Feto-maternal Outcomes of Hypertensive Disorders of Pregnancy in Yekatit-12 Teaching Hospital: a Retrospective Study

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Mekoya Dabulo Mengistu  mekoyamengistu@gmail.com
Addis Ababa University
Corresponding Author
ORCiD: 0000-0002-2977-5606

Tilahun Kuma
Yekatit-12 Teaching Hospital

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Abstract

Background

In resource poor countries, hypertensive disorders of pregnancy are common and form one of the deadly triad, along with hemorrhage and infection, which contribute greatly to maternal and fetal jeopardy.

Methods

The aim of this study was to assess the prevalence of hypertensive disorders of pregnancy, and determine the effects of hypertensive disorders of pregnancy on the feto-maternal outcomes. It was a descriptive, cross-sectional, retrospective study on 615 women who attended delivery at Yekatit-12 Teaching Hospital from July 2017 - Jan 2018. Data was analyzed using SPSS version 20 software. Descriptive statistics were used to calculate rates. Chi-square statistics were used to estimate the associations among selected predictor variables. A p-value < 0.05 was taken as statistically significant.

Results

Out of the 615 study population, the prevalence of hypertensive disorders of pregnancy was found to be 25.4%, of which the majority (54.5%) was severe pre-eclampsia. Eclampsia accounted for 2.6%, and superimposed pre-eclampsia was 2.6%. The rate of severe pre-eclampsia with HELLP syndrome was 7.1% of all mothers with the hypertensive disorders. The majority of mothers with hypertensive disorders (59.6%) had age range of 25-34 years. About 46% of mothers required interventions to terminate the pregnancy either by cesarean section (42.3%) or instrumental deliveries (3.7%). The rate of preterm, low birth weight, and low Apgar at 1st and 5th minutes accounted for 30%, 25%, 24.4% and 16.7% of neonates born to mothers with hypertensive disorders, respectively. Over 19% of neonates required resuscitation and 11.5% NICU referral. The rate of still birth was 2.6%.
Conclusion

The prevalence of hypertensive disorders of pregnancy is high in the study area and complicates maternal and fetal outcomes of the pregnancy. To deter its detrimental effects both on fetal and maternal outcomes of pregnancy, antenatal surveillance should be expanded to enable early detection, stringent follow-up and timely intervention in severely affected pregnancies.

Background

Hypertensive disorders of pregnancy (HDP) are common medical complications of pregnancy and form one of the deadly triad, along with hemorrhage and infection, contributing greatly to maternal, fetal and neonatal morbidity and mortality [1]. The hypertensive disorders in pregnancy includes chronic hypertension and the group of hypertensive disorders unique to pregnancy including gestational hypertension, preeclampsia and eclampsia. Approximately 30% of hypertensive disorders in pregnancy are due to chronic hypertension, and 70% are due to pregnancy induced hypertension [2]. ACOG estimated that hypertensive disorders complicates about 12-22% of pregnancies [3] and it has diverse risk factors [4, 5, 6, 7]. In Ethiopia the prevalence of HDP and their effects on feto-maternal outcomes are obscure due to disproportionately low institutional delivery and also limited studies conducted in this important area so far. These limited studies indicate that the hypertensive disorders of pregnancy contributed to a very significant maternal and neonatal disease burden [8]. The HDP complicated wide ranges of institutional deliveries from 5% - 8.5% [9, 10] to 18.25% - 25.1% [11, 12].

The spectrum of HDP ranges from mildly elevated blood pressures with minimal clinical significance to severe hypertension and multi-organ dysfunction [2]. Gestational hypertension is defined as a systolic blood pressure (SBP) of at least 140 mm Hg and/or a diastolic blood pressure (DBP) of at least 90 mm Hg on at least two occasions at least 6
hours apart after the 20th week of gestation in women known to be normotensive before before 20 weeks' gestation [13]. Preeclampsia is primarily defined as gestational hypertension plus proteinuria (300 mg or more per 24-hour period). If the 24-hour urine collection is not available, proteinuria is defined as a concentration of at least 30mg/dL (at least 1+ on dipstick) in at least two random urine samples collected at least 6 hours apart[3, 4, 14]. In the absence of proteinuria, preeclampsia should be considered when gestational hypertension is associated with persistent cerebral symptoms, epigastric or right upper quadrant pain with nausea or vomiting, or thrombocytopenia and abnormal liver enzymes [4].

The criteria for mild preeclampsia is when the SBP 140 mm Hg and/or DBP 90 mm Hg on two occasions at least 6 hours apart but no more than 1 week apart, typically occurring after 20 weeks gestation and the Proteinuria of 300 mg in a 24-hour urine collection or ≥1+ on two random sample urine dipsticks at least 6 hours apart (no more than 1 week apart) [2]. Preeclampsia is considered severe if there is severe gestational hypertension in association with severe proteinuria (at least 5g per 24-hour). Furthermore, preeclampsia is considered severe in the presence of multi-organ involvement such as pulmonary edema, acute kidney injury, thrombocytopenia (platelet count less than 100,000/mm³), abnormally elevated liver enzymes (twice the normal upper level) in association with persistent epigastric or right upper quadrant pain, or new onset of persistent cerebral or visual symptoms [3, 4]. A particularly severe form of preeclampsia is the HELLP syndrome, which is an acronym for three major abnormalities; hemolysis, elevated liver enzymes, and low platelet count [2]. The onset of convulsions in a woman with preeclampsia that cannot be attributed to other causes is termed eclampsia. The seizures are generalized and may appear before, during, or after labor[6].

The outcomes of pregnancy complicated by hypertensive disorders range from uneventful
pregnancy in women with chronic but controlled hypertension to death in cases of preeclampsia-eclampsia[13]. The feto-maternal outcomes of hypertensive disorders of pregnancy are affected by multiple factors. These embrace but are not limited to gestational age at onset, severity of disease, the presence of multifetal gestation, and the presence of co-morbid conditions including diabetes mellitus, renal disease, thrombophilia, or preexisting hypertension [4,13,15]. Women with gestational hypertension are more likely to have higher rates of induction of labor for maternal reasons and higher rates of cesarean delivery than women with normotensive gestation [16, 17]. The increased rate of cesarean delivery in such women is mainly related to failed medical induction or dystocia [18]. On the other hand, maternal and perinatal morbidities are substantially increased in women with severe gestational hypertension [17, 18]. WHO estimates that the incidence of preeclampsia is 7 times higher in low- and middle-income countries than in high-income countries, and the risk of a woman in a low-income country dying of pre-eclampsia/eclampsia is 300 times that of a woman in a high-income country [23]. The risk of death due to preeclamptic disease increases when eclampsia supervenes on the clinical picture. Pre-eclampsia/eclampsia is responsible for an estimated 16% of global maternal mortality annually [24]. The perinatal mortality and morbidities such as low birth weight, preterm, SGA, IUGR, need for resuscitation as well as NICU admission are substantially increased in women with severe preeclampsia [13, 17, 18, 20, 21]. The high perinatal mortality in women with HDP is mainly due to premature delivery and growth restriction [20]. The multi-country survey of WHO has shown that there were about 3- and 5-fold increased risk of perinatal death in women with preeclampsia and eclampsia, respectively, as compared to women with no preeclampsia/eclampsia [19]. The majority of perinatal deaths due to complications of HDP have occurred in the low and middle income countries [22]. In
Ethiopia, there are few hospital based reports [10, 22, 25] on the maternal and fetal outcomes of hypertensive disorders of pregnancy and they may not represent the larger population due to the low institutional delivery rate [30]. The objectives of this study were to assess the prevalence of hypertensive disorders of pregnancy, and determine its common feto-maternal outcomes.

Methods

Study design and setting

It was a descriptive, cross-sectional, retrospective study using data from the hospital records of pregnant women who delivered at Yekatit-12 Teaching Hospital from 1st of July 2017 up to 1st of Jan 2018. The study was conducted at the Gynecology and Obstetrics department of Yekatit-12 Teaching Hospital which is one of the Government Hospitals in Addis Ababa, the capital of Ethiopia. The Hospital has 16 Health Centers and a total of about 1.5 million population in its catchment area. The health centers in the catchment area refer the risky pregnancies including those with hypertensive disorders to this Hospital based on the referral network system designed recently by the Ethiopian government as part of the strategies to decrease the high maternal and perinatal mortality and morbidity. The referral network system is coordinated by liaison office and Task force which are directly over sighted by the city Health Bureau and Ministry of Health. Therefore, the Gynecology and Obstetrics department is overwhelmed by gravid women referred from the Health centers in the catchment area, women already enrolled to have their ANC follow up at the hospital based on the previous history of abnormal pregnancy, and also mothers coming with referral from the nearby rural areas and other Hospitals. The health centers are responsible to handle the ANC follow up of only the normal pregnancy requiring basic care and refer to the hospital any abnormal pregnancy
requiring specialized care as soon as possible based on the ANC risk identification protocol.

Study population

This study included all eligible women admitted to and delivered at the study hospital from 1st of July 2017 up to 1st of Jan 2018. The exclusion criteria was mothers transferred to other hospitals after being admitted to the study hospital, lost or incomplete data, or mother died on arrival before adequate diagnosis. A total of 615 were randomly selected from all the women attended delivery during the specified period.

Data Variables for the study

In order to assess the maternal and fetal outcomes of hypertensive disorders of pregnancy, data was obtained from the medical records of the study subjects. The maternal parameters obtained included; chief complaints, maternal age, maternal vital sign, parity, gestational age, number of fetuses, other maternal risk factors for HDP (such as previous history of similar illness, diabetes mellitus, chronic kidney disease), Highest systolic and diastolic blood pressure recorded, type of HDP, onset of HDP, severity symptoms of HDP, type of anticonvulsant and antihypertensive given. Furthermore, onsets of labor, mode of deliveries, as well as obstetric complications were obtained. Laboratory findings included; proteinuria, hemoglobin, platelet count, serum creatinine, BUN, serum uric acid level, and serum liver enzyme levels. Neonatal outcome parameters obtained included; gestational age, birth outcome (alive or not), birth weight, APGAR score at 1st, and 5th minutes, need of resuscitation, and need for NICU.

Quality Control and Data collection procedures

In order to ensure the accuracy, completeness, and comparability of data, the medical records of the study subjects were meticulously evaluated by the investigators. First the
hospital registration numbers of the study subjects were obtained from the delivery registry logbook. Using these registration numbers the chart of each patient was retriever from the archives. The ANC chart for women having follow-up at the hospital, referral chart of those referred from other health facilities, Admission chart for women who were admitted to Maternity ward for inpatient follow up, Admission chart to the labor ward for all women and their postnatal profile were thoroughly evaluated. Data collection was made by the pretested check lists to document all the pertinent profiles of the study subjects by the investigators themselves.

Data Processing and Statistical Analysis

After checking for completeness, data was coded, entered, and analyzed using SPSS version 20 software. Descriptive statistics was used to calculate rates. Chi-square was used to estimate the associations between selected predictor variables. A p-value < 0.05 was taken as statistically significant.

Ethical Consideration

Ethical clearance was obtained from institutional review board of Yekatit–12 Teaching Hospital. Since the study was retrospective cohort, written consent was not obtained. Anonymity of the patient profile was upheld.

Results

Demographic and clinical characteristics of the study population

Data was collected from 615 samples randomly taken from all deliveries attended from 1st of July 2017 up to 1st of Jan 2018 at Yekatit–12 Teaching Hospital. The maternal age of the study population ranged from 14 years up to 42 years. About 60% of maternal age was in the range of 25 to 34 years (Table 1). However, only about 7% of mothers had at least 35 years of age. Primiparity accounted over half of the mothers and grand multiparity
accounted almost less than 1% of the mothers. The rate of twin pregnancy in the study population was 3.6%. The majority of mothers had term pregnancy (78%) with preterm and very preterm both accounted for about 15% of the total, and the remaining being post term.

Over 62% of mothers had spontaneous vaginal delivery, and instrumental delivery with vacuum and forceps accounted for additional 3 and 4% of deliveries, respectively. Episiotomy was done for 69% of mothers to facilitate their vaginal deliveries. Cesarean section was done to 30.7% of pregnancies for various obstetric indications. Most of the patient had multiple indications for cesarean deliveries. Preclampsia-Eclampsia was implicated in over 15% of the cesarean sections whereas previous uterine scar was implicated in about 25% of the cesarean indications. Non-reassuring fetal heart pattern (NRFHRP) was associated with about 20% of the total cesarean indications with half of the types of NRFHRP was persistent fetal bradycardia. The male to female sex ratio of the neonates were almost equivalent with male accounted for 50.9% and female accounted for the remaining 49.1% of the neonatal sex. The majority of the birth weight of neonates (79.75%) was in the range of normal birth weight whereas over 17% of neonates had birth weight of less than 2500g. Apgar score less than 7 in the first minute accounted for 15.5% of neonates and Apgar score less than 7 in the 5th minutes was 8.3%.

Demographic and clinical characteristics of women with hypertensive disorders of pregnancy

Out of the 615 population studied, the prevalence of hypertensive disorders of pregnancy was found to be 25.4% (156), of which the majority (54.5%) was severe pre-eclampsia. The incidence of superimposed pre-eclampsia was 2.6% and eclampsia accounted for only 2.6%. The rate of severe pre-eclampsia with HELLP syndrome was 7.1% of all HDP. The
majority of mothers with HDP (59.6%) had age range of 25–34 years and only 9% had age of at least 35 years. The association of maternal age to the severity of hypertension was not statistically significant (p = 0.441). Over one half (55.8%) of mothers with hypertensive disorders were primipara (Table 2). The rate of twins’ pregnancy constituted 3.2% of mothers with hypertensive disorders with the remaining being singleton pregnancies.

Maternal outcomes of Hypertensive Disorders of Pregnancy

Vaginal delivery accounted for 53.8% of the mode of deliveries in all mothers with HDP. However, the rate of cesarean section contributed for 42.3% of deliveries. There were no destructive deliveries but instrumental delivery was 3.8% with forceps and vacuum had equal share. There was statistically significant association between severity of hypertensive disorders to the mode of deliveries with the risk of cesarean delivery increased with the severity of hypertension (p = 0.009). Headache resistant to ordinary anti-pain medications was among the chief complaints in 54% of mothers with severe pre-eclampsia and eclampsia. Similarly, blurring of vision was presented as part of the chief complaints in 39.4% of mothers with severe pre-eclampsia and eclampsia. All eclamptic mothers had generalized tonic-clonic seizure coupled with loss of consciousness as a chief complaint at presentation and had preceding history of headache and blurring of vision. About one fifth of mothers with severe pre-eclampsia and eclampsia developed acute renal failure (AKI) manifested by the creatinine level of at least 1.2mg/dl (Cr≥1.2mg/dl) (Table 4). Thrombocytopenia (platelet<100,000/mm³) was observed in 13.5% of mothers with severe pre-eclampsia and eclampsia. Over 88% of mothers with severe pre-eclampsia required hydralazine for immediate control of hypertension as did to all eclamptic mothers. About 92% of severe pre-eclamptic mothers who were given hydralazine also
required another antihypertensive agent; mostly methyl-dopa for further stabilization of the blood pressure. All mothers with severe pre-eclampsia and eclampsia as well as 38.7% of mothers with mild pre-eclampsia were given MgSo4 for seizure preventive prophylaxis. The mean of systolic blood pressure and diastolic blood pressure in mothers with Gestational hypertension, Mild pre-eclampsia, Severe-eclampsia and Eclampsia were shown in the figure 1 and Figure 2 below.

Perinatal outcomes of Hypertensive Disorders of Pregnancy

The rates of very preterm and pre-term born to the mothers with HDP were 10.3%, and 19.2%, respectively. Over 70% of mothers with HDP had pregnancy lasted for at least 37 weeks. There was statistically significant association between the severity of hypertensive disorders and prematurity (p<0.001). Among the total hypertensive mothers, 7%(11) of them delivered babies with extremely low birth weight whereas the rate of low birth weight was 17.3% (27) with the cumulative rate of babies with birth weight less than 2500g was 24.5%. There was also significant association between severity of hypertension with low birth weight (p<0.001). The rate of Apgar score of less than 7 at first minute was 24.4% among all neonates delivered from hypertensive mothers. On the other hand, the rate of low Apgar score (less than 7) at fifth minute was 16.7% among all neonates delivered from mothers with hypertensive disorders. Compared with neonates of normotensive mothers with depressed Apgar score at first minute(12.4%) and fifth minutes (4.9%), the depressed Apgar score was much higher among neonates delivered from mothers with mild pre-eclampsia (Apgar at first minute (25%) and fifth minutes(14.3%)), severe pre-eclampsia (Apgar at first minute (28.0%) and fifth minutes(23.2%)) and eclampsia ((Apgar at first minute (50%) and fifth minutes(50%))). This association of depressed Apgar sore with severity of maternal hypertensive disorders was statistically significant both at first minute (p = 0.007) and fifth minutes (p<0.001).
Among neonates of eclamptic mothers, 50% of them required resuscitational support and NICU referral. Similarly, 12.2% (10) of neonates born to the mothers with severe pre-eclampsia were complicated with IUGR, 13.4% (21) needed the resucitational support, and 17% (14) needed referral to NICU. However, among normotensive mothers only 3.1% (12) of neonates were resuscitated and only 2.8% (11) neonates were referred to NICU. This increased likelihood of neonatal complications with increased severity of hypertension was statistically significant (p<0.001). Nevertheless, there was no statistically significant increase in the rate of still birth among hypertensive mothers compared to the normotensive counter parts (p>0.05).

Discussion

Hypertensive disorders of pregnancy (HDP) are common and form one of the deadly triad, along with hemorrhage and infection, which contribute greatly to maternal morbidity and mortality, fetal, and neonatal jeopardy [1]. In our study, the prevalence of hypertensive disorders of pregnancy was 25.4%, of which severe pre-eclampsia was 67% and eclampsia accounted for 2.6% of the total cases of hypertensive disorders. The present prevalence is comparable to some of the studies in Ethiopia; 18.25% of preclampsia in Arbaminch [11] and 25.1% in Derashie, SNNP [12] and also findings in other countries [26, 27]. However, it is higher than some of the overall global reports [13, 23] and also some studies in Ethiopia; 2.4% at Mettu Referral Hospital [25], 5.7% in Debrebrhan Referral Hospital [28], and 8.5% at Jimma Specialized Hospital [10]. The exaggerated prevalence of HDP in the current study is not surprising as the Hospital receives referrals of complicated pregnancies from 16 Health centers with catchment area of over 1.5 million populations. Therefore, the current prevalence might be the effect of the aggregate rates from a number of primary care facilities in the catchment area with the large denominator population. Studies also show that the increased prevalence is common in centers that
serve as a referral medical facility for an extended number of primary care units [5]. The low socioeconomic status, young age, primiparity and urban residency are known risk factors for the development of preeclampsia [29] and could also be another cause for increased prevalence of HDP in the present study. As the study was a retrospective type, measurement bias and errors could also have played a role. Severe pre-eclampsia accounted for the majority of HDP (54.5%) in this study. This is comparable to other studies in Ethiopia; 51.8% in Jimma[10], 60.7% in Mettu[25] but less than the 78% in Addis Ababa[9]. The prevalence of eclampsia in our study was 2.6% which is comparable to the study in Jimma[10] but much less than the 19% report of eclampsia in Mettu[25], 27.8% in Debrebrhan[28] and Addis Ababa [9]. The decreased proportion of eclampsia in the present study could partly be attributed to early diagnosis of preeclampsia, stringent follow up with appropriate medical management and termination of pregnancy after ascertaining fetal maturity before sequelae of preeclampsia. The increased awareness of the pregnant mothers towards the complication of hypertension coupled to the increased trend in the ANC utilization by the urban residents in the recent years due to massive work by the Ethiopian government[30] could also contributed for the low proportion eclampsia in the current study.

Majority of the mothers affected by the hypertensive disorders were nullipara(55.8%) and 91% of mothers had at most 34 years of age. This is similar with the findings of other studies conducted in Ethiopia [10, 25, 28]. However, there was no statistically significant association between age of mothers and severity of hypertensive disorders (p = 0.441). In 53.2% of mothers with HDP, onset of labor was by induction and the likelihood of induced labor was significantly higher with severity of HDP (p<0.001). Almost all inductions were for mothers with preeclampsia, eclampsia and superimposed preeclampsia; which is less than the finding from studies in Debrebrhan (60.9%)[28], but greater than studies in
Jimma (36.6%) [10], and Mettu (44.6%) [25]. The mode of delivery was significantly associated with severity of HDP (p = 0.009). The rate of cesarean section was 42.5% and instrumental delivery contributed for 3.9% of all deliveries of mothers with HDP. The cesarean rate was higher than the study in Jimma (34%) [10], Mettu (16.2%) [25], and Debrebrhan (6.3%) [28]. On the contrary, the rate of instrumental delivery was slightly lower than the study in Jimma (7.8%) [10] and Mettu (6.9%) [25], but much lower than the study in debrebrhan (34.7%) [28]. The presence of appropriate professionals in higher number might have contributed to the higher operative delivery in the present study area. This might have also contributed for lower maternal and perinatal mortalities in the present study. Most of the mothers (76.3%) with hypertensive disorders had the highest systolic blood pressure record of at least 160mmHg and 83% had the highest diastolic blood pressure of at least 110mmHg. This finding is in agreement to the study in Mettu [25].

Headache refractory to the ordinary anti-pain medications was among the chief complaints in 30.8% of all mothers with HDP and in 54% of pre-eclamptic and eclamptic mothers combined. This is in agreement with the 48.9% incidence of headache among mothers with severe preeclampsia and superimposed preeclampsia from Debrebrhan [28] and studies done in other countries; 46.2% in Iran [31], 42.22% in India [29]. Blurring of vision was observed in 22.5% of mothers with HDP and in 30.7% of mothers with pre-eclampsia and eclampsia combined. This is also in agreement with other reports [28, 29, 31]. In our study, all the eclamptic mothers had preceding complaints of headache and blurring of vision before they were progressed to develop the abnormal body movement and loss of consciousness. Therefore, early detection and subsequent intervention of severe preeclampsia including termination of the pregnancy could have paramount importance in averting the sequelae. The proportion of epigastric pain (5.8%) and abruptio placentae
(1.3%) were much lower than the findings in Iran (27% and 16% of HDP, respectively)[31]. The rate of abruption is comparable to the finding in Mettu (2%) [25] but much less than reports of other countries [29, 31]. In developed countries pregnancy related acute renal failure (AKI) has decreased, with current estimates are around 1-2.8%, where as in developing countries it is 4.5–15% and responsible for both maternal and fetal morbidity and mortality [34]. Some setups showed an alarmingly high value to a 36% with HDP contributing for 12% [32]. Our study indicated the prevalence of AKI (Cr>1.2mg/dl) to be 10.9% among mothers with HDP which is relatively higher than the reports in Mettu (6.6%) [25]. This could partly be attributed to the increased prevalence of the HDP in the present study. However, the rate of AKI (10.9%) and thrombocytopenia (7.7%) are less than similar studies in other countries [31].

Pre-eclampsia/eclampsia is responsible for an estimated 16% of global maternal mortality annually [24] and according to ACOG the HDP is responsible for 17.6% of direct maternal deaths[26]. The risk of maternal death is much more common in settings in which prenatal and intrapartum care is not routinely available to pregnant women [8, 24]. Surprisingly, maternal mortality associated with HDP or ICU admission in the present study was non-existent even if the HDP is rampant in the study area. This is uncommon finding even compared to the other Ethiopian report of maternal mortality of 2.5% in Debrebrhan[28], 1.2% in Jimma[10], and also the national cause-specific case fatality rate of 3.6% [8]. It is in agreement to the zero mortality rate of the study in Mettu[25]. This could be attributed partly to the fact that our hospital having improved care facilities, well-staffed with appropriate professionals, giving services for 24 hours a day–7days a week, early presentation of the mothers to the hospital and/or health centers in the catchment area, vibrant referral system to the hospital from the health centers, and stringent interventions in the hospital including the termination of pregnancy might have
contribute to no maternal death. WHO study also showed that the availability of basic and comprehensive EmOC 24 hours per day, 7 days per week—in conjunction with a functioning referral system—is thought to prevent most maternal deaths with direct causes [33]. The low institutional delivery in the country [30] could be another contributing factor for the low maternal mortality observed in this study.

Hypertensive disorders of pregnancy are known to be associated with a number of perinatal complications which can be measured in terms of prevalence of preterm delivery, low birth weight, low Apgar score, intrauterine growth restriction, the need for resuscitation and/or admission to a neonatal intensive care unit (NICU), and stillbirths. In the present study, there was statistically significant association of preterm delivery with severity of HDP (p<0.001). The rate of preterm delivery was 29.5%, out of which severe pre-eclampsia and eclampsia accounted for over 80% of preterm deliveries. This finding is comparable with the study from Jimma (31.6%) [10] and Mettu (28.1%)[25] but less than other reports in Ethiopia where the preterm rate was 35.4% in Debrebrhan[28], and 48.6% in Addis Ababa [9]. The study also showed increased likelihood of low birth weight with increasing severity of HDP (p<0.001). The rate of low birth weight was 24.4%, of which very low birth weight accounted for 29% and severe pre-eclampsia together with eclampsia contributed for 84.2% of low birth weight. This finding is in agreement to the report from Mettu (25.4%) [25] but much less than reports from Debrebrhan (39.9%) [28] and Jimma 47.9% [10]. The rate of low Apgar at the first minute was 24.4% and the likelihood of poor Apgar corresponds to the severity of HDP (p = 0.007). The rate of low Apgar score at the 5th minutes was 16.7% among mothers with HDP and has statistically significant association with the severity of HDP (p<0.001). This is in agreement with other reports [10, 25]. Preeclampsia-eclampsia can also lead to higher frequency of neonatal respiratory difficulties, and increased frequency of admission to neonatal intensive care
Those infants born small and premature may experience prolonged stays in neonatal intensive care units and often face developmental delays [13]. In our study, the need for resuscitational support was 19.3%, of which 77% were neonates born to mothers with severe pre-eclampsia and eclampsia. Similarly, 11.5% of neonates required referral to NICU, of which 89% were neonates born to severe pre-eclamptic and eclamptic mothers. The rate of resuscitation in this study is comparable to the finding from Debrebrhan[28]. The rate of ICU admission is also comparable to the study from Jimma(16.4%) [10], but much less than the 40.1% of the Debrebrhan study [28].

The WHO multicountry survey has shown that there were about 3- and 5-fold increased risk of perinatal death in women with preeclampsia and eclampsia, respectively [21]. In Ethiopia, hypertensive disorders of pregnancy account for perinatal mortality rate of 290/1000 total births [22]. There were 4 still births in our study yielding still birth rate of 2.6%. This rate is much less than other studies in Ethiopia; 10.7% in Mettu[25], 27.5% in Jimma[10], 30.8% in Debrebrhan[28]. This contracted prevalence of still birth in Yekatit-12 teaching hospital could be partly due to the extensively coordinated and commendable effort by every stakeholder from the senior obstetrician up to the health centers and extension health workers at grass root level and the efficient referral system from health centers to the hospital for every woman with the risk factor. The other very important contributing factor why the incidence of still birth is so low in the present study area could be associated with the low prevalence of eclampsia (2.6%) as compared to other studies in Ethiopia[10, 25, 28]. Eclampsia accounts for 5-fold increased risk perinatal death [21]. The limited sample size could also have partly contributed to the low stillbirth rate.

Conclusions

This study revealed high prevalence of hypertensive disorders of pregnancy in our study area as the hospital is managing the referral cases of mothers with risk factors from large
number of health centers from the wide range of catchment areas. Hypertensive disorders of pregnancy have significant detrimental feto-maternal outcomes mostly due to severe preeclampsia. There was no maternal mortality encountered in the present study, the rate of eclampsia was relatively low, and the rate of still birth attributable to the hypertensive disorders of pregnancy was also low compared to similar studies done in Ethiopia; indicating partly the commendable achievement of providing better obstetric care at hospital level and also efficiency of the referral system from the health centers in the catchment area. Much of the obstetric researches in the past several decades have been directed at finding ways to prevent preeclampsia and eclampsia. However, there is no definitive preventive method for the hypertensive disorders of pregnancy to date apart from termination of pregnancy. Therefore, it is imperative to expand and strengthen the focused antenatal surveillance to early recognize the pregnant women with hypertensive disorders of pregnancy, provide them appropriate care and/or refer to the hospital from health centers. Up to date and goal oriented training for lower and middle level health professionals at the health centers and in the Hospitals can further increase their capacity for early detection of high-risk pregnancies, and timely referral to advanced tertiary health facilities.

Abbreviation

ACOG: American College of Obstetrics and Gynecology; AKI: Acute kidney injury; ANC: Antenatal care, APGAR: Appearance, Pulse, Grimace, Activity, Respiration; BP: Blood Pressure; GA: Gestational Age, HELLP: Hemolysis, elevated liver enzymes and low platelets; IUGR: Intrauterine Growth Restriction; NICU: Neonatal Intensive Care Unit; HDP: Hypertensive Disorders of Pregnancy

Declaration
Ethics approval and consent to participate

Ethical approval was obtained from Research review board of Yekatit-12 Hospital Medical College (protocol number: 01/2017)

Consent for publication:

Not applicable

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Some financial assistance for data collection was obtained from Yekatit-12 Hospital. The funding agent has no role in study design, data collection, data analysis, and final write up.

Authors’ contributions

MM conceived of the study, collected data, analyzed and interpreted the data, and was a major contributor in writing the manuscript. TK involved in data collection and manuscript writing.

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Authors’ information

MM: MD, Msc, assistant professor of physiology at Addis Ababa University, School of Medicine. TK: MD, Assistant professor and head of gynecology and obstetrics at Yekatit-12
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Tables

Table 1. Demographic and clinical characteristics of the study population
| Variable                              | Frequency | Percentage |
|--------------------------------------|-----------|------------|
| Maternal Age (Year)                  |           |            |
| ≤24                                  | 214       | 34.8%      |
| 25-34                                | 356       | 57.9%      |
| ≥35                                  | 45        | 7.3%       |
| Parity                               |           |            |
| primipara                            | 337       | 54.8%      |
| Multipara                            | 278       | 45.2%      |
| Gestation                            |           |            |
| Singleton                            | 593       | 96.5%      |
| Twins                                | 22        | 3.6%       |
| Gestational Age (Weeks)              |           |            |
| <34 (very preterm)                   | 34        | 5.5%       |
| 34-36+6 (preterm)                    | 60        | 9.8%       |
| 37-41+6 (term)                       | 480       | 78.0%      |
| >42 (post-term)                      | 41        | 6.7%       |
| Mode of delivery                     |           |            |
| Vaginal                              | 384       | 62.4%      |
| Vacuum                               | 24        | 3.9%       |
| Forceps                              | 18        | 2.9%       |
| Cesarean                             | 189       | 30.7%      |
| Sex of neonate                       |           |            |
| Male                                 | 325       | 50.9%      |
| Female                               | 313       | 49.1%      |
| Birth weight (gram)                  |           |            |
| <1500 (ELBWT)                        | 24        | 3.76%      |
| 1500-2499 (LBWT)                     | 88        | 13.81%     |
| 2500-3999 (NBWT)                     | 508       | 79.75%     |
| ≥4000 (big baby)                     | 17        | 2.67%      |

Table 2 Demographic and clinical characteristics of mothers with HDP
| Variable                        | Frequency | Percentage |
|--------------------------------|-----------|------------|
| **Maternal Age (years)**       |           |            |
| ≤24                            | 49        | 31.4%      |
| 25-34                          | 93        | 59.6%      |
| ≥35                            | 14        | 9.0%       |
| **Parity**                     |           |            |
| Primipara                      | 87        | 55.8%      |
| Multipara                      | 69        | 44.2%      |
| **Gestation**                  |           |            |
| Singleton                      | 151       | 96.8%      |
| Twins                          | 5         | 3.2%       |
| **Gestational Age**            |           |            |
| <34weeks                       | 16        | 10.3%      |
| 34-36weeks                     | 30        | 19.2%      |
| ≥37week                        | 110       | 70.5%      |
| **Mode of delivery**           |           |            |
| Vaginal                        | 84        | 53.8%      |
| Vacuum                         | 3         | 1.9%       |
| Forceps                        | 3         | 1.9%       |
| Cesarean                       | 66        | 42.3%      |

Table 3 Maternal and Perinatal outcomes of the hypertensive disorders of pregnancy

| Perinatal outcomes | Types of hypertension | Gestational hypertension (36 (23.1%)) | Mild Preeclampsia (31 (19.9%)) | Severe Preeclampsia (85 (54.5%)) | Eclampsia (4 (2.6%)) | Normotensive (387 (71.3%)) | P-value |
|--------------------|-----------------------|----------------------------------------|--------------------------------|----------------------------------|----------------------|--------------------------|---------|
| **Gestational Age**|                       |                                        |                                |                                  |                      |                          |         |
| <34weeks           | 0                     | 2(6.5%)                                | 13(15.3%)                      | 1(25%)                           | 10(2.6%)             | <0.001                   |         |
| 34-36weeks         | 5(13.9%)              | 2(6.5%)                                | 22(25.9%)                      | 1(25%)                           | 17(4.4%)             |                         |         |
| ≥37week            | 31(86.1%)             | 27(87%)                                | 50(58.8%)                      | 2(50%)                           | 360(93.0%)           |                         |         |
| **Birth weight**   |                       |                                        |                                |                                  |                      |                          |         |
| <1500g             | 0                     | 1(3.2%)                                | 10(11.7%)                      | 0                                | 5(1.3%)              | <0.001                   |         |
| 1500-2499g         | 2(5.6%)               | 3(9.7%)                                | 19(22.3%)                      | 3(75%)                           | 35(9.0%)             |                         |         |
| ≥2500g             | 34(94.4%)             | 27(87.1%)                              | 56(65.9%)                      | 1(25%)                           | 347(89.7%)           |                         |         |
| **APGAR at 1st minute** |                  |                                        |                                |                                  |                      |                          |         |
| <7                 | 3(8.3%)               | 7(22.6%)                               | 26(30.6%)                      | 2(50%)                           | 48(12.4%)            | 0.007                    |         |
|                          | ≥7                  | <7                  | ≥7                  | <7                  | ≥7                  |
|--------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| **APGAR at 5th minute**  | 33(91.7%)           | 24(77.4%)           | 59(69.4%)           | 2(50%)              | 338(87.3%)          |
| <7                       | 1(2.8%)             | 4(12.9%)            | 19(22.4%)           | 2(50%)              | 19(4.9%)            |
| ≥7                       | 35(97.2%)           | 27(87.1%)           | 66(77.6%)           | 2(50%)              | 368(95.1%)          |
| **Birth outcome**        |                     |                     |                     |                     |                     |
| Still birth              | 1(2.8%)             | 1(3.2%)             | 2(2.4%)             | 2(50%)              | 378(97.7%)          |
| Alive                    | 35(97.2%)           | 30(96.8%)           | 83(97.6%)           | 0                   | 92(2.3%)            |
| **Neonatal complication**|                     |                     |                     |                     |                     |
| No complication          | 34(94.4%)           | 22(71%)             | 62(72.9%)           | 2(50%)              | 374(96.6%)          |
| IUGR†                    | 0                   | 1(3.2%)             | 9(10.6%)            | 0                   | 0                   |
| Need for resuscitation   | 2(5.6%)             | 5(16.1%)            | 21(24.7%)           | 2(50%)              | 12(3.1%)            |
| Need for NICU‡           | 0                   | 2(6.5%)             | 14(16.5%)           | 2(50%)              | 11(2.8%)            |
| **Maternal outcome**     |                     |                     |                     |                     |                     |
| Maternal age             |                     |                     |                     |                     |                     |
| ≤24yrs                   | 14(38.9%)           | 8(25.8%)            | 27(31.8%)           | 0                   | 141(36.4%)          |
| 25-34yrs                 | 19(52.8%)           | 21(67.7%)           | 49(57.6%)           | 4(100%)             | 219(56.6%)          |
| ≥35yrs                   | 3(8.3%)             | 2(6.5%)             | 9(10.6%)            | 0                   | 27(7.0%)            |
| **Mode of delivery**     |                     |                     |                     |                     |                     |
| Vaginal                  | 22(61.1%)           | 15(48.4%)           | 46(54.1%)           | 1(25%)              | 252(65.1%)          |
| Instrumental             | 1(2.8%)             | 3(9.7%)             | 2(2.4%)             | 0                   | 34(8.8%)            |
| Cesarean                 | 13(36.1%)           | 13(41.9%)           | 37(43.5%)           | 3(75%)              | 101(26.1%)          |

P-value <0.05 † Intrauterine growth restriction ‡Neonatal intensive care unit

Table 4 Maternal Effects of HDP: clinical conditions of severity features
| Clinical manifestations                  | Frequency | Mothers with Severe preeclampsia and eclampsia (89) | All Mothers with HDP (156) |
|-----------------------------------------|-----------|------------------------------------------------------|---------------------------|
| Headache                                | 48        | 54%                                                  | (30.8%)                   |
| Blurring of vision                      | 35        | 39.3%                                                | 22.5%                     |
| Epigastric pain                         | 9         | 10.1%                                                | 5.8%                      |
| Abruptio placentae                      | 2         | 2.2%                                                 | 1.3%                      |
| Seizure and Loss of consciousness       | 4         | 4.5%                                                 | 2.6%                      |
| AKI (cr≥1.2mg/dl)                       | 17        | 19.1%                                                | 10.9%                     |
| Thrombocytopenia (plat<100x10^3)        | 12        | 13.5%                                                | 7.7%                      |

**Figures**

Figure 1

Bar graph of Mean Maternal Systolic Blood Pressure in Different classes of Hypertensive Diseases of Pregnancy (P<0.001)
Bar graph of Mean Maternal Diastolic Blood Pressure in Different classes of Hypertensive Diseases of pregnancy (p<0.001)