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The Prevalence, and Feto-Maternal Outcomes of Hypertensive Diseases in Pregnancy among Pregnant Women in a Resource-Poor Setting in Nigeria

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Abstract

Hypertensive disorders commonly complicate pregnancies and they are one of the leading causes of maternal and perinatal morbidity and mortality globally. The objective of this study was to determine the prevalence, maternal-fetal complications, and predictors of feto-maternal complications among pregnant women with hypertensive diseases in a health facility in a low-resource setting in Enugu. This longitudinal study prospectively studied 167 mothers who had hypertension at any time in their pregnancy from June 2015 to May 2017. Data was collected at the admission and discharge of the patients using a structured proforma and analysed with Statistical Package for Social Sciences version 25. The result showed that the prevalence of hypertensive diseases in pregnancy was 4.42% with preeclampsia contributing 69.5% and gestational hypertension 19.2%. Hypertensive diseases in pregnancy were more common (38.9%) among the nulliparous women. The mode of delivery was mainly by caesarean section (65.3%). The mean gestational age at delivery was 36.53 ± 3.99 weeks and the mean birth weight was 2.6 ± 0.85 kg. Maternal and perinatal deaths were recorded in 2.4% and 25.2% of the patients, respectively. The predictors of fetal mortality were marital status (p =0.047, AOR =0.220, CI - 0.049 - 0.982) and the mode of delivery (P=0.000, AOR = 0.197, CI- 0.091- 0.425). In conclusion, the prevalence of hypertensive diseases in pregnancy was high in this study and associated with increased maternal and perinatal morbidity and mortality. The predictors of foetal mortality were both the marital status and the mode of delivery.

Keywords: *Enugu, Hypertensive Diseases, Management, Outcomes, Pregnancy.*

Introduction

Hypertensive disorders are the most common complication of pregnancy, affecting about 5%-10% of all pregnancies [1, 2]. Hypertensive diseases in pregnancy could be classified into four categories; gestational hypertension (transient hypertension of pregnancy included), preeclampsia-eclampsia, preeclampsia (PE) superimposed on chronic hypertension; and chronic hypertension [3–5].

Gestational hypertension refers to the development of hypertension after 20 weeks gestation without proteinuria in a woman who was previously normotensive [6]. About 50% of women with gestational hypertension subsequently develop preeclampsia later in their pregnancy [7]. The diagnosis of chronic hypertension in pregnancy is made following a blood pressure of ≥140/90mmHg recorded on two occasions at least four hours apart before

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20 weeks' gestation. Chronic hypertension is associated with preeclampsia, intrauterine growth restriction, and placental abruption [6]. Treatment involves the use of oral medications such as Methyldopa, Labetalol, and Nifedipine.

Preeclampsia, a precursor of eclampsia, has been variously defined as hypertension with significant proteinuria [4]. Although, recently, the American Congress of OBGYN Task Force on Hypertension in Pregnancy has eliminated proteinuria as a requirement for the diagnosis of Preeclampsia [1]. According to an update published in 2014 by the International Society for the Study of Hypertension in Pregnancy (ISSHP), preeclampsia is defined as the de novo emergence of hypertension after the 20th week of pregnancy in addition to signs of maternal organ failure, which includes the following: new-onset proteinuria of greater than 300 mg per day or other signs of renal insufficiency, haematological complications like thrombocytopenia and liver dysfunction, neurological problems like visual disturbance, and/or signs of uteroplacental insufficiency like foetal growth restriction [8]. Eclampsia, a complication of pre-eclampsia, is the occurrence of generalized convulsions usually associated with signs of preeclampsia during pregnancy, labour, or within seven days of delivery not caused by epilepsy or other convulsive disorders [6].

The morbidity and mortality associated with hypertensive disorders in pregnancy are largely caused by pre-eclampsia and eclampsia. Preeclampsia typically affects 2%-5% of pregnant women and is one of the leading causes of maternal and perinatal morbidity especially with early onset [9, 10]. Globally, 76,000 women and 500,000 babies die from this disorder, [11] especially in low-resource countries. There is much variation in the incidence and prevalence of preeclampsia in Nigeria, with a reported incidence of 8.8% in Jos; 3.3% in the University of Nigeria Teaching Hospital (UNTH) Enugu, and 1.2% in Calabar [12–14].

Preeclampsia (PE) is a multi-systemic disease characterised by variable degrees of placental hypoperfusion, with the release of soluble factors into the circulation. These factors cause maternal vascular endothelial injury, which leads to hypertension and multi-organ injury, as well as foetal growth restriction and stillbirth; and may have lasting effects on the pregnant woman long after the pregnancy has ended [15]. It is thought that PE develops following a complex interaction between placental factors, maternal constitutional factors, and pregnancy-specific vascular and immunological adaptation that occurs in the first trimester of pregnancy. The pathogenesis is not completely understood and various theories have been proposed [16, 17].

The principles of treatment of preeclampsia is targeted at fluid management, seizure prevention, lowering blood pressure (BP) to prevent maternal end-organ damage, and expediting delivery based on disease severity and gestational age [1].

Despite extensive interest in hypertensive diseases in pregnancy and their impact on maternal and foetal health, not much has been documented on the outcome of the management of patients that come down with the diseases in pregnancy. There is no existing institutional data on hypertensive diseases and the outcome of its management in Enugu State University Teaching Hospital (ESUTH) and most of the previous studies in this region of the country were retrospective studies. This study aimed to generate reliable institutional data from a prospective study on the prevalence and outcomes of the management of hypertensive diseases in pregnancy in ESUTH. The findings will be relevant in determining our baseline values on the outcomes of the management of hypertensive diseases in pregnancy and may also be relevant to the hospital management, government, and non-governmental agencies in policy development and review of the existing deficient policies. By extension data generated will also affect policy formulation in other

resource-limited countries of the world. The STROBE guidelines were strictly adhered to in the reporting of this research findings [18].

Materials and Methods

Study Design and Setting

This was a longitudinal study that was carried out between June 2015 and May 2017. This study was carried out carried out at the Department of Obstetrics and Gynaecology, Enugu State University Teaching Hospital, Parklane. This tertiary health facility is located in Enugu North, one of the three local governments (Enugu South, Enugu North, and Enugu East) in Enugu metropolis. Enugu metropolis is the capital of Enugu State. The hospital gets referrals from villages, towns, primary healthcare, and secondary health facilities in Enugu state. Patients from neighbouring states of Ebonyi, Cross River, Rivers (Port Harcourt), Delta, Edo, Anambra, Abia, Kogi, Benue, and Imo states are also referred to the hospital for management. The population of the Enugu metropolis is 722,664 (male- 348,902 and female- 468, 223) according to the 2006 Nigeria census figures [19].

Enugu state is located mainly in the semi-tropical rain forest of southern Nigeria and also, spreads towards the middle belt region of Nigeria. The state covers a total land area of approximately 8727.1 km^2. Subsistent farming and civil service works are practised mainly in rural areas and urban centres respectively. The Igbo tribe is the predominant tribe in the state and the population of the state is about 4.396098 million [19].

Study Population

The study population was all pregnant women who had hypertension at any time in their pregnancy and who accessed services at the Enugu State University Teaching Hospital, Parklane within the study period.

Inclusion Criteria

The participants included in the study were all pregnant mothers who had hypertension at any time in their pregnancy within the study period.

Exclusion Criteria

All pregnant women who were transferred to other hospitals after being admitted to the study hospital, or that died on arrival before adequate diagnosis was made were excluded from the study.

Sample Size Estimation and Sampling

The minimum sample size (n) for this study was estimated by using the formula: [20] $n = Z^2 pq/E^2$. Where Z = coefficient of Z statistics obtained from the standard normal distribution table, p = prevalence rate (in per cent), q = 100 – p, E = sample error tolerated (in per cent), Using a prevalence rate (p) of 11.6% for hypertensive diseases in pregnancy obtained in a similar study carried out in Benin City, Nigeria, [21] at a confidence limit of 95%, and a sampling error of 5%, therefore, the calculated sample size (n) was 158. Assuming an attrition rate of 10% (16), the minimum sample size was 174 pregnant women.

All eligible pregnant women who had hypertension during pregnancy and were managed at the Department of Obstetrics and Gynaecology, ESUTH, and met the inclusion criteria were consecutively recruited for the study, over the study period.

Data Collection Tool and Technique

Data collection was done prospectively over a period of two years, from June 2015 to May 2017. Trained resident doctors were responsible for data collection from each participant. The researchers coordinated and supervised the data collection and ensured the accuracy and completeness of the data collected.

Data were collected at the admission and discharge of the patients using a structured proforma. The information documented

included the mother's demographic characteristics, parity, weight and height of the mother at booking, body mass index, and antenatal, and delivery complications. Delivery information required included gestational age at delivery, birth weight, sex, and APGAR score at birth.

Data Processing and Analysis

Data collected were analyzed with Statistical Package for Social Sciences version 25. The findings were presented as means, percentages, tables, and graphs. Bivariate statistical analysis was performed using Chi-square to determine the sociodemographic characteristics of the participants that were significantly associated with maternal and fetal deaths. Multivariate analysis using Binary logistic regression was used to determine predictors of maternal and fetal deaths. All the independent variables with a p-value of 0.25 or lower were used to build the regression model. Fisher's exact test was applied where Chi-square was not appropriate such as where >20% of the cells have expected counts of less than 5 [22]. Statistical significance was set at a p-value of less than 0.05 ($p<0.05$).

Outcome Measures

The primary outcome measure was the prevalence of hypertensive diseases in pregnancy among the participants. The secondary outcome measures were feto-maternal complications and their predictors.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Research and Ethics Committee of the Enugu State University of Science and Technology Teaching Hospital, Parklane, Enugu. The ethical certificate number was ESUTHP/C-MAC/RA/034/187. At the point of recruitment to participate in the study, a written informed consent was read and signed by each participant in the presence of the researchers and a witness. Women below 18 years (minors) had their consent forms signed and granted by their legally authorized representatives/relatives.

Results

The Socio-demographic Characteristics of the Respondents

During the period of the study, there were a total of 3,560 deliveries and 218 miscarriages recorded. A total of 175 cases of patients with hypertensive diseases in pregnancy had their data collected but 167 cases were analysed. A total of 4 cases with hypertensive diseases opened folders for access to health care but left the hospital for different reasons. Reasons for leaving the hospital were financial constraints and personal decisions, unavailability of healthcare professionals at the point of the presentation, the level of morbidity of the patient (needed immediate intensive care unit admission) and the patient already dead at presentation.

The majority of the patients were aged between 25 and 34 years with average age of 30.2 ± 5.8 years. The majority of the participants were married (92.8%), had tertiary education (50.3%), were in the middle socioeconomic class (67.7%), and all (100%) were Christians. Table 1 shows the details of the sociodemographic characteristics of the respondents.

Table 1. Socio-demographic, Anthropometric and Obstetric Characteristics of Respondents

Variable	Subcategory	Frequency	Percentage
Age group (years)	15-24	24	14.4
	25-34	101	60.5
	35-44	41	24.5
	45 and above	1	0.6
Level of Education	Primary	10	6.0

	Secondary	73	43.7
	Tertiary	84	50.3
Occupation	Civil/Public Service	44	26.3
	Petty Trading	40	24.0
	Skilled worker	15	9.0
	Unemployed	68	40.7
Marital Status	Single	12	7.2
	Married	155	92.8
Religion	Christian	167	100.0
	Others	0	0.0
Socio-economic class	Lower class	47	28.1
	Middle class	113	67.7
	Upper class	7	4.2
Tribe	Igbo	161	96.4
	Others	6	3.6
Weight (kg)	<90	106	67.9
	90 kg and above	50	32.1
Parity	Nulliparous	65	38.9
	Primiparous	31	18.6
	P2 – P4	60	35.9
	P5 & above	11	6.6
Type of hypertensive disease	Gestational hypertension	32	19.2
	Preeclampsia	116	69.5
	Chronic hypertension	6	3.6
	Chronic hypertension with superimposed preeclampsia	13	7.8
Gestational age at delivery	<28	9	5.4
	28 – 31	14	8.4
	32 – 34	18	10.8
	35 – 36	30	18.0
	37 – 40	82	49.1
	41 & above	14	8.4

Prevalence of Hypertensive diseases in Pregnancy and Obstetric Characteristics of the Participants

The prevalence of hypertensive diseases in pregnancy was 4.42% with preeclampsia alone constituting 69.5% while 19.2%% of the patients had gestational hypertension. Preterm deliveries occurred in 37.1% (62) of the participants while 3.6% (6) were post-term. A total of 65 (38.9%) were nulliparous while 11 (6.6%) were grand-multiparous. Miscarriages occurred in a total of 37 (22.2%) participants while 130 (77.8%) participants did not have a previous history of a miscarriage. Details of the obstetric characteristics of the participants are also shown in Table 1.

The Maternal Outcomes and Complications of the Participants

The mode of delivery was mainly by caesarean section (65.3%). Out of a total of 58 participants that delivered vaginally, 19

(32.7%) had induction of labour. Among the participants that delivered vaginally, 3 (5.2%) had assisted vaginal delivery and the majority (66.7%) of the assistance was by the use of a vacuum pump. Among the participants that had caesarean section the common indications for the caesarean deliveries were foetal distress (27, 16.2%), unfavourable cervix (24, 14.4%), previous caesarean section (27, 16.2%), prematurity (19, 11.4%) severe oligohydramnios (13, 7.8%) amongst others. Details are shown in table 2.

Table 2. Maternal Outcomes of the Management of the Respondents

Category	Sub-category	Frequency	Per cent
Mode of delivery	Vaginal delivery	58	34.7
	Caesarean delivery	109	65.3
Type of labour	Spontaneous labour	39	67.2
	Induction of labour	19	32.7
Type of presentation at vaginal birth	Cephalic	53	91.4
	Breech	5	8.6
Assistance during delivery	Yes	3	5.2
	No	55	94.8
Type of assisted delivery	Vacuum assistance	2	66.7
	Breech assistance	1	33.3
Reasons for caesarean section			
Placenta previa	Yes	3	1.8
	No	164	98.2
Malpresentation	Yes	11	6.6
	No	156	93.4
CPD	Yes	8	4.8
	No	159	95.2
Foetal distress	Yes	27	16.2
	No	140	83.8
Foetal macrosomia	Yes	6	3.6
	No	161	96.4
Unfavourable cervix	Yes	24	14.4
	No	143	85.6
Failed induction	Yes	4	2.4
	No	163	97.6
Previous caesarean section	Yes	27	16.2
	No	140	83.8
Prematurity	Yes	19	11.4
	No	148	88.6
Severe oligohydramnios	Yes	13	7.8
	No	154	92.2

Twin gestation	Yes	9	5.4
	No	158	94.6
Uncontrollable blood pressure	Yes	10	6.0
	No	157	94.0
Prolonged labour	Yes	13	7.8
	No	154	92.2

Most of the participants (69, 41.3%) received hydralazine for the control of hypertension. Magnesium sulphate was used for the control of seizure in 36 (21.6%) participants while it was given as prophylaxis to 121 (72.5%). Blood transfusion was given to 25 (15.0%) of the participants mainly for primary postpartum haemorrhage (16, 64%), anaemia (8, 32%), etc. details are shown in Table 3.

Table 3. Details of Maternal Care received by the Respondents

Category	Sub-category	Frequency	Per cent
Control of hypertension	Hydralazine	69	41.3
	Labetalol	13	7.8
	Both drugs	15	9.0
	Oral antihypertensives	60	35.9
	None	10	6.0
Control of seizures	MgSO4	36	21.6
	Diazepam	1	.6
	None	130	77.8
Seizure prophylaxis	MgSO4	121	72.5
	Diazepam	7	4.2
	None	39	23.4
Use of blood in the management	Yes	25	15.0
	No	142	85.0
Reasons for transfusion	Anaemia at presentation	8	32.0
	For DIC	1	4.0
	PPH	16	64.0
Number of days of admission	7 days	107	64.1
	8-14 days	49	29.3
	15-21 days	2	1.2
	>=22 days	9	5.4
The presence of financial challenges affecting management	Yes	30	18.0
	No	137	82.0
How the financial challenges were sorted	Borrowing	22	73.3
	Hospital waiver	3	10
	Payment by Philanthropist	5	16.7

The complications developed by the participants during their management were neurological deficits (61, 36.5%), eclampsia (37, 22.2%), intra-uterine foetal death (26, 15.5%), loss of consciousness (12, 7.2%), visual disturbances (10, 6.0%), oligohydramnios (11, 6.6%), abruptio placenta (9, 5.4%) amongst others. Maternal death occurred in 2.4% (4) of the participants. Details are shown in Table 4.

Most of the participants (107, 64.1%) were discharged within one week of their management. A total of 30 (18%) had financial constraints and most (22, 73.3%) sorted out their financial constraints by borrowing and donations from philanthropists. Details are shown in table 4.

The Foetal Outcomes and Complications

Most of the babies (95. 56.9%) were normal-weight babies while 64 (38.3%) were underweight. A total of 54 (32%) foetuses were either severely asphyxiated or dead after 5 minutes of delivery. Only 52 (31.1%) of the babies were admitted to the newborn care special unit. Most of the babies (34, 68.0%) admitted to the NBSCU were discharged in the first week while 5 (10%) babies stayed above two weeks. Three (1.8%) of the babies had neonatal sepsis while death (stillbirth + late neonatal) occurred in 33 (19.8%) of the babies. Details are shown in table 4.

Table 4. Maternal Complications at Presentation and Fetal Outcomes

Maternal Complications	Sub-category	Frequency	Per cent	Fetal Outcomes/ Peri-Natal Complications	Sub-category	Frequency	Percent
Neurological deficit	Yes	61	36.5	**Foetal presentation at birth**	Cephalic	148	88.6
	No	106	63.5		Breech	17	10.2
Acute renal failure	Yes	5	3.0		Transverse	2	1.2
	No	162	97.0	**Birth weight**	<2.5	64	38.3
Disseminated Intravascular Coagulopathy	Yes	3	1.8		2.5-3.9	95	56.9
	No	164	98.2		4 & above	8	4.8
HELLP syndrome	Yes	8	4.8	**5th minute APGAR score at birth**	0	32	19.2
	No	159	95.2		1 – 4	4	2.4
Visual disturbances	Yes	10	6.0		5 – 6	18	10.8
	No	157	94.0		7 – 8	31	18.6
Visual loss	Yes	4	2.4		9 – 10	82	49.1
	No	163	97.6	**Any NBCSU admission**	Yes	52	31.1
Hearing loss	Yes	0	0		No	114	68.3
	No	167	100.0	**Neonatal mortality**	Yes	44	26.3
Loss of consciousness	Yes	12	7.2		No	123	73.7
	No	155	92.8	**Foetal anaemia**	Yes	1	.6
Oliguria	Yes	8	4.8		No	166	99.4
	No	159	95.2	**Congenital abnormalities**	Yes	1	.6
Abruptio placentae	Yes	9	5.4		No	166	99.4
	No	158	94.6	**Early neonatal jaundice**	Yes	8	4.8
Abnormal liver enzymes	Yes	7	4.2		No	159	95.2
	No	160	95.8	**Sudden infant death**	Yes	2	1.2

Epigastric pain	Yes	10	6.0		No	165	98.8
	No	157	94.0	**Neonatal sepsis**	Yes	3	1.8
Pulmonary oedema	Yes	3	1.8		No	164	98.2
	No	164	98.2	**Length of days of admission of baby in the NBSCU**	Zero days	117	70.1
Oligohydramnios	Yes	11	6.6		1-7 days	34	20.4
	No	156	93.4		8-14 days	11	6.6
Low platelets	Yes	1	0.6		15-21 days	3	1.8
	No	166	99.4		>21 days	2	1.2
Eclampsia	Yes	37	22.2	**Foetal mortality**	Alive	134	80.2
	No	130	77.8		Dead	33	19.8
IUFD	Yes	26	15.6				
	No	141	84.4				
Maternal death	Yes	4	2.4				
	No	163	97.6				

The Predictors of Maternal and Foetal Mortality

There were no sociodemographic variables of the participants that predicted maternal death. See details in Table 5. The predictors of foetal mortality were both the marital status and the mode of delivery. Single mothers were about 4.6 times less likely to have a foetal death from complications of hypertensive disease in pregnancy compared to their married counterparts (p =0.047, AOR =0.220, CI - 0.049 - 0.982). Also, women who had vaginal delivery were about 5.1 times less likely to have a foetal death from hypertensive disease in pregnancy (P=0.000, AOR = 0.197, CI- 0.091-0.425) compared to those that were delivered through caesarean section. Details are shown in table 5.

Table 5. Predictors of Maternal and Perinatal Death among the Participants

Variables	**Sub-category**	**Maternal outcome**				**P value**	**AOR**	**Confidence interval (CI)**	
								Lower	**Upper**
		Dead	%	Alive	%				
Age category	<35 years	2	1.6	123	98.4	0.444	2.728	0.208	35.720
	≥35 years	2	4.8	40	95.2				
Marital status	Single	12	0	100	100	0.999	980445 15.827	0.000	0.000
	Married	4	2.6	151	97.4				
Educational status	Less than tertiary	4	4.8	79	95.2	1.000	0.642	0.000	0.000
	Tertiary and above	0	0.0	84	100.0				
Parity	Nulliparous	2	3.1	63	96.9	0.476	0.440	0.046	4.201
	Parous	2	2.0	100	98.0				
Employment status	Unemployed	1	1.6	63	98.4	0.855	0.770	.046	12.758
	Employed	3	2.9	100	97.1				
	Vaginal	3	5.2	55	94.8	0.264	0.250	0.022	2.847

Mode of delivery	Cesarean section	1	0.9	108	99.1				
Social class	Upper class	0	0.0	7	100	0.998	0.000	0.000	0.000
	Middle class	0	0.0	109	100				
	Lower class	4	7.8	47	92.2				

Variables	**Sub-category**	**Perinatal death**				**P value**	**AOR**	**Confidence interval (CI)**	
								Lower	**Upper**
		Dead	%	Alive	%				
Age category	<35 years	30	24.0	95	76	0.244	1.683	0.701	4.039
	≥35 years	14	33.3	28	66.7				
Marital status	Single	6	50	6	50	0.047	.220	0.049	.982
	Married	38	24.5	117	75.5				
Educational status	Less than tertiary	27	32.5	56	67.5	0.109	0.440	0.162	1.199
	Tertiary and above	17	20.2	67	79.8				
Parity	Nulliparous	15	23.1	50	76.9	0.366	1.484	0.631	3.490
	Parous	29	28.4	73	71.6				
Employment status	Unemployed	18	28.1	46	71.9	0.830	0.912	0.392	2.120
	Employed	26	25.2	77	74.8				
Mode of delivery	Vaginal	27	46.6	31	53.4	0.000	0.197	0.091	0.425
	Cesarean section	17	15.6	92	84.4				
Social class	Upper class	1	14.3	6	85.7	0.559	1.323	0.517	3.389
	Middle class	27	24.8	82	75.2				
	Lower class	16	31.4	35	68.6				

Discussion

This study aimed to determine the prevalence, outcomes of management, and predictors of feto-maternal outcomes of hypertensive diseases among pregnant women in Enugu, Nigeria. The findings showed that the prevalence of hypertensive diseases in pregnancy was 4.42% with preeclampsia contributing 69.5% while 19.2% of the patients had gestational hypertension. Maternal and perinatal deaths were recorded in 2.4% and 25.2% of the patients, respectively. The predictors of fetal mortality were marital status and the mode of delivery.

The prevalence of hypertensive diseases in pregnancy (HDP) was 4.42% (44 in 1000). This is comparable to the 3.7% observed in a retrospective study in Nnewi, Nigeria [23]. However, it is lower than the findings from Benin City and Ibadan, Nigeria where the incidences were 11.6% and 10% respectively [21, 24]. Another study in Sokoto, Nigeria revealed a much higher prevalence of hypertensive diseases in pregnancy (17%) when compared to this study [25]. In a systematic review and meta-analysis of hypertensive diseases in pregnancy in Sub-Saharan Africa, the overall prevalence of HDP was 8% [26]. The lower prevalence of HDP

observed in this study may be attributed to the fact that the respondents in the study involved all pregnant women irrespective of gestational age, and those with risk factors for HDP would have been identified and appropriate preventive mechanisms instituted. The most common type of hypertensive disease in pregnancy from this study was preeclampsia. This is similar to findings from other areas such as Nnewi, south-east Nigeria, Benin City, south-south Nigeria, and Ibadan south-west Nigeria [15, 21, 23]; and underscores the need for early diagnosis and prompt treatment.

Extremes of age and nulliparity have been identified as risk factors for hypertensive diseases in pregnancy [27], findings from our study showed that the majority of the respondents were nulliparous (38.9%); however, the mean age of respondents was 30.2 ± 5.8 years and does not reflect extremes of age.

The high rate of caesarean delivery observed in this study (65.3%) was similar to findings from other studies from Lagos, south-west Nigeria (77.2%) [28], and Abakaliki, south-east Nigeria (51.7%) [29], as well as from other countries like China (84.9%) [30], and Brazil (68.2%) [31]. According to Amorim *et al* in a prospective cohort study conducted with 500 pregnant women with severe preeclampsia in a tertiary centre in Northeastern Brazil, Caesarean section was the commonest mode of delivery in patients with severe preeclampsia and was associated with significant postpartum maternal morbidity. The study recommended that induction of labour should be considered a feasible option in these patients [31]. Among the 58 participants that had vaginal delivery from our study, 32.7% had successful induction of labour. On the contrary, a multicentre, large-sample, cross-sectional study in mainland China among 2516 women with severe preeclampsia revealed that most of the women opted for caesarean section which had a lower perinatal mortality rate. The study suggested that caesarean delivery should be the preferred option of delivery for better neonatal outcomes [30]. Another hospital-based longitudinal case-series study conducted in a tertiary hospital in Western Kenya among 53 women with eclampsia concluded that there was no benefit of emergency caesarean section for women with eclampsia and that induction of labour and vaginal delivery could be successfully achieved in pregnant women with eclampsia [32]. The mode of delivery among patients with preeclampsia and eclampsia should be individualized and should be based on the method that would guarantee a good outcome for both the mother and the baby.

Most of the participants in our study who had preeclampsia with severe features received Magnesium sulphate for either prevention of seizure or seizure control while parenteral hydralazine was used to control severe hypertension. Studies have shown that $MgSO_4$ helps prevent eclamptic seizure and placental abruption in women who have preeclampsia with severe features and is more effective for preventing recurrent eclamptic seizures and decreasing maternal mortality than phenytoin, diazepam, or a combination of chlorpromazine, promethazine, and meperidine [32, 33]. Intravenous labetalol and hydralazine are equally effective in the control of severe hypertension, while oral nifedipine could be used as an alternative in the absence of intravenous access [2].

The most common maternal complication among the participants in this study was neurological deficit, followed by eclampsia, while maternal death occurred in 2.4 % of the participants. The maternal mortality rate from this study is lower than 3.8%, 12.1%, 9%, and 7.9% from other studies [15, 28, 29, 34]. The lower maternal mortality rate could be attributed to improved antenatal, intrapartum, and postpartum care with a multidisciplinary approach as obtainable in our centre. Other complications were abruptio placentae, intrauterine foetal death, visual disturbances, oliguria, pulmonary oedema, loss of consciousness, HELLP syndrome and

disseminated intravascular coagulopathy. These are common complications associated with hypertensive diseases in pregnancy as also reported by other studies [28, 34], and underscores the need for close monitoring of the patients [15, 35].

The perinatal mortality rate among the participants in our study was 19.8%, while 31.1% of the babies required admission into the newborn special care unit. The perinatal mortality rate is similar to the finding from a retrospective study in Lagos, Southwest, Nigeria by Ugwu et al. [28] and Mbachu et al in Nnewi, South east, Nigeria [23]. However, it is higher than the 10% reported by Oladokun et al in Ibadan, Southwest, Nigeria, and Awoyesuku in Port Harcourt, Southsouth, Nigeria, but lower than 22.7%, 29%, and 40% reported in other studies, respectively [29, 36, 37]. Risk factors associated with admission into the newborn special care unit were prematurity, low birth weight, neonatal asphyxia, neonatal sepsis, neonatal jaundice, foetal anaemia, and congenital abnormalities. Most of the babies (68%) admitted to the newborn special care unit were discharged within one week of admission. This buttresses the fact that a good newborn intensive care unit is essential for improving the neonatal outcome of babies of pregnant mothers with hypertensive diseases in pregnancy.

Marital status and mode of delivery were significant predictors of perinatal mortality from our study ($p<0.05$). Arntzen *et al* conducted a comparative study on marital status as a risk factor for foetal and infant mortality and reported that the unmarried mothers were younger, less well-educated, and had a lower socioeconomic status than the married mothers. Hence, the stillbirth, neonatal, and post-neonatal mortality rates were higher among offspring of unmarried mothers [38]. In another study on determinants of perinatal mortality in public secondary health facilities in Abuja, Nigeria, Nwokoro *et al* observed that being unmarried was found to be associated with an increased risk of perinatal mortality compared to being married. The study suggested that being married offers women the opportunity of having partner support leading to increased social and economic support and such women are more likely to afford antenatal and intrapartum care services at the health facilities [39]. Balayla and Azoulay in a population-based cohort study using the Centers for Disease Control and Prevention's Linked Birth–Infant Death and Fetal Death data on all births in the United States between 1995 and 2004 also reported that unmarried status was a predictor of both stillbirth, perinatal, neonatal and infant deaths [40].

The mode of delivery for most of the participants in our study was caesarean section. According to our study, the commonest indications for caesarean delivery were foetal distress, previous caesarean section, unfavourable cervix, prematurity, and severe oligohydramnios. These are valid indications and a caesarean section is more likely to give a better outcome. However, this does not make the caesarean section a better option for the delivery of patients with hypertensive disease in pregnancy. Each patient should be properly assessed to determine the route of delivery that would give a satisfactory outcome for both the mother and the baby. Pre-eclampsia through its numerous pathogenesis is a cause of perinatal morbidity and mortality [9, 41]. The timing of the caesarean section, indications for caesarean section, and availability of competent neonatal facilities for resuscitation of the fetus play a major role in the recorded neonatal outcome of patients with pre-eclampsia [42]. Also, the quality of initial care received at the primary point of referral, the travel time to reach the next better facility [43], the elements of third delay and decision-intervention time at the referral centre contribute greatly to the neonatal outcomes of the baby of preeclamptic mothers despite delivery through caesarean section [44]. In our study, fetal distress, prematurity (low birth weight), and severe oligohydramnious were the commonest indications for caesarean

section hence the increased poor outcomes in women who had a caesarean delivery. Other studies also noted increased poor neonatal outcomes in fetuses who had an increased risk of death despite receiving a caesarean delivery [45, 46].

Strengths and Limitations of the Study

This study was a prospective longitudinal study that actively spanned over 2 years, therefore loss of data attrition and reduced correctness characteristic of retrospective studies which was common in most of the previous similar studies in the study area and Nigeria were almost eliminated in this study. The study was limited by not comparing data with a control (normal women). This would have made the report sharper but this is recommended for future studies.

Conclusion

The prevalence of hypertensive diseases in pregnancy was high in this study and associated with increased maternal and perinatal morbidity and mortality. The predictors of foetal mortality were both the marital status and the mode of delivery. Good antenatal care and early intervention will contribute to a great extent in reducing the occurrence and complications of hypertensive diseases in pregnancy.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of the Enugu State University of Science and Technology Teaching Hospital, Parklane, Enugu. The ethical certificate number was ESUTHP/C-MAC/RA/034/187.

Informed Consent

At the point of recruitment to participate in the study, a written informed consent was read and signed by each participant in the presence of the researchers and a witness. Women below 18 years (minors) had their consent forms signed and granted by their legally authorized representatives/relatives.

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