

# Immediate Outcome of Neonates with Maternal Hypertensive Disorder of Pregnancy at a Neonatal Intensive Care Unit

M Hassan<sup>1</sup>, M Begum<sup>2</sup>, SMZ Haque<sup>3</sup>, N Jahan<sup>4</sup>, BHN Yasmeen<sup>5</sup>, A Mannan<sup>6</sup>, K Choudhury<sup>7</sup>, H Rahman<sup>8</sup>

## Abstract

**Aims :** Hypertensive disorders in pregnancy remain a major cause of maternal and neonatal morbidity and mortality worldwide. This study prospectively examined the immediate neonatal outcome of women with maternal hypertensive disorder of pregnancy (HDP).

**Methods :** Sixty mothers and their newborn were selected. Mothers with gestational hypertension, preeclampsia, preeclampsia superimposed on chronic hypertension and chronic hypertension were included.

**Results :** Forty five (75%) mothers were multipara and 15(25%) were primipara. Mean maternal age was 26.4 years. Mean gestational age was 34+<sup>4</sup> weeks. 38 were male and 22 were female with Male: Female ratio was 1.72: 1. Thirty six (60%) were from in patient with regular antenatal check up, 60% mothers had gestational hypertension. Fifty four (90%) mothers needed lower uterine caesarian section. Forty four (73.33%) delivered preterm before 36 weeks of pregnancy. Low birth weight (<2.5kg) babies were 30(50%), very low birth weight (<1.5kg) were 16(26.66%). Intrauterine growth retardation (IUGR) were 18(30%) and Appropriate for gestational age (AGA) were 14(23.33%). Respiratory distress 30(50%) were the most common cause of admission, other associated problems were perinatal asphyxia (PNA) with seizure and meconium aspiration syndrome and to rule out sepsis in suspected cases. Nine (15%) needed ventilator care and 6(10%) needed nasal continuous positive airway pressure (NCPAP) for respiratory problem. 6(10%) babies were expired and 54(90%) survived. Average hospital stay were 18.32(±10.68) days with a highest hospital stay of 49 days and the lowest 4 days.

**Conclusion :** Maternal hypertensive disorder of pregnancy is associated with neonatal morbidity.

**Key words :** Maternal hypertensive disorder of pregnancy (HDP).

## Introduction

Hypertensive disorders of pregnancy (HDP) is the most common complication and seriously endanger the safety of the mother and the fetus during pregnancy as well as continue its impact on neonatal period. HDP is a multi-organ, heterogeneous disorder of pregnancy associated with significant maternal and neonatal morbidity and mortality. In some circumstances, delivery is needed to halt its progression for the benefit of the mother, fetus and for the neonate.

The most widely accepted definition and classification of hypertensive disorders of pregnancy was proposed by the National High Blood Pressure Education Program (NHBPEP) Working, which used a blood pressure of 140/90 mm Hg or higher on two separate occasions at least 4 hours apart as the diagnostic criterion.<sup>1</sup>

The classification of high blood pressure in pregnancy<sup>1</sup> are as follows.

Gestational hypertension :

Hypertension manifested after 20 weeks of gestation.

Pre-eclampsia (PE)/Pre-eclamptic toxemia (PET): Hypertension associated with proteinuria greater than 0.3 g in a twenty four hour urine collection or greater than 1 g/L in a random sample.

Essential hypertension :

The presence of sustained blood pressure of 140/90 mm Hg or higher before pregnancy or before twenty weeks of gestation.

Pre-eclampsia superimposed on essential hypertension (HTN) :

Pre-eclampsia diagnosed in a previously hypertensive women.

This classification by National High Blood pressure Education Programme Working Group<sup>1</sup>.

Eclampsia :

Pre-eclampsia when complicated with convulsion and/or coma.

The term pregnancy induced hypertension (PIH) is defined as the hypertension that develops as a direct result of the gravid state. It includes (i) Gestational hypertension (ii) Pre-eclampsia (iii) Eclampsia.<sup>2</sup>

Ten percent of the pregnancy was complicated with hypertensive disorders of pregnancy. Among them 90% was due to gestational hypertension and PE.<sup>3</sup> Moreover, preeclampsia produces potentially lethal complications including placental ablation, disseminated intravascular coagulation, intracranial hemorrhage, hepatic failure, acute renal failure, and cardiovascular collapse. IUGR, intrauterine fetal demise are the other related obstetric problems<sup>4</sup> were observed among these mother. The offspring of women with hypertension during pregnancy experience higher rates of prematurity and low birth weight compared to healthy maternal controls. Other medical problems like respiratory distress syndrome (RDS), transient tachypnea of the neonate (TTN), persistent pulmonary hypertension (PPHN) and respiratory failure observed in late preterm neonates (34 to 36 weeks) specially with maternal history severe preeclampsia.<sup>5</sup> Special neonatal care is

<sup>1</sup> Dr. Mahmuda Hassan  
Associate Professor  
Dept. of Pediatrics  
Ad-din Women's Medical college

<sup>2</sup> Dr. Marium Begum  
Associate Professor

<sup>3</sup> Dr. SM Zabul Haque  
Professor and director

<sup>4</sup> Dr. Nasim Jahan  
Associate Professor

<sup>5</sup> Dr. B H Nazma Yasmeen  
Associate Professor  
Dept. of pediatrics  
Northern International Medical College

<sup>6</sup> Dr. Abdul Mannan  
Associate Professor

<sup>7</sup> Dr. Kona Choudhury  
Assistant Professor

<sup>8</sup> Dr. Hamidur Rahman  
Professor and Head

2,7,8  
Dept. of pediatrics  
Ad-din Women's medical college

3,4,6  
Dept. of NICU & PICU  
Ad-din Women's medical college

Correspondence  
Dr. Mahmuda Hassan  
Associate Professor  
Dept. of Pediatrics  
Ad-din Women's Medical College  
e-mail: mahmudahasn@yahoo.com

required for such babies, which is associated with emotional and financial stress for both parents and third party payers and long-term developmental consequences.<sup>6</sup>

**Material and method**

This is a prospective study conducted at NICU in Ad-din Women’s Medical college Hospital over a period from 1<sup>st</sup> Jan 2012 to 31<sup>st</sup>. March 2013. 60 neonates with their maternal history of hypertensive disorder during pregnancy, like Gestational hypertension, Pre-eclampsia, Eclampsia or Essential hypertension were selected for the study. Both in- patient and out-patient mothers with regular antenatal check-up (ANC) with good documentation regarding maternal physical condition, regular documentation of blood pressure with anti hypertensive medication and documentation of condition of the fetus were included for the study. Six neonates were died at NICU during the study period and were not included for the study.

This study was done to evaluate the immediate outcome of admitted neonates. Data regarding the demographic parameters of the mothers like antenatal check up, gestational age (determined by last menstrual period or 1st trimester ultrasound) type of maternal hypertensive disorder of pregnancy, obstetric problems like preterm labour, mode of delivery were recorded in a structured questionnaire.

Neonatal parameters were sex, gestational age, birth weight and the neonatal medical problems like respiratory distress syndrome, congenital pneumonia, meconium aspiration syndrome, perinatal asphyxia with convulsion were also recorded. Gestational age (GA) were categorized as pre-term (<37 completed weeks), term (37 to 42 weeks), post term (>42 weeks), birth weight were categorized as normal birth weight, (2.5 to 4 kg), low birth weight (rom 1.5 kg up to 2.5kg), Very low birth weight (from 1kg up to 1.5kg), extremely low birth weight baby (up to 1kg). Considered IUGR when the birth weight was less than 10<sup>th</sup> percentile for the gestational weight. During hospital stay neonates with hyperbilirubinaemia, feeding intolerance, abdominal distension with signs necrotizing enterocolitis (NEC), pre-NEC, clinical signs of sepsis were observed. Also neonates with apnea as well as respiratory distress with respiratory failure, severe sepsis with metabolic derangement and who needed respiratory supports like of NCPAP or ventilator care were also documented. Investigation were complete blood count and blood culture, serum electrolytes were done, abnormal coagulation profile was assessed by prothombin time and partial thromboplastin time.

Mothers with infant of diabetic mother (IDM), gestational mellitus (GDM), chronic diseases like chronic renal failure, chronic liver disease, endocrine diseases, collagen disease, mothers with raised blood pressure observed in only last one or two visit at term and babies with definite congenital malformation, metabolic disorder, any syndrome were excluded from the study.

**Result :** Total 60 mothers with their neonates were selected for the study. Mean maternal age was 26.4years. Mean gestational age was 34+<sup>4</sup> weeks. 45(75%) mothers were mutipara and 15(25%) were primipara. 38 were male and 22 were female. Male : Female ratio of neonates were 1.72: 1.

In this study most of the mothers 36(60%) were from in patient with regular antenatal check up, 54(90%) needed lower uterine caesarian section (LUCS) for delivery. 30(50%) multipara had previous history of Intra uterine death (IUD), neonatal death (NND) or abortion, some of them gave the history of raised blood pressure during their past pregnancies but no documents were reproduced. (Table I)

**Table I : Maternal demographic profile**

	Frequency	Percent
Regular ANC (>4 ANC)	36	60.0
Irregular ANC (<4 ANC)	24	40.0
In patients(Mother)	53	88.33
Out patients (Mother)	7	11.66
LUCS	54	90
NVD	6	10
Multi-para/Previous H/O IUD, NND, Abortion	30	50
Multi-para/ no previous H/O IUD, NND or abortion	15	25
Primi-para	15	25

In our study different type of maternal hypertensive disorders during pregnancy were found thirty six (60%) mothers had gestational hypertension. (Table II)

**Table II : Type of maternal hypertensive disorder**

	Frequency	Percent
Gestational Hypertension	36	60.0
PET	13	21.66
Echlmapsia	5	8.33
EC after essential HTN	6	10
Total	60	100.0

We found that only 16(26.66%) babies were delivered term and rest 14+30=44 (23.33%+ 50%=73.33%) were delivered preterm before 36 weeks of pregnancy. (Table III )

**Table III : Distribution of neonates according to gestational age**

Gestational age	No. of neonates	Percent
<34wks	14	23.33
34 to 36 wks.	30	50
36 to 40	16	26.66

This study showed that low birth weight babies were 30(50%), very low birth weight were 16 (26.66%). IUGR were 18(30%) and AGA were 14(23.33%). Most of the babies 30(50%)+16(26.66%)= 46(76.66%) were <2.50 kg. (Table IV )

**Table IV : Distribution of neonates according to birth weight**

Birth weight	No. of neonates	Percent
Low birth weight (1.5 to 2.5kg)	30	50
Very low birth weight(1kg to 1.5kg.)	16	26.66
Normal birth weight 2.5 kg or more	14	23.33
LGA	0	0
SGA/IUGR	18	30

Respiratory distress were the most common cause of admission, other problems were PNA with seizure and meconium aspiration syndrome for admission at NICU. (Table V)

**Table V : Neonatal clinical problems at the time of admission:**

	Frequency	Percent
Respiratory distress	30	50
PNA with seizure	8	13.33
Meconium aspiration syndrome (MAS)	12	20
Suspected sepsis or to rule out sepsis	23	38.33

In this study neonates were observed clinically with investigations like CBC, coagulation profiles like PT, APTT and blood culture. Neonates

were investigated for the electrolyte imbalance. Raised hematocrite were observed among the 12(20%) neonate. feeding intolerance or pre-NEC/NEC in 24(40%) neonate and hyperbilirubinaemia needed phototherapy in 60(100%). During their hospital stay 6 (10%) developed apnea needed NCPAP, respiratory failure needed ventilator care among 9(15%) neonates. (Table VI )

**Table VI : Different investigation profiles of the neonates during hospital stay**

Hyperbilirubinemia needed phototherapy	60	100
Reduced total count <5,000	11	18.33
Increased HCT>65%	12	20
Reduced Platelet count <50,000	27	45
Thrombocytopenia with platelet transfusion	12	20
Abnormal coagulation profile, needed FFP	17	28.33
Anemia of prematurity with PRBC transfusion	7	11.66
Electrolyte imbalance(Na <sup>+</sup> , K <sup>+</sup> )	12	20
Blood culture, Positive	20	33.33
Blood culture, Negative(clinical sepsis)	30	50
Sepsis ruled out	10	16.66
Feeding intolerance/ Pre NEC/NEC	24	40
Respiratory failure on Vent.	9	15
Apnea on NCPAP	6	10

Six (10%) babies were expired and 54(90%) survived. Average hospital stay were 18.32(±10.68) days with a highest hospital stay of 49 days and the lowest 4 days. (Table VII)

**Table VII : Immediate outcome**

Discharge	54	90.0	
Expired	06	10.0	
	Mean ±SD	Minimum	Maximum
Hospital stay (in days) among survivors	18.32(±10.68)	04	49

## Discussion

Worldwide hypertensive disorders of pregnancy have been identified as a major health problem, associated with increased perinatal morbidity and mortality. Various authors have found the frequency of hypertensive disorders of pregnancy between 7-10%<sup>7,8</sup>. Among them gestational hypertension was 46%, pre-eclamtic toxemia 45%<sup>9</sup>. In our study gestational hypertension 36(60%) was the major hypertensive disorder of pregnancy and PET was 13(21.66%).

In this study mothers had>4 ANC 36(60%) and 24(40%) mothers had irregular ANC. 54(90%) neonates were delivered by LUCS and only 6(10%) delivered by NVD. In other study operative delivery were reported to be increased in hypertensive disorders of pregnancies as seen in another study<sup>10</sup>.

Hypertensive disorders of pregnancy predispose women to acute or chronic utero-placental insufficiency, resulting in ante or intra-partum hypoxia even anoxia that may lead to fetal death. In our study 30(50%) mothers had previous history of fetal demise or neonatal death out of 60 mothers, but the cause of fetal and neonatal death was not from any medical documents. Another 15(25%) were multipara without any previous history of fetal or neonatal death and rest of them 15(25%)

mothers were primi-para. Perinatal outcome is strongly influenced by gestational age and the severity of hypertension as expressed by the need for antihypertensive treatment, irrespective of the underlying syndrome. Another main impact on the fetus is under-nutrition as a result of utero-placental vascular insufficiency, which leads to intrauterine growth retardation.

So, fetal growth is a useful marker for fetal well-being<sup>11,12</sup>. Pregnancies complicated by intrauterine growth restriction (IUGR), defined as a pathological process of reduced fetal growth, have been associated with an increase in perinatal mortality<sup>13,14</sup>. A high incidence of IUGR/SGA infants in women who have PE has been reported, ranging from 15% to more than 50%<sup>15,16</sup>. Intrauterine growth retardation was 18 (30%) in our study. Low birth weight baby were 30(50%) and very low birth weight baby 16(26.66%) in this study. Therefore total 46(76.66%) neonates were <2.5 kg.

Another problem is preterm delivery with maternal hypertensive disorder of pregnancy. Epidemiologic studies have reported alarmingly high rates of preterm births, predominantly due to preeclampsia<sup>17,18</sup>. In our study, preterm (<34 weeks) were 14(13.33%), near term neonates (34–36 weeks) were 30(50%), so total 44(73.33%) delivered before 36 weeks. Term neonates (37–40 weeks) were 16(26.66%). The percentage of preterm and low birth weight babies were high in this study as seen in various earlier studies too<sup>19,20</sup>.

Neonates needed admission for other than intrauterine growth retardation and/or preterm delivery, were due to complications like PNA were 8(13.33%), respiratory distress 30 (50%), MAS 12(20%) and 23(38.33%) to rule out sepsis.

No difference in incidence of lung maturity was seen in different studies with or without the history of maternal hypertensive disorder of pregnancy or PE.<sup>21,22</sup>

Increased risk of necrotizing enterocolitis (NEC), primarily newborns who have intrauterine growth restriction<sup>23</sup>. and in one study it was 8% (17/211).<sup>24</sup>

In our study feeding intolerance and pre-NEC/NEC were observed among 24(40%) of the admitted neonates during their hospital course. The pathogenesis of thrombocytopenia among infants born to mothers with preeclampsia is unknown<sup>25</sup>. One potential mechanisms is that preeclampsia, and the resultant fetal hypoxia, has a direct depressant effect on megakaryocyte proliferation<sup>26</sup>. Maternal preeclampsia can result in neonatal thrombocytopenia, typically defined as a platelet count less than 150,000/uL<sup>27</sup>. In pregnancies complicated by preeclampsia, thrombocytopenia is generally identified at birth or within the first 2–3 days following delivery, and resolution occurs by 10 days of life in most cases<sup>28</sup>. Severity of thrombocytopenia related to preeclampsia is highly variable, with a small percentage of infants developing severe or clinically significant thrombocytopenia (<50,000/uL)<sup>29,30</sup>. In our study 27(45%) babies had thrombocytopenia 12(20%) required platelet transfusion for significant thrombocytopenia.

In addition to the well-described effects of preeclampsia on platelets, neonates delivered to women with preeclampsia have a 50% incidence of neutropenia (defined as absolute neutrophil count less than 500)<sup>31</sup>. Neutropenia has a variable course, typically lasting days to weeks in affected infants. The biological mechanism for preeclampsia resulting in neonatal neutropenia has not been fully elucidated. One potential mechanism is that preeclampsia, and the resultant uteroplacental insufficiency, inhibits fetal bone marrow production of the myeloid lineage manifested by a decrease in neutrophil production<sup>32</sup>. We

observed neutropenia in 11(18.33%) cases. Hematocrits increased in 12(20%) neonates on first complete blood count (CBC) done just after admission. 17(28.33%) babies had abnormal coagulation profile with bleeding manifestations needed fresh frozen plasma transfusion during the course of hospital stay and packed red blood cell (PRBC) required in 7 (11.66%) for anemia of prematurity.

Out of 60 neonates 20(33.33%) had blood culture positive and 30(66.66%) were culture negative but clinically septic. 10(16.66%) neonate were ruled out for sepsis and discharged after a short hospital course. 6(10%) were on nasal continuous positive airway pressure (NCPAP) and 9(15%) baby needed ventilator care. Mean hospital stay was 18.32( $\pm$ 10.68) with minimum 4 days to maximum 49 days. 54(90%) neonates were discharged and 6(10%) neonate were expired.

### Conclusion

Maternal hypertensive disorder of pregnancy (HDP) is associated with neonatal mortality and the morbidity.

### References

- Report of National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. *Am J Obstet Gynecol.* 2000;183:S1–S22.
- D. C Datta's Hypertensive Disorder of Pregnancy. Hiralal Kona. Editor. Text book of obstetrics. 17<sup>th</sup> edition. New central Book Agency Limited. 2011; 219-220.
- Roberts CL, Algert CS, Morris JM, Ford JB, Henderson-Smart DJ. Hypertensive disorders in pregnancy: a population based study. *MJA.* 2005;182:332–335.
- Tranquilli AL, Giannubilo SR. The 'weight' of foetal growth restriction in 437 hypertensive pregnancies. *Arch Gynecol Obstet* 2004; 270: 214-6.
- G. G. Dudell and L. Jain, "Hypoxic respiratory failure in the late preterm infant," *Clinics in Perinatology*, 2006;33( 4): 803–830
- Markestad T, Vik T, Ahlsten G, Gebre-Medhin M, Skjaerven R, Jacobsen G, et al. Small-for-gestational-age (SGA) infants born at term: growth and development during the first year of life. *Acta Obstet Gynecol Scand Suppl.* 1997; 165: 93-101.
- Deorari AK, Arora NK, Paul VK, Singh M. Perinatal outcome in hypertensive disease of pregnancy. *Indian Pediatr* 1985; 22: 877-881.
- Joshi N, Pandit SN, Shah PK, Vaidya PR. A study of pre-eclampsia toxemia in pregnancy. *Indian J Obstet Gynecol* 1990; 40: 506-509.
- Roberts CL, Algert CS, Morris JM, Ford JB, Henderson-Smart DJ. Hypertensive disorders in pregnancy: a population based study. *MJA.* 2005;182:332–335.
- Goften EN, Capewel V, Natale R, Gratton RJ. Obstetrical intervention rates and maternal and neonatal outcomes of women with gestational hypertension. *Am J Obstet Gynecol* 2001; 185:798-803.
- M. Habli, R. J. Levine, C. Qian, and B. Sibai, "Neonatal outcomes in pregnancies with preeclampsia or gestational hypertension and in normotensive pregnancies that delivered at 35, 36, or 37 weeks of gestation," *American Journal of Obstetrics and Gynecology.* 2007; 197(4): 406 e1–406 e7
- A. F. Saftlas, D. R. Olson, A. L. Franks, H. K. Atrash, and R. Pokras, "Epidemiology of preeclampsia and eclampsia in the United States, 1979-1986," *American Journal of Obstetrics and Gynecology.* 1990; 163( 2): 460–465
- S. W. Aucott, P. K. Donohue, and F. J. Northington, "Increased morbidity in severe early intrauterine growth restriction," *Journal of Perinatology.* 2004;24( 7) 435–440,.
- J. H. Richardus, W. C. Graafmans, S. P. Verloove-Vanhorick et al., "Differences in perinatal mortality and suboptimal care between 10 European regions: results of an international audit," *An International Journal of Obstetrics and Gynaecology.* 2003;110( 2) 97–105,
- Roberts CL, Algert CS, Morris JM, Ford JB, Henderson-Smart DJ. Hypertensive disorders in pregnancy: a population based study. *MJA.* 2005;182:332–335
- Ray JG, Burrows RF, Burrows EA, Vermeulen MJ. Outcome Study of Hypertension in Pregnancy. *Early HumDev.*2001;64:129–143
- Sibai B, Dekker G, Kupferminc M. Pre-eclampsia. *Lancet.* 2005;365:785–799
- Duley L. The global impact of pre-eclampsia and eclampsia. *Semin Perinatol.* 2009;33:130–137
- Yadav S, Saxena U, Yadav R, Gupta S. Hypertensive disorders of pregnancy and maternal and fetal outcome: A case controlled study. *J Indian Med Assoc* 1997; 95: 548-6551.
- Sibai BM. Eclampsia: VI. Maternal perinatal outcome in 254 consecutive cases. *Am J Obstet Gynecol*, 1990; 163: 1054-1055.
- Schiff E, Friedman SA, Mercer BM, Sibai BM. Fetal lung maturity is not accelerated in preeclamptic pregnancies. *Am J Obstet Gynecol.*1993;169:1096–1101
- Silveira RC, Procianny RS, Koch AS, Benjamin AC, Schindwein AF. Growth and neurodevelopment outcome of very low birth weight infants delivered by preeclamptic mothers. *Acta Paediatr.* 2007;96:1738–1742
- Bashiri A, Zmora E, Sheiner E, Hershkovitz R, Shoham-Vardi I, Mazor M. Maternal hypertensive disorders are an independent risk factor for the development of necrotizing enterocolitis in very low birth weight infants. *Fetal Diagn Ther.* 2003;18: 404–407
- Bashiri A, Zmora E, Sheiner E, Hershkovitz R, Shoham-Vardi I, Mazor M. Maternal hypertensive disorders are an independent risk factor for the development of necrotizing enterocolitis in very low birth weight infants. *Fetal Diagn Ther.* 2003 Nov-Dec;18(6):404-7.
- J. E. Brazy, J. K. Grimm, and V. A. Little, "Neonatal manifestations of severe maternal hypertension occurring before the thirty-sixth week of pregnancy," *Journal of Pediatrics,* 1982;100( 2): 265–271
- C. P. Weiner and R. A. Williamson, "Evaluation of severe growth retardation using cordocentesis—hematologic and metabolic alterations by etiology," *Obstetrics and Gynecology.* 1989; 73( 2): 225–229
- R. F. Burrows and M. Andrew, "Neonatal thrombocytopenia in the hypertensive disorders of pregnancy," *Obstetrics and Gynecology.* 1990; 76(2): 234–238
- J. M. Koenig and R. D. Christensen, "The mechanism responsible for diminished neutrophil production in neonates delivered of women with pregnancy-induced hypertension," *American Journal of Obstetrics and Gynecology.* 1991;165(2): 467–473
- V. Castle, M. Andrew, and J. Kelton, "Frequency and mechanism of neonatal thrombocytopenia," *Journal of Pediatrics.* 1986;108(5): 749–755
- P. Mehta, R. Vasa, L. Neumann, and M. Karpatkin, "Thrombocytopenia in the high-risk infant," *Journal of Pediatrics.* 1980; 97(5):791–794
- A. Mouzinho, C. R. Rosenfeld, P. J. Sanchez, and R. Risser, "Effect of maternal hypertension on neonatal neutropenia and risk of nosocomial infection," *Pediatrics.* 1992;90: 430–435
- J. M. Koenig and R. D. Christensen, "The mechanism responsible for diminished neutrophil production in neonates delivered of women with pregnancy-induced hypertension," *American Journal of Obstetrics and Gynecology.* 1991;165(2): 467–473