about preeclampsia, the clear understanding is not yet achieved. Till now preeclampsia has no measures for primary prevention. Currently no single cost effective, reliable, valid and economical screening test is present for preeclampsia.

Preeclampsia is a multi-systemic disorder after the 20th week of pregnancy characterized by hypertension and development of new-onset proteinuria. Severe preeclampsia is characterised by systolic blood pressure of at least 160 mmHg, or diastolic blood pressure of at least 110 mmHg when measured on two occasions at least 4 hours apart while the patient is on bed rest. One of the serious obstetric emergencies and complication of severe preeclampsia is eclampsia seen in our region. Eclampsia is defined as new onset of grand mal seizure activity and/or unexplained coma during pregnancy or postpartum in a woman with signs or symptoms of preeclampsia.[10]

Mortality due to preeclampsia is preventable and majority occurs in developing countries.[11] Therefore, excellent antenatal care and coverage to be implemented in developing countries. In preeclamptic women, inadequate and delayed initiation of treatment and preterm deliveries was found to be associated with poor fetal outcome.[12]

Our institution receives many complicated cases as emergency from peripheral, maternity clinics and nursing homes as it is a tertiary care centre for the region.

Therefore, this study was conducted to find the association between preeclampsia management modalities, maternal complications and perinatal outcome among severe preeclamptic women.

METHODS

Present study was a descriptive observational study conducted at department of obstetrics and gynecology in a tertiary care centre. Study was conducted for the duration of 18 months from January 2019 to June 2020 after the approval from the institutional ethics committee.

Inclusion criteria

Patients included were gestational age >34 weeks, vertex presentation, systolic BP>160 mmHg and/or diastolic BP>110 mmHg, urine albumin >1+, patient willing to participate.

Exclusion criteria

Patients with absolute indications mentioned below for caesarean section were excluded from the study. These were gestational age <34 weeks, non-vertex presentation, eclampsia, premature rupture of membranes (PROM), abnormal lie and presentation, placental previa, diabetic mothers, multifetal gestation, previous caesarean section, chronic renal disease, chronic hypertension (before 20 weeks of gestation), mild preeclampsia and patient not willing to participate.

Sample size for present study was 114 cases as it was a duration-based study from January 2019 to June 2020. After written valid informed consent of the patient, case proforma filled with all basic demographic details like maternal age, parity, address, booking status, gestational age at diagnosis, chief complaints, pre-monitory symptoms (like headache, vomiting, blurring of vision and epigastric pain), detailed menstrual history, obstetric history and antenatal complication, past history of medical illness, if any in present pregnancy which was assessed from antenatal records. The high-risk factors that were noted- nulliparity, previous history of preeclampsia, maternal age >40, molar pregnancy, vascular, endothelial or renal diseases, maternal smoking, obesity (BMI>35 kg/m^2) and certain genetic factors.

On general examination, pulse, blood pressure (seated or at 45° recline position), height and weight were recorded.

Abdominal and vaginal examination done to decide the mode of management and delivery. Investigations like hemogram, LFT, RFT, coagulation profile, ultrasonography done to identify the complications of severe preeclampsia.

Management of the patients were done as per standard protocol in our department. Since our study enrolled patients with gestational age >34 weeks all were delivered after initial stabilisation. Labetalol used as first line treatment for hypertension with the aim of BP<140/90 mmHg. Magnesium sulfate was the anticonvulsant of choice used as prophylaxis in severe preeclampsia with imminent signs of eclampsia. Rest and salt restricted diet were advised. The mode of delivery was determined by severity of maternal condition, Bishop's score, gestational age, fetal condition, ultrasonography and laboratory investigations. Blood pressure and urine output were noted frequently. Careful monitoring of the fetal well-being was done. All patients were watched closely for at least 48 hours postpartum and were kept in the hospital till the blood pressure brought to a safe level of 140/90 mmHg with absent proteinuria. After discharge, follow-up was done every week till the blood pressure became normal without any antihypertensives. Maternal outcome was assessed by maternal complications, ICU stay (if any) and maternal mortality. Fetal outcome was assessed by Apgar score, birth weight, head and abdominal circumference, NICU admissions and neonatal mortality.

Data entry and analysis were done using computer software Microsoft excel sheet. Frequency and percentages were taken for categorical variable. All data were analysed graphically.

RESULTS

This was an observational descriptive study conducted in a tertiary care hospital from January 2019 to June 2020. A total of 114 cases were enrolled in our study who fits the inclusion and exclusion criteria with blood pressure more than 160/110 mmHg and urine albumin more than 1+ on dipstick.

Table 1: Frequency of severe preeclampsia.

Total no. of deliveries	No. of cases diagnosed with severe preeclampsia	Frequency
8568	114	1.3%

Frequency of severe preeclampsia in our study was 1.3%.

Table 2: Age distribution of subjects with severe preeclampsia.

Maternal age	Count	%
<20 years	28	24.6
20 to 30 years	80	70.1
>30 years	6	5.3

Majority of the patients were in the age group of 20-30 years. Mean age was 26 years.

Table 3: Risk factors distribution.

Risk factors	Count	%
Nil	101	88.6
BMI ($\geq$35 kg/m^2)	25	21.92
PIH in previous pregnancy	10	8.7
Connective tissue disorder (Sjogren's syndrome)	2	1.8

85.9% patients in the study were registered. Out of them 60.5% were registered outside and 25.4% were registered in the same institute and 14% patients were unregistered. 63.2% patients were primigravida. Preeclampsia is more commonly seen in primigravidas. Among the gestational age, 35.1% patients were from 34 to 36 weeks gestation, 53.5% were in the gestational age 37 to 40 weeks and 11.4% were in the gestational age of >40 weeks.

80 out of 114 patients were asymptomatic. Out of 34 patients, majority (12) presented with headache, 10 (8.8%) patients had vomiting, 5 (4.4%) patients had epigastric Pain and blurring of vision respectively and 2 (1.8%) patients had nausea. Dipstick urine albumin 2+ and 3+ were found to be very common presentation. 44.7% had Urine albumin 2+, 44.7% had urine albumin 3+ and 10.5% had urine albumin 4+. Most common antenatal

complication was oligohydramnios in 14.1%, IUGR in 8.8% and combined oligohydramnios/IUGR in 6.2% of cases.

Table 4: Magnesium sulfate given to subjects and regime used.

MgSO$_4$	Count	%
No	71	62.3
Yes (prophylactic)	38	33.3
Yes (Pritchard regimen)	5	4.4

Table 3 shows 21.92% had BMI$\geq$35 kg/m^2, 8.7% had history of preeclampsia in previous pregnancy, 1.8% had Sjogren's syndrome as risk factors for severe preeclampsia. Magnesium sulfate was not given in 62.3% of cases. 33.3% received prophylactic dose and 4.4% received Pritchard regimen of magnesium sulfate (Table 4).

Out of 114 patients at admission, 77 patients were not in labour and 37 were in labour. From the cases who were "Not in labour", 40 (35.08%) patients were induced and 37 underwent elective LSCS. 30 patients were delivered vaginally after induction and 10 patients required emergency LSCS due to failed induction, MSL with fetal distress, variable FHS. Out of the patients who were in spontaneous labour on admission, 25 delivered vaginally and 12 required emergency LSCS.

Table 5: Maternal complications distribution.

Maternal complications	Count	%
Nil	85	74.56
Eclampsia (intrapartum, postpartum)	7	6.10
Abruption	6	5.30
Postpartum haemorrhage (PPH)	6	5.30
Renal failure	3	2.60
HELLP syndrome	3	2.60
Ascites and pleural effusion	2	1.80
DIC	2	1.80
Pulmonary edema	1	0.90
MgSO$_4$ gluteal abscess	1	0.90
Peripartum cardiomyopathy	1	0.90
Wound gape	1	0.90

Mode of delivery was LSCS in 56.7% patients, vaginal delivery in 42.4% and Forceps delivery in 0.9%. Indication for LSCS was maternal factors in 28 subjects and fetal factors in 31 subjects. Most common fetal factor was meconium-stained liquor with fetal distress (10.5%) and most common maternal factor was impending eclampsia (6.1%) and severe preeclampsia for maternal sake (6.1%). Among the laboratory investigations, 15.79% patients had deranged RFT with serum creatinine >1.2 mg/dl and BUN>40 mg/dl, 8.78% had platelet count less than 100000/mm^3, liver enzymes (SGOT and SGPT) were

raised more than 100 IU in 4.38% of patients and 2.63% patients had deranged INR (value >1.6).

In this study, 29 subjects had maternal complications. Of them most common complication was eclampsia (intrapartum and postpartum), followed by abruption and postpartum haemorrhage as shown in Table 5.

Maternal ICU care was needed in 11 subjects out of 114. Most common reason for ICU admission was acute renal failure in 2.6% of subjects who later needed dialysis for treatment, DIC (1.7%), eclampsia (1.7%) and HELLP syndrome in 1.7% subjects (Table 6). All patients recovered from ICU. There was no maternal mortality in our study.

Table 6: Maternal ICU care reason.

Reason for maternal ICU care	Count	%
Renal failure	3	2.6
DIC	2	1.7
HELLP syndrome	2	1.7
Eclampsia	2	1.7
Cardiomyopathy	1	0.8
Pulmonary edema	1	0.8

Neonatal status

Low birth weight is commonly seen in neonates born to preeclamptic mother. 60.5% neonates were low birth weight (<2.5 kg) and 39.5% had normal birth weight (>2.5 kg). Mean birth weight was 2.38±0.54 kg. Out of 114 neonates, 29 neonates required NICU admission. Mean Days in NICU was 8.43±5.574 days. Most common indication for NICU care was low birth weight in 10.5% of neonates, respiratory distress in 6.14%, birth asphyxia in 4.38%, 1.8% in meconium aspiration syndrome and preterm neonates. In our study conducted at tertiary care hospital, perinatal mortality was found out to be 14.9%. Out of 29 neonates in NICU, 8 died due to causes like respiratory distress syndrome (3.5%), birth asphyxia (2.6%) and meconium aspiration syndrome (0.9%). 7 (6.1%) neonates were stillbirth.

Table 7: Perinatal mortality reason distribution.

Perinatal mortality reason	Count	%
Nil	97	85.1
Still birth	7	6.1
Respiratory distress syndrome	4	3.5
Birth asphyxia	3	2.6
Meconium aspiration syndrome	1	0.9

DISCUSSION

There were 8568 deliveries conducted at the institution during the period from January 1, 2019 to June 30, 2020. Total 114 cases of severe preeclampsia of >34 weeks were noted. The frequency of severe preeclampsia was 1.3% in

our institute. This correlates with the studies of Ngwenya et al and Ajah et al.[13,14] 70% of the women in the study were between 21-30 years of age with mean age of 26 years. This result correlates with the studies done by Pillai et al (mean age was 26 years).[15] 74.56% of the patients were unregistered or registered in outside hospital. The studies done by Saxena et al and Shaikh et al showed that 59% and 82% of the cases respectively were unbooked/ transferred for suitable management. In the study, 63.2% patients were primigravidas.[16,17] The findings are in good agreement with observations in the studies of Pillai et al and Saxena et al.[15,17] It shows that nullipara is one of the risk factors for severe preeclampsia. 53.5% of patients have gestational age between 37 to 40 weeks which forms the majority of patients of severe preeclampsia.

Almost 70.2% patients are asymptomatic on admission. 10.5% presented with headache which correlates with the study of Singhal SR et al that showed 44% patients in their study had headache as the main symptom.[18] 55.2% patients in our study had urine proteinuria 3+ or more which defines severe preeclampsia. Similar findings were reported by Saxena et al and Ngwenya et al where 64% and 81% cases respectively had proteinuria 3+ or more. Oligohydramnios and IUGR was reported in 16 and 10 patients respectively.[13,17] According to the study of Zhang et al in 2014, oligohydramnios, preterm birth, fetal distress, postpartum hemorrhage, fetal growth restriction (FGR) are the complications seen in severe preeclampsia.[19]

In our study the following risk factor were found: 25 (21.92%) patients had BMI≥35 Kg/m², 10 (8.7%) patients had history of preeclampsia in their previous pregnancy and 2 (1.8%) patients had connective tissue disorder which are considered as high risk for preeclampsia according to NICE guidelines.[20,21] Magnesium sulfate (MgSO₄) was given to 38 (33.3%) patients as prophylactic dose, Pritchard regimen was given to 5 (4.4%) patients to prevent recurrence of eclampsia. According to Thapa et al, 9 out of 16 patients of severe preeclampsia had received magnesium sulfate as prophylaxis and is an excellent drug of choice for prevention of eclampsia.[22]

In our study, LSCS was done in 59 (56.7%) women and vaginal delivery in 55 (43.3%) women which shows that half of the women in our study were delivered by LSCS. The rate of LSCS (56.7%) in severe preeclampsia patients were comparatively lower than other studies in literature like Pillai et al reported 64.5%, Ngwenya et al reported 78.5% LSCS rate.[13,15] Similar LSCS rates were seen in studies like 41.7% in Ajah et al in 2016 and 51.7% in Saxena et al[14,17] This difference in LSCS rate among studies is probably due to differences in inclusion, exclusion criteria and institutional protocol. The most common indication for LSCS found in our study was meconium-stained liquor with fetal distress (47.40%) and Impending eclampsia (6.10%) which is similar to the findings of Saxena et al who stated that fetal distress was the most common indication for LSCS.[17] Our study

showed that 18 (15.79%) patients had renal function abnormalities with creatinine >1.2 mg/dl and BUN>40 mg/dl which signifies the importance of evaluating renal parameters in severe preeclampsia patients. This correlates with the study done by Ries et al.[23]

Maternal morbidity was seen in 25.44% of women. Eclampsia (intrapartum and postpartum) was the highest accounting to 7 patients (6.1%), followed by abruption with 6 patients. In a study conducted by Nankali et al, 6.3% of severe preeclamptic women developed eclampsia.[24] Considerable percentage of severe preeclampsia patients develop eclampsia. The other most common complication in severe eclampsia found in literature review was placental abruption and postpartum haemorrhage. The incidence of placental abruption found in our study was 5.3% while other conducted by Nankali et al found 7.7%.[24] So, anticipation of common complication will reduce the maternal mortality rate. Other maternal complications found in our study were renal failure (2.60%), HELLP syndrome (2.60%), DIC (1.80%). In a ten-year study done by Igberase et al the important causes of maternal mortality in severe preeclampsia were acute renal failure, disseminated intravascular coagulopathy (DIC), cardiac arrest, pulmonary edema and cerebrovascular accidents.[25]

Low birth weight (birth weight <2.5 kg) is the most common neonatal complication in severe preeclampsia. The 60.5% low birth weight reported in this study is lower than 71.43% reported by Saxena et al (India) and higher than 44.3% reported by Ajah et al in Nigeria.[14,17] The strong association between preeclampsia with severe features and low birth weight in this study may have been due to the interventional delivery being carried out irrespective of the gestational age and IUGR. In our study, 25.43% of neonates got admitted in NICU causing strain to the healthcare resources. Most common indication for NICU care was low birth weight in 10.5%, respiratory distress in 6.14%, birth asphyxia in 4.38% and 1.8% in meconium aspiration syndrome and prematurity respectively. In the study conducted by Ngwenya et al, 54.5% of neonates required NICU care with most common indication for NICU admission was Low birth weight/ respiratory distress syndrome and prematurity.[13] The difference in both studies for NICU admission of neonate can be the different cut-off for gestational age and different inclusion/exclusion criteria.

Perinatal mortality is defined as number of stillbirths and early neonatal death. Being a tertiary care centre, we have an efficient team of neonatologists and neonatal intensive care unit (NICU) back up. In a study conducted by Tlaye et al, perinatal mortality rate was 25.9% in which stillbirths accounts for 16.3%. They found that perinatal mortality is considerably higher in severe preeclampsia than mild preeclampsia.[26] In other study conducted by Pillai et al, perinatal mortality was 18%.[15] But in our study, we recorded less perinatal mortality rate comparatively as 13.15% of which stillbirth accounts for 6.1%. Differences in death rates might arise from difference in the gestational

age cut off points used among studies, the type of hypertensive disorders included, and service-delivery capacity of the hospitals where the patients were managed. The causes of perinatal death found in our study were respiratory distress syndrome (3.5%), birth asphyxia (2.6%) and meconium aspiration syndrome (0.9%).

Out of 114 patients, 11 patients (9.64%) need ICU care and the most common cause for maternal ICU admission was the need for dialysis in acute renal failure (2.6%). In the study conducted by Ngwenya et al, 2 patients died of renal failure.[13] Other causes in our study were HELLP syndrome (1.7%), eclampsia (1.7%) and disseminated intravascular coagulation (1.7%). In our study and the study conducted by Pillai et al, there were no maternal mortality.[15] The reason for no mortality in our study can be early reporting, identification of symptoms, early intervention, good ICU care and monitoring and appropriate implementation of government policies.

CONCLUSION

Adequate antenatal visits, good antenatal care and NICU care can reduce the morbidity and mortality. For early detection of cases, regular blood pressure monitoring by family physician is essential in predisposed individuals. Early reporting to the institute on development of symptoms, timed termination of pregnancy, wider use of magnesium sulfate, availability and implementation of emergency obstetric care reduces the morbidity and mortality. Although the number of patients undergoing LSCS is more, a fair amount of induction trial can be given with proper monitoring services.

ACKNOWLEDGEMENTS

REFERENCES

1. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Rouse DJ, Catherine YS. Williams Obstetrics. 24th edn. New York, NY: McGraw Hill Companies; 2014.
2. Khan KS, Wojdyla D, Say L, Gulmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. Lancet. 2006;367:1066-74.
3. Government of India (Sample Registration System) Maternal mortality in India, 1997-2003. Trends,

causes and risk factors. Registrar General of India, New Delhi in collaboration with Centre for Global Health Research, Toronto. Available from: https://ideas.repec.org/p/ess/wpaper/id753.html. Accessed on 12 July 2023.

4. Oyston CJ, Stanley JL, Baker PN. Potential targets for the treatment of preeclampsia. Expert Opin Therap Targets. 2015;19(11):1517-30.

5. Gathiram P, Moodley J. Pre-eclampsia: its pathogenesis and pathophysiolgy. Cardiovasc J Africa. 2016;27(2):71-8.

6. Ngwenya S. Postpartum haemorrhage: incidence, risk factors, and outcomes in a low resource setting. Int J Women's Health. 2016;8:647-50.

7. Multidisciplinary management of severe preeclampsia (PE) experts' guidelines 2008. French society of anesthesia and intensive care. National College of French gynecologists and obstetricians. French Society of Perinatal Medicine. French Society of Neonatology. Ann Fr Anesth Reanim. 2009;28:275-81.

8. Pottecher T, Luton D. Prise en charge multidisciplinaire de la prééclampsie. French. Issy Les Moulineaux, France: Elsevier; Masson SAS; 2009.

9. Minire A, Mirton M, Imri V, Lauren M, Aferdita M. Maternal complications of preeclampsia. Med Arch. 2013;67(5):339-41.

10. American College of Obstetricians and Gynecologists, Task Force on Hypertension in Pregnancy. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. Obstet Gynecol. 2013;122:1122.

11. Kuklina EV, Ayala C, Callaghan WM. Hypertensive disorders and severe obstetric morbidity in the United States. Obstet Gynecol. 2009;113(6):1299-306.

12. Pannu D, Das B, Hazari P, Shilpa. Maternal and perinatal outcome in eclampsia and factors affecting the outcome: a study in North Indian population. Int J Reprod Contracep Obstet Gynecol. 2010;3:347-51

13. Ngwenya S. Severe preeclampsia and eclampsia: incidence, complications, and perinatal outcomes at a low-resource setting, Mpilo Central Hospital, Bulawayo, Zimbabwe. Int J Women's Health. 2017;9:353-7.

14. Ajah LO, Ozonu NC, Ezeonu PO, Lawani LO, Obuna JA, Onwe EO. The feto-maternal outcome of preeclampsia with severe features and eclampsia in Abakaliki, South-East Nigeria. J Clin Diagn Res. 2016;10(9):QC18.

15. Pillai SS. Fetomaternal outcome in severe preeclampsia and eclampsia: a retrospective study in a tertiary care centre. Int J Reprod Contracept Obstet Gynecol. 2017;6:3937-41.

16. Shaikh S, Ruby AJ, Piotrowski M. Pre eclampsia related chorioretinopathy with Purtscher's like findings and macular ischaemia. Retina. 2003;23:247-50.

17. Saxena N, Bava AM, Nandanwar Y. Maternal and perinatal outcome in severe preeclampsia and eclampsia. Int J Reprod Contracept Obstet Gynecol. 2016;5:2171-6.

18. Singhal S, Deepika, Anshu, Nanda S. Maternal and perinatal outcome in severe pre-eclampsia and eclampsia. South Asian Feder Obstet Gynecol. 2009;1(3):25-8.

19. Zhang Y, Li W, Xiao J, Chen S. The complication and mode of delivery in Chinese women with severe preeclampsia: a retrospective study. Hypertens Pregnancy. 2014 Aug;33(3):283-90.

20. National Guideline Alliance (UK) Hypertension in Pregnancy: Diagnosis and Management (NG133); 2019. Available from: https://www.nice.org.uk/guidance/ng133. Accessed on 3 October 2019.

21. Bartsch E, Medcalf KE, Park AL, Ray JG. Clinical risk factors for pre-eclampsia determined in early pregnancy: systematic review and meta-analysis of large cohort studies. BMJ. 2016;353.

22. Thapa K, Jha R. Magnesium sulfate: a life saving drug. JNMA J Nepal Med Assoc. 2008;47(171):104-8.

23. Ries A, Kopelman JN, Macri C. Laboratory testing for preeclampsia: result trends and screening recommendations. Milit Med. 2000;165(7):546-8.

24. Nankali A, Malek-KhosraviSh, Zangeneh M, Rezaei M, Hemati Z, Kohzadi M. Maternal complications associated with severe preeclampsia. J Obstet Gynaecol India. 2013;63(2):112-5.

25. Igberase GO, Ebeigbe PN. Eclampsia: ten-years of experience in a rural tertiary hospital in the Niger delta, Nigeria. J Obstet Gynecol. 2006;26(5):414-7.

26. Tlaye KG, Endalfer ML, Kassaw MW, Gebremedhin MM, Aynalem YA. Preeclampsia management modalities and perinatal death: a retrospective study in Woldia general hospital. BMC Pregnancy Childbirth. 2020;20(1):1-9.