Pregnancy Outcome of Hemolysis Elevated Liver Enzymes and Low Platelet Count Syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia: A Retrospective Cross Sectional Study

Muhudin Arusi[1]*; Wondimu Gudu[2]; Knife Haile[2]; Abdulfetah Abdulkadir[2]; Abraham Fessehaye[2]; Yasin Awol wabe[1]

[1]*Worabe Comprehensive Specialized Hospital, Worabe, Ethiopia.*

[2]*Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.*

*Corresponding Author(s): Muhudin Arusi

Worabe Comprehensive Specialized Hospital, Worabe, Ethiopia.

Email: Muhudinarusi@gmail.com

Abbreviations: ACS: Antenatal Corticosteroids; ANC Antenatal Care; APGAR: Appearance Pulse Grimace Activity Respiration; DIC: Disseminated Intravascular Coagulation; END: Early Neonatal Death; FHB: Fetal Heart Beat; HELLP: Hemolysis Elevated Liver Enzymes and Low Platelets; IUGR: Intrauterine Growth Restriction; LBW: Low Birth Weight; LDH: Lactate Dehydrogenase; NICU: Neonatal Intensive Care Unit; PNM: Perinatal Mortality; RDS: Respiratory Distress Syndrome; SGPT: Serum Glutamic Pyruvic Transaminase; SGOT: Serum Glutamic Oxaloacetic Transaminase; SPHMMC: Saint Paulo's Hospital Millennium Medical College; SPSS- Statistical Package of Social Science; U/A: Urine Analysis.

Abstract

Introduction: HELLP syndrome is a life-threating complication in pregnancy that occurs in 0.5 to 0.9% of all pregnancies and in 10-20% of cases with severe preeclampsia/eclampsia with increased rate of both maternal and perinatal morbidity and mortality. The aim of the study is to assess maternal and perinatal outcome of HELLP syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia.

Methods: A retrospective based chart review was conducted among 115 patients who developed HELLP syndrome during 2017 October to 2019 October at Saint Paul's Hospital Millennium Medical College in the Department of Obstetrics and Gynaecology. Data entry and analysis was made using SPSS version 23 software. Univariate and multivariable logistic regression analysis was employed with 95% CI and a p- value of < 0.05 was used to determine strength of associations.

Results: 0.57% of patients admitted for delivery developed HELLP syndrome. Majority of patients developed the condition during antepartum (89.1%). The mean gestational age was 33.40 ± 4.47 weeks. Maternal morbidity was 30.7% (31/101) and acute kidney injury was the most frequent maternal complication (24.8%), followed by pulmonary Oedema (11.9%). Mothers with complete HELLP syndrome and when it arises in postpartum period were found to have significant influence on maternal morbidity with p -value of 0.0029, AOR= 0.223 (95% CI= 0.058 -0.863) and p -value of 0.0029, AOR =2.779 (95% CI= 1.109 -6.961) respectively. Most, 70.4 %(76/108) of babies were born preterm. The overall perinatal morbidity and mortality in this study were

23/108(21.3%) and 33/108(306/1000) respectively. Place of residency, gestational age and mode of delivery found to have significant influence on perinatal mortality rate (p < 0.05).

Conclusions: The incidence of HELLP syndrome in this study was low with significant maternal morbidity and perinatal complications. It needs further prospective study with large sample size in country level.

Introduction

HELLP syndrome was first described in 1982 by Weinstein and the term HELLP refers to an acronym used to describe the clinical condition that leads to H = Hemolysis, EL = Elevated Liver Enzymes and LP = Low Platelets [1]. It occurs in about 0.5-0.9% of all pregnancies and in 10- 20% of cases with severe preeclampsia/Eclampsia. In about 70% of the cases, this syndrome develops before delivery while in about 30% of the cases develops after delivery. The HELLP syndrome may be complete or partial. Diagnosis of the complete form of this syndrome requires the presence of all three major components, while partial HELLP syndrome consists of only 1 or 2 elements of the triad (H or EL or LP) [2,3]. This syndrome, mainly in complete form is significantly associated with maternal death and increased rates of maternal morbidity such as; DIC, abruptio placentae, ARF and pulmonary oedema, thus it is necessary to have a faster diagnosis and appropriate clinical intervention [2-16]. However, Question regarding its management remain unknown; many authors consider its presence to be an indication for immediate delivery.

A prospective cohort study, which represent the largest well-defined group of patients with the HELLP syndrome in the medical literature, comprising 442 pregnancies complicated by the HELLP syndrome, in a tertiary care facility in Memphis, U.S.A. The presence of HELLP syndrome was associated with an increased rate of maternal morbidity including DIC (21%), abruption placenta (16%), ARF (7.7%) and pulmonary oedema (6%), especially when it arises in the postpartum period [5]. It is generally agreed that perinatal mortality and morbidity are substantially increased in pregnancies complicated by this syndrome [2]. Due to absence of literature in this subject in Africa, the exact incidence of HELLP syndrome is unknown. At present, there are few published studies with an adequate sample size to describe maternal and perinatal outcomes. The studies done in Nigeria and Mali reported case fatality rate of 11.8% and 33.3 % respectively [17,18].

In Ethiopia, pregnancy and childbirth complications are among the leading cause of mortality among women, with an estimated 412 maternal deaths per 100,000 live births and perinatal mortality rate ranges from 273 to 551 deaths per 100,000 live births [19].

The continuum of preeclampsia/ eclampsia is one of the major maternal health problems in Ethiopia. Although there are no representative, community based data that addressed its magnitude and adverse maternal and perinatal outcomes, HELLP syndrome is mostly reported complication of sever preeclampsia with greater risk of maternal and perinatal death in Ethiopia [20-22]. This study will be helpful for estimating the burden of disease and associated adverse pregnancy out comes so that it can pave the way for further study in order to minimize adverse pregnancy outcomes in country level.

Methods and materials

Study area and period

The study was conducted at Saint Paul's Hospital Millennium Medical College in Addis Ababa, Ethiopia during the period from Oct 11, 2017 to Oct 10, 2019 G.C.

Description of study areas

Saint Paul's Hospital Millennium Medical College is tertiary teaching referral hospitals located in Addis Ababa, Ethiopia .It provides the highest maternity service of the country. The hospital handles complicated obstetric cases, while referring normal or less complicated pregnant mothers to other hospital and health centers for birth. It gives nearly more than 10,000 antenatal care services and around 9000 deliveries per year.

Study design

A two years' retrospective hospital based chart review study

Source population

All pregnant women who delivered at SPHMMC from Oct 11, 2017 to Oct 10, 2019 G.C.

Study population

All women who delivered at SPHMMC and had diagnosis of HELLP syndrome from Oct 11, 2017 to Oct 10, 2019 G.C.

Inclusion and exclusion criteria

Inclusion criteria

All pregnant women whose Gestational age >20 weeks and meeting the diagnostic criteria of HELLP syndrome as judged by the most senior physician.

Exclusion criteria

Mothers with incomplete data on important variables and cards has been lost

Mothers with other causes of thrombocytopenia and deranged liver function tests like viral hepatitis, acute cholecystitis and gastro enteritis.

Study variables

Independent variables

Sociodemographic characteristics (age, place of residence), Obstetric history (Gravidity, Parity, gestational age, number of fetus, ANC visits, mode of delivery), Preexisting medical conditions (chronic hypertension, lupus), laboratory variables (complete blood count, U/A(proteinuria), creatinine and BUN, SGPT, SGOT, LDH, bilirubin, peripheral morphology) and management (use of antihypertensive, Magnesium sulfate, corticosteroid and blood transfusion).

Dependent variables

Maternal mortality and morbidity.

Perinatal mortality and morbidity.

Sampling and sample size methods

Purposive sampling was used and all cases with HELLP syndrome in the two years' period were included sequentially.

Data collection technique

Structured questionnaire was developed based on review of the previous published studies, and adapted to local situation with certain modifications. The questionnaires include information on baseline characteristics, obstetric data, diagnosis, management, maternal outcomes and perinatal outcomes. Before conducting the study, data collectors (BSC nurses) were trained for two days. We took corrective measures for identified problem related to the tool, such as difficult question to understand or unclear. The primary investigator was continuously supervising the data collection process.

Data analysis and interpretation

After data collection, each questionnaire checked for completeness and coded before data entry in to SPSS version 23 software. Further, data cleaning was performed for outliers, missed values and any inconsistencies before the data analysis. The results were expressed as number and percentage for all the qualitative variables. Mean and standard deviation was used for quantitative variables. Bivariate analysis was used to test association between association between explanatory and outcome variables. Multivariate analysis was done for those variables statically significant at bivariate analysis to identify their independent effects. Finally, Variables with p-value less than 0.05 on multivariable analysis were taken as statically significant factors for the outcome variable. The strength of association between dependent variable and independent variables were expressed by odds ratio (OR) with 95% confidence interval.

Results

During the study period, Oct 11, 2017 to Oct 10, 2019 G.C, there were 20,111 deliveries in our institution. Of these, 1356 cases had preeclampsia with sever feature and 76 cases had eclampsia. Out of these, 115 patients developed HELLP Syndrome making prevalence of 0.57% among all deliveries and 8 % in cases of preeclampsia with sever feature /eclampsia. Fourteen patients: 10 patients who were incompletely investigated and 4 patients their charts lost were excluded from the study. Among the remainder 101 women fulfilling the inclusion criteria were included and their records were analysed retrospectively. Ninety -seven cases (96 %) had a prior diagnosis of preeclampsia with sever feature and 4% of the cases had Eclampsia.

Most of the mothers (36.6%) were in the age group of 27-31 years. Majority of them were married and from Addis Ababa, 99% and 63.4% respectively. 92% (93/101) of the mothers were referred from primary hospital, clinics and health centres. Regarding educational levels, 45.5% and 18.9% of the mothers were elementary and secondary school level respectively.11.9% college level and 22.7 % had no formal education. Only 40(39.6%) were employed.

As for parity, 61(60.4%) cases were primiparous while 40 (39.6%) patients were multiparous. Majority, 96 %(97/101) of mothers had ANC follow up. 89.1 %(90/101) occurred during antepartum: 55.4% between the 28th and 37th weeks of gestation, 10.9% of the cases before 28th week, and 22.8% after 37th week. The mean gestational age was 33.40 ± 4.474 wks. The remaining (10.9%) of the cases develop it after delivery. Majority, 68 %(69/101) of the patients had Partial HELLP and 32 %(32/101) of them had complete HELLP syndrome. 18.8% of the mothers had spontaneous on set of labour. Eighty-two cases (81.2%), pregnancy was terminated before the onset of spontaneous labour. Of these (64.4 %) of the cases active management

was taken in the form of termination of pregnancy by induction of labor and 16.8% by caesarean delivery. Overall caesarean and vaginal delivery rate in our study were 47.5 %(48/101) and 52.5% (53/101) respectively. Majority of complete HELLP cases 53.1% had caesarean delivery whereas the caesarean and vaginal delivery rate of the partial HELLP cases were comparable (50.7% *vs.* 49.3%).

Maternal out comes

In the present study, no maternal death was observed. Around 30.7 %(31/101) of the mothers developed maternal complications. Majority of them had more than one complication. Acute kidney injury was the most frequent maternal complication 24.8 %(25/31), followed by pulmonary Oedema 11.9 %(12/31).

Table 1: Cases according to maternal outcomes of Hellp syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Oct 11, 2017 to Oct 10, 2019 (N=101).

Character	No of cases	Percent (%)
Acute Kidney Injury	25	24.8
Pulmonary Oedema	12	11.9
Disseminated Intravascular Coagulation	9	8.9
Abruptio Placenta	7	6.9
Postpartum haemorrhage	6	5.9
Blood transfusion	18	17.8
Hysterectomy	1	1
ICU stay	3	3
Maternal death	0	0
Total	74	-

Key: *some women had more than one out come.

Morbidity stratified by sociodemographic characteristics of patients.

The highest adjusted maternal morbidity,37.5%(12/32) was seen in the age group of 22-26 years while the lowest adjusted maternal morbidity, was in the age category of 17-21 years which accounting 25%(4/16) of the cases. As for place of residency, mothers from outside of Addis Ababa had highest adjusted maternal morbidity of 40.5%. Multiparous women had the highest adjusted maternal morbidity of 32.5%. In our study also showed that those mothers who were unmarried, unemployed, had no formal education had highest adjusted maternal morbidity of 100, 34.4 and 52.2 percent of the cases respectively (Table 2).

There was no significant association of maternal morbidity and variables such as place of residency, parity, past medical history, number of fetus, ANC and use of Mgso4 (p>0.05). The presence of fetal death during referral was significantly associated maternal morbidity with p-value of 0.0045 (COR =6.25, 95% CI =1.5-26.09).Those mothers who develop this syndrome in postpartum period were 4.81 times more likely to develop maternal complications with p-value of 0.032 (95% CI= 1.29-17.9). Mothers with complete HELLP syndrome 2.92 times more likely to develop maternal morbidity with p-value of 0.0169 (95% CI =1.2-7.13) (Table-3).

Table 2: Maternal morbidity stratified based on sociodemographic factors of pregnancy outcome of Hellp syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Oct 11, 2017 to Oct 10, 2019 (N=101).

Character	Cases of HELLP syndrome		Adjusted maternal morbidity	
	No Percent (%)		No Percent (%)	
Age in years				
17-21	16	15.8	4	25
22-26	32	31.7	12	37.5
27-31	37	36.6	10	27
32-37	13	12.9	4	30.8
38-42	3	3	1	33.3
Total	101	100	31	-
Parity				
Primiparous	61	60.4	18	29.5
Multiparous	40	39.6	13	32.5
Total	101	100	31	-
Referral				
Yes	93	92	30	32.3
No	8	8	1	12.5
Total	101	100	31	-
Address				
Addis Ababa	64	63.4	16	25
Out of Addis Ababa	37	36.6	15	40.5
Total	101	100	31	-
Marital status				
Married	100	99	30	30
Unmarried	1	1	1	100
Total	101	100	31	-
Occupation				
Employed	40	39.6	10	25
Unemployed	61	60.4	21	34.4
Total	101	100	31	-
Education level				
No formal education	23	22.7	12	52.2
Elementary	46	45.5	8	17.4
Secondary	19	18.8	7	10.5
College	12	11.9	2	11.8
Total	101	100	31	-

In addition, multivariate logistic regression analysis was done for those variables significantly associated with maternal complications with bivariate analysis. Only type and time of onset of HELLP syndrome were found to have significant influence on maternal morbidity with p-value of 0.0029 (AOR= 0.223 (95% CI= 0.058-0.863) and p-value of 0.0029 (AOR =2.779 (95% CI= 1.109-6.961)) respectively (Table 4).

Table 3: Factors associated with adverse maternal outcomes of HELLP syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia Oct 11, 2017 to Oct 10, 2019 (N=101).

Character	Cases		Maternal morbidity		COR(95%CI)	p-value
	No	(%)	Yes	No		
Place of residency						
Out of Addis Ababa	37	39.6	15	22	2.05(0.86-4.87)	0.103*
Addis Ababa	64	60.4	16	48		
Total	101	100	31	70		
Parity						
Primiparous	61	60.4	18	43	0.87(0.37-2.06)	0.75
Multiparous	40	39.6	13	27		
Total	101	100	31	70		
Time of on set						
Postpartum	11	10.9	7	4	4.81(1.29-17.9)	0.032*
Antepartum	90	89.1	24	66		
Total	101	100	31	70		
ANC						
Yes	97	96	30	67	0.12(0.03-0.47)	1
No	4	4	1	3		
Total	101	100	31	70		
Number of fetus						
Single	94	93.1	27	67	0.3(0.06-1.44)	0.1158
Twin(multiple)	7	6.9	4	3		
Total	101	100	31	70		
Type of HELLP syndrome						
Complete	32	31.7	15	17	2.92(1.2-7.13)	0.016*
Partial	69	68.2	16	53		
Total	101	100	31	70		
Past medical history						
Yes	9	8.9	3	6	1.14(0.27-4.9)	0.857
No	92	91.1	28	64		
Total	101	100	31	70		
FHB						
Negative	10	9.3	7	3	6.25(1.5-26.09)	0.0045*
Positive	91	90.7	24	67		
Total	101	100	31	70		
Administration of Mgso4						
Yes	99	98	30	69	0.43(0.03-7.18)	0.522
No	2	2	1	1		
Total	101	100	31	70		

Key: *Candidate variable for multivariate analysis.

Table 4: Multivariate logistic regression analysis of factors associated with adverse maternal outcomes of HELLP syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Oct 11, 2017 to Oct 10, 2019 (N=101).

Variables	Beta	P-value	AOR(95%CI)
Type of HELLP syndrome			
Complete	1.022	0.029**	2.779 (1.109 -6.961)
Partial			
Time of on set			
Antepartum	-1.499	0.030**	0.0223(0.058 -0.863)
Postpartum			
Constant	1.843	0.031**	

Key: **Variable significant at P<0.05, AOR: Adjusted Odd Ratio.

Maternal morbidity based on laboratory findings

Most (96.8%) maternal complications occurred in those mothers with platelet count of ≤100,000/mm³. Other laboratory findings: SGPT /SGOT levels ≥72IU/L, LDH ≥ 600 IU/L, Bilirubin ≥2 mg/dl and Creatnine ≥ 1.2 mg /dl indicate more than 60% of sever maternal morbidity.

Table 5: Maternal morbidity according to laboratory findings of HELLP syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Oct 11, 2017 to Oct 10, 2019 (n=31).

Character	Maternal morbidity No.	Percent (%)
Platelet count ≤ 1*105/mm3	30	96.8
SGPT≥72IU/L	26	83.9
SGOT≥72IU/L	24	77.4
LDH ≥600IU/L	19	61.3
Bilirubin >2mg/dl	19	61.3
Uric acid ≥ 6mg/dl	26	83.9
Creatinine≥1.2mg/dl	25	80.6
Total	-	-

Key: *some cases may have more than one elevated laboratory findings.

There were 108 infants delivered by the 101 mothers with HELLP syndrome: 78.7 %(85/108) of the neonates were born alive, 11 %(13/108) were intrapartum deaths and 9.3 %(10/108) were stillbirths. Most of the newborns, 70.4 %(76/108) were preterm deliveries, of which 69.7 %(23/77) of babies had IUGR, while 29.6% (32/108) were term deliveries. 25 %(27/108) of the neonates admitted to NICU: 19 neonates were discharged alive and eight neonates died. Prematurity was the cause of death in the five babies at NICU and three newborns due to IUGR. Additionally, two newborns were died before arrival in the hospital: one home delivery and one on the way to health center, all died soon after delivery, possibly due to complications of birth asphyxia making over all proportion of ENDs to be 9.3%(10/108). The overall perinatal morbidity and mortality in our study were 23/108(21.3%) and 33/108(306/1000) respectively

Table 6: Composite perinatal out of HELLP syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Oct 11, 2017 to Oct 10, 2019 (N=108).

Character	No of cases	Percent (%)
Preterm	76	70.4
Term	32	29.6
IUGR	23	21.3
Still birth	10	9.3
Intrapartum death	13	12
APGAR score (single) 1st minute < 5 5th minute <7	20 8	18.5 7.4
NICU admission	27	25
Early ND	10	9.3
Total	-	-

Key: *Some cases had more than one out come.

Place of residency, gestational age and mode of delivery were found to have significant influence on PNM rate (p < 0.05) on binary logistic regression analysis (Table 7).

Table 7: Binary logistic regression analysis comparing predisposing factors and PNM of HELLP syndrome at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Oct 11, 2017 to Oct 10, 2019 (N=101).

Variables	Beta	P-value
Place of residency	1.807	0.001**
Gestational age	-1.794	0.004**
Mode of delivery	-1.692	0.002**
Constant	1.994	0.003

Key: **Variable significant at P<0.05.

Discussion

HELLP syndrome is a life threating complication in pregnancy that associated with significant maternal and perinatal morbidity and mortality. No population-based estimates of incidence were identified in the literature. The prevalence of HELLP Syndrome in our study was 0.57 % of all deliveries, which is comparable to a 2015 review of revisiting of HELLP syndrome, which quotes a prevalence of 0.5-0.9% of all pregnancies (3). The prevalence was also consistent to a study done in Mali (0.58%) [18]. Another study conducted in India found prevalence of 1.83% [7].

In our study, HELLP syndrome was found in 60.4% primiparous compared to 39.6% multiparous. Majority of the mothers were unbooked, 80.2% while 19.8% were booked. This is in keeping with studies done in India 20% were booked and 73.3% belonged to Primiparous (14). This also agreed with another study from Nigerian, 24.5 % of cases were booked and 64.7% cases were primiparous [17].

Ninety (89.1%) cases developed HELLP Syndrome during antenatal period which is comparable to a study done in U.S.A about 70 % of the cases developed HELLP Syndrome during antenatal period and majority of cases developed the same gestational age as ours i.e. < 37 week (74.4% *vs.* 80%) [5]. A study done India reported maximum number of cases at 32 - 36 week [7]. The mean gestational at presentation was 33.40 ± 4.474

week compared to the study conducted in Nigeria [17].

Caesarean delivery rate in our study was 47.5 %(48/101) which is comparatively lower than the study done in India that is 86.6 %(14). This is might be due to the protocol in our institution is to terminate the pregnancies immediately or after completion of ACS especially in those cases with complete HELLP pregnancy with induction irrespective of gestational age to avoid progression of the disease in order to prevent adverse pregnancy outcomes.

In our study, 31(30.7%) cases developed at least one major morbidity, which is comparable to a study done in India i.e. 34.54 % [7]. Acute kidney injury was the most frequent maternal complication in this study 25(24.8%), four patients (16%) required dialysis during hospitalization. This finding is similar to the study in turkey study; Acute Renal Failure (ARF) the most frequent maternal complication i.e. 36% and Six of patients (20%) who had ARF were given hemodialysis [16]. Another study done in Mali found acute renal insufficiency as the most frightening maternal complication and hemodialysis was helpful for four of patients (44.4%) after failure of diuretic administration [18]. A study done in U.S. A, which represent the largest well-defined group of patients with the HELLP syndrome in the medical literature. HELLP syndrome was associated with serious maternal morbidity, especially when it arises in the postpartum period. DIC and Abruptio placenta as most frequent maternal complications [5]. In our study, it was found in nine (8.9%) and seven (6.9%) of the cases respectively. Moreover, when it arises in postpartum period and complete form were found have significant influence on maternal morbidity with p -value of 0.0029, AOR= 0.223 (95% CI= 0.058-0.863) and p -value of 0.0029, AOR =2.779 (95% CI= 1.109-6.961) respectively.

In our study, there were no maternal deaths, which is similar to Indian study [19]. In contrast to these studies, the studies done in Nigeria and Mali had reported fatality rate of 11.8% and 33.3 % respectively [7,8]. The difference of results with our study could be explained by early recognition, timely and prompt referral from our health centers and primary hospital once they identify the precursors of HELLP syndrome (those with uncomplicated preeclampsia-eclampsia). Moreover, most of the cases 64(63.4%) were referred from health centers in Addis Ababa where there is strong and coordinated referral system.

Still birth and Intrapartum deaths accounts for majority of perinatal deaths, 9.3% (10/108) and 12% (13/108) unlike the study conducted in India and Nigeria [7,14]. This could be due to large percentage of referred patients to our institute that serves as the main referral center for mothers (preeclamptic and eclamptic patients) that requires extreme premature deliveries as well as with fetal demise. Ten newborns (9.3%) were END making perinatal deaths of 30.6%, which is higher than a study done in India, 9 % [7] and Nigerian, 15.8% [14]. Another study in Mali reported perinatal mortality of 66.7% (6/9): 3 fetal deaths in utero and 3 ENDs due to birth asphyxia [8].

Few studies attempted to investigate the relative influence of gestational versus the severity of HELLP syndrome, however there is general agreement that perinatal mortality is depend on gestational age at deliver as well as presence of IUGR and abruptio placentae [2,23]. In present study, place of residency, gestational age and mode of delivery were found to have significant influence on PNM rate (p-value < 0.05) on binary logistic regression analysis. A study conducted in Indian reported pre-

maturity as main cause for perinatal mortality.

Limitations of the study

First, this study was based on retrospective data collection, which means that some data might be incomplete so that it needs further large sample sized prospective study. Second, the study population might not represent the general population. Besides, we do not yet have an incidence rate for the overall population in our country, which might limit the generalizability of the results to other settings. In spite of these limitations, this was the first study that evaluated the prevalence, maternal and perinatal outcomes of HELLP syndrome in Ethiopia, and so it might be helpful for estimating the prevalence and burden of disease and pave a way to do further prospective study with large sample size in country level in order to minimize adverse pregnancy outcomes.

Conclusions

The incidence of HELLP syndrome in this study was low with significant maternal morbidity and perinatal complications. It needs further prospective study with large sample size in country level.

Declarations

Availability of data and materials: All necessary data are available within the paper.

Ethical considerations: The study was ethical approved by the Institutional Review Board of Saint Paul's Millennium Medical College Department of Public Health. Confidentiality was maintained during data collection, analysis and interpretation by coding variables.

References

1. Weinstein L .Syndrome of hemolysis, elevated liver enzymes and low platelet count: A severe consequence of hypertension in pregnancy Am J Oster Gynecol. 1981; 142: 159-167.

2. Haram K, Svendsen E, Abildgaard U. The HELLP syndrome: Clinical issues and management. BMC Pregnancy and Childbirth. 2009; 9: 8.

3. Dusse LM, Alpoim PN, Silva JT, Alves Rios DR, Brandão AH. Antônio Carlos Vieira Cabral. Revisiting HELLP syndrome. Clinica Chimica Acta. 2015; 451: 117-120.

4. Sibai BM. Diagnosis, controversies, and management of the syndrome of hemolysis, elevated liver enzymes, and low platelet count. Obstet Gynecol. 2004; 103: 981-991.

5. Sibai BM, Ramadan MK, Usta I, Salma M, Mercer BM, et al. Maternal morbidity and mortality in 442 pregnancies with hemolysis elevated liver enzymes, and low platelets (HELLP-syndrome). Am J Obstet Gynecol. 1993; 169: 1000-1006.

6. Amrit PK, Navdeep K, SPS Dhillon. HELLP syndrome and its implications on maternal and perinatal outcome. . Int J Reprod Contracept Obstet Gynecol 2018 ; 7: 1007-1011.

7. Preetha G, VM Jayasree T. HELLP syndrome - a study from a tertiary centre in India. International Journal of Contemporary Medical Research. 2017; 4: 1604-1606.

8. Abdoulaye D, Dieneba D, Fangoro S, Jeanette T, Ibrahim M, et al. HELLP Syndrome in Mali. The Internet Journal of Gynecology and Obstetrics. 2004; 4: 1-5.

9. 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.

10. Hupuczi P, Nagy B, Sziller I, Rigó B, Hruby E, et al. Characteristic Laboratory Changes in Pregnancies Complicated by HELLP Syndrome.Hypertension in Pregnancy. Informa Healthcare USA. 2007; 26: 389-401.

11. Steegers EA, von Dadelszen P, Duvekot JJ, Pijnenborg R. Pre-eclampsia. Lancet. 2010; 376: 631-644.

12. Lakshmi NK, Kavitha G, Prabha DK, Gayathri KB. Study on HELLP syndrome - maternal and perinatal outcome. Int J Reprod Contracept Obstet Gynecol. 2017; 6: 714-719.

13. Satpathy Hemant K, Satpathy Chabi, Donald Frey. Review Article Hellp syndrome. J Obstet Gynecol India: January/February. 2009; 59: 30-34

14. Çetin C, Gezginç K, Altintepe L, Zeki H, Tulin Y, et al. Results of the Pregnancies with HELLP Syndrome, Renal Failure. 2003: 25; 613-618.

15. Ngwenya S. Severe preeclampsia and eclampsia: incidence, complications, and perinatal outcomes at a low-resource setting, Mpilo central Hospital, Bulawayo, Zimbabwe. International Journal of Women's Health. 2017; 9: 353-357.

16. Makinde ON, Adegoke OA, Adediran IA, Ndububa D, Adeyemi AB, et al. HELLP syndrome: The experience at Ile-Ife, Nigeria. Journal of Obstetrics and Gynaecology. 2009; 29: 195-199.

17. Central Statistical Agency (CSA) and ICF. Ethiopia Demographic and Health Survey: Key Indicators Report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA. CSA and ICF. 2016; 1-46.

18. Maereg W, Muluken D, Alemayehu W, Josephat N. Trends of preeclampsia/eclampsia and maternal and neonatal outcomes among women delivering in Addis Ababa selected government hospitals, Ethiopia. The Pan African Medical Journal. 2016; 25: 12.

19. Berhan Y, Berhan A. Causes of maternal mortality in Ethiopia: a significant decline abortion related death. Ethiopian journal of health sciences. 2014; 24: 15-28.

20. Gaym A. Diseases burden due to Preclampsia/Eclampsia and the Ethiopian health system response. Inter Journa Obstet Gynecol. 2011; 115: 1.

21. Ahmed A. Maternal Mortality Trend in Ethiopia. Ethiop. J. Health Dev. 2010; 24: 115-122.

22. Abadi K, Getachew M, Gedefaw A, Achenefi A. Prevalence of hypertensive disorders of pregnancy in Ethiopia. systemic review and meta-analysis . BMC Pregnancy and Childbirth. 2018; 18: 34.

23. Lynette Barnhart, HELLP Syndrome and the Effects on the Neonate: Neonatal net work. 2015; 34.