STUDY OF THE EFFECTS OF HYPERTENSION ON PREGNANT MOTHERS AND THEIR NEW-BORN BABIES IN A MEDICAL COLLEGE IN KOLKATA

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ABSTRACT

BACKGROUND

Hypertension in pregnancy not only affects the mother adversely, but also the new-born babies. Hypertension is one of the most common medical disorders complicating pregnancy. The World Health Organisation (WHO) systematically reviews maternal mortality worldwide and in developed countries; 16 percent of maternal deaths were reported to be due to hypertensive disorders (Khan, 2006). This proportion is greater than three other leading causes that include haemorrhage- 13 percent, abortion- 8 percent and sepsis- 2 percent.

Aims and Objectives- In this study, we intend to determine the adverse maternal and neonatal outcomes of hypertensive mothers and their new-born babies.

MATERIALS AND METHODS

In this prospective observational case-control study done in a two-year study period (2014 - 2016) in a Tertiary Care Medical College in Kolkata, 50 hypertensive mothers were taken as cases and 50 healthy pregnant women as controls. General parameters as well as the pregnancy outcome of mothers and their new-born babies were recorded by interview from bed-head case records and relevant blood tests and other tests done. All pregnant women diagnosed as pregnancy induced hypertension and other healthy pregnant women were periodically followed during their pregnancy and up to delivery required clinical observations, laboratory investigations done were recorded, complications of interest were noted of them along with that of their new-born infants.

RESULTS

Mean age, mean weight and mean BMI of hypertensive mothers at booking visit were significantly higher; 64% of hypertensive mothers had BMI > 25 kg/mt² as opposed to only 12% of that of control mothers; 40% had positive family history of hypertension in first degree relatives, 2% had a past history of PIH. The mean gestational age of neonates at delivery of both the groups was similar. Amongst statistically significant adverse maternal outcomes were higher performance of LUCS, occurrence of PPH associated preeclampsia/eclampsia, occurrence of oligohydramnios and associated GDM. Amongst statistically significant adverse neonatal outcomes were mean birth weight, occurrence of low birth weight new-borns (LBW), occurrence of Intrauterine Growth Restriction (IUGR), NICU admission > 24 hrs., mean Apgar score at 1 minute, mean Apgar score at 5 minutes, perinatal mortality and Respiratory Distress Syndrome (RDS). Birth trauma and congenital anomalies found were insignificant.

CONCLUSION

Hypertensive disorders of pregnancy are associated with significant adverse maternal and neonatal outcomes, which could be minimised with Institutional delivery and proper antenatal care.

KEYWORDS

Pregnancy Induced Hypertension, Intrauterine Growth Restriction, Perinatal Mortality, Respiratory Distress Syndrome.

HOW TO CITE THIS ARTICLE: Pramanick S, Panda P. Study of the effects of hypertension on pregnant mothers and their new-born babies in a medical college in Kolkata. J. Evolution Med. Dent. Sci. 2017;6(31):2497-2501, DOI: 10.14260/Jemds/2017/541

BACKGROUND

Pregnancy Induced Hypertension (PIH) is one of the most common causes of both maternal and neonatal morbidity.^[1] Pre-eclampsia is a multi-system disorder of the mother that affects the foetus, because of uteroplacental insufficiency.^[2] In consequence, these children are at risk for intrauterine growth restriction and may be delivered prematurely. They may also suffer from the consequences of high rate of

operative deliveries and the adverse effects of maternal drugs. American College of Obstetricians and Gynaecologists (2013) describes four types of hypertensive diseases.^[1] 1. Gestational hypertension- BP $\geq$ 140/90 mmHg for the first time in pregnancy after 20 weeks without proteinuria, evidence for the preeclampsia syndrome does not develop and hypertension resolves by 12 weeks postpartum; 2. Preeclampsia and eclampsia syndrome; 3. Chronic Hypertension of any aetiology (known hypertension before pregnancy or hypertension diagnosed first time before 20 weeks of pregnancy); 4. Preeclampsia superimposed on chronic hypertension.

In this study, we intend to determine maternal and neonatal outcomes of hypertensive mothers and compare the same with that of healthy pregnant women and their new-born infants.

Financial or Other, Competing Interest: None.

Submission 09-03-2017, Peer Review 03-04-2017,

Acceptance 08-04-2017, Published 17-04-2017.

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DOI: 10.14260/Jemds/2017/541

MATERIALS AND METHODS

This prospective observational comparative case control study was conducted in the admitted pregnant female patients and their new-born infants in the Dept. of Obstetrics and Gynaecology, and the Dept. of Paediatrics, respectively in KPC Medical College and Hospital, Jadavpur, Kolkata, West Bengal. Ethical clearance was obtained from respective authority. Informed written consent was taken from all the subjects. Pregnant women, matched for ethnicity and race having hypertension, either chronic or pregnancy induced and their new-born infants were included in the study. This prospective observational case controlled study was carried for a period of 2 (two) years from inception (2014 - 2016); 50 cases of hypertensive pregnant women (i.e. both pregnancy induced hypertension and chronic hypertension) along with 50 controls of non-diabetic, non-hypertensive Healthy Pregnant Women (HPW) and their respective new-born infants were included in this study. The number of subjects for this study was $200.4 \sim 200$ with power 85%. (From the different studies done, expected proportion of the patients, amongst the cases had been assumed to be 60%). The formula used for sample size calculation is as follows: $n = \frac{4pq}{L^2}$; where n = required sample size; $p = 0.20$; $q = 1 - p$; L = Loss % (Loss of Information). Inclusion criteria was all hypertensive pregnant women, i.e. both pregnant induced hypertension and chronic hypertension. All multiple pregnancies, pregnancies with serious comorbid conditions (anaemia, asthma, epilepsy, thyroid dysfunction, heart

disease, etc. that can affect pregnancy outcome adversely; all pregnancies having complications of medical and/or surgical illness, malposition/malpresentation or those using drugs that can lead to hypertension as a side effect were excluded from the study (Exclusion criteria).

General parameters as well as the pregnancy outcome of mothers and their new-born babies was recorded by interview from bed-head case records and relevant blood tests and other tests done.

PIH defined as a systolic blood pressure level of ≥ 140 mmHg and/or diastolic blood pressure level of ≥ 90 mmHg on two separate occasions without proteinuria after 20 weeks of gestation in a previously normotensive woman. PIH screened in antenatal clinic in pregnant women > 20 weeks of gestation. All pregnant women thus diagnosed and other healthy pregnant women were periodically followed during their pregnancy and up to delivery. All the required clinical observations, laboratory investigations done were recorded; complications of interest were noted of them along with that of their new-born infants. The data was arranged in a master chart in New Microsoft Office Excel Worksheet, version 2010 and analysed by SPSS (version-20). Continuous variables were analysed using Student's 't' test and categorical variables by means of χ^2 analysis or Fisher exact test when appropriate. P values less than 0.05 were considered significant.

RESULTS

Parameters	Hypertensive Mothers (n = 50)	Control Mothers (n = 50)	P-value
Religion (Hindu/Muslim/Others)			0.097
• Hindu	38 (76)	32 (64)	
• Muslim	12 (24)	18 (36)	
• Others	0 (0)	0 (0)	
Mean age on first visit (yrs.)	26.5 $\pm$ 23.4	23.26 $\pm$ 6.56	0.000031*
Mean body weight (kgs)	65.02 $\pm$ 57.86	55.12 $\pm$ 26.23	0.00001*
Mean BMI (kg/mt ²)	26.74 $\pm$ 11.38	22.69 $\pm$ 3.88	0.00001*
BMI > 25 kg/mt ²	32 (64)	6 (12)	0.00001*
Parity (nullipara/multipara)			0.346
• Nullipara	24 (48)	26 (52)	
• Multipara	26 (52)	24 (48)	
Family history of hypertension in first degree relatives	20 (40)	0 (0)	0.0036*
Past history of PIH in previous pregnancy	1 (2)	0 (0)	0.16*
Education level ($< 10^{\text{th}}$ or $> 10^{\text{th}}$ Std.)			0.112
• $< 10^{\text{th}}$ Std.	13 (26)	8 (16)	
• 10^{th} or $> 10^{\text{th}}$ Std.	37 (74)	42 (84)	
Smoking history	1 (2)	0 (0)	0.16
Mean gestational age of neonates at delivery (weeks)	37.11 $\pm$ 4.33	36.54 $\pm$ 4.15	0.086

Table 1. Baseline Demographic and Clinical Characteristics of Hypertensive Mothers vs Control Group

*Statistically significant at P-value < 0.05 ; BMI- Body Mass Index; Data are given as number (percentage) and mean $\pm$ standard deviation.

In our study 76% of all hypertensive mothers are Hindus, while only 64% are Hindus in the control group which is statistically insignificant ($p = 0.097$). Mean age, mean weight and mean BMI of hypertensive mothers at booking visit are

higher (26.5 $\pm$ 23.4), (65.02 $\pm$ 57.86) and (26.74 $\pm$ 11.38) respectively than that of control mothers (23.26 $\pm$ 2.56), (55.12 $\pm$ 5.12) and (22.69 $\pm$ 1.97) respectively, which are all statistically significant; 64% of hypertensive mothers have

BMI > 25 Kg/mt² as opposed to only 12% of that of control mothers, which is statistically significant; 40% have positive family history of hypertension in first degree relatives (vs 0% in the control group), 2% have a past history of PIH (vs 0% in the control group), all of which are statistically significant; 52% of hypertensive mothers (vs 48% in control group) are multipara and 74% have an educational level of that of 10th standard or above (vs 84% in the control group). These two are statistically insignificant. The mean gestational age of neonates at delivery of both the groups are similar (37.11 ± 4.33) vs (36.54 ± 4.15) and statistically not significant. (Table-1) Amongst statistically significant adverse maternal outcomes were performance of LUCS (82% in the cases vs only 16% in the controls), occurrence of PPH (6% in the cases vs 0% in the controls), associated preeclampsia/eclampsia (36% in the hypertensive group v/s 0% in the control group), occurrence of oligohydramnios (22% in the cases v/s 0% in the controls) and associated GDM (14% in the cases v/s 0% in the controls).

Parameters	Hypertensive Group (n = 50)	Control Group (n = 50)	P-value
Induction of Labour	1 (2)	4 (8)	0.086
LUCS	41 (82)	8 (16)	0.00001*
PPH	3 (6)	0 (0)	0.04*
Associated Preeclampsia/ Eclampsia	18 (36)	0 (0)	0.00001*
Preterm Labour	26 (52)	21 (42)	0.16
PROM	6 (12)	4 (8)	0.255
Oligohydramnios	11 (22)	0 (0)	0.000167*
Associated GDM	7 (14)	0 (0)	0.00287*
Maternal Death	2 (4)	0 (0)	0.078

Table 2. Comparison of Maternal Outcomes between Hypertensive vs Control Groups

*Statistically significant at P-value < 0.05; BMI- Body Mass Index; LUCS- Lower Uterine Caesarean Section; PPH- Post-Partum Haemorrhage; PROM- Premature Rupture of Membrane; GDM- Gestational Diabetes Mellitus; Data are given as number (percentage).

Amongst other adverse maternal outcomes were induction of labour, associated preterm labour, Premature

Rupture of Membrane (PROM) and occurrence of maternal death, all of which were statistically insignificant. (Table-2) Amongst statistically significant adverse neonatal outcomes were mean birth weight (2.38 ± 0.42 Kgs in the cases v/s 2.56 ± 0.04 Kgs in the controls), occurrence of low birth weight new-borns (LBW) (60% in the cases v/s 24% in controls), occurrence of Intrauterine Growth Restriction (IUGR) (54% in the cases v/s 2% in the controls), NICU admission > 24 hrs. (62% in the cases v/s 8% in the controls), mean Apgar score at 1 minute (5.78 ± 5.4 in the cases v/s 8.16 ± 0.79 in the controls), mean Apgar score at 5 minutes (7.8 ± 8.61 in the cases v/s 9.42 ± 0.25 in the controls), perinatal mortality (18% in the cases v/s 0% in the control group) and Respiratory Distress Syndrome (RDS) (32% in the cases v/s 0% in the control group). Amongst other adverse neonatal outcomes were occurrence of birth trauma and congenital anomalies, which were statistically insignificant (Table-3).

Parameters	Hypertensive Group (n = 50)	Control Group (n=50)	P-value
Mean Birth Weight (Kgs)	2.38 ± 0.42	2.56 ± 0.04	0.0286*
LBW (< 2500 gm)	30 (60)	12 (24)	0.00001*
IUGR	27 (54)	1 (2)	0.00001*
NICU admission >24 hrs.	31 (62)	4 (8)	0.00001*
Mean Apgar 1	5.78 ± 5.4	8.16 ± 0.79	0.00001*
Mean Apgar 5	7.8 ± 8.61	9.42 ± 0.25	0.0001*
Apgar 5 (< 7)	6 (12)	0(0)	0.00001*
Perinatal mortality	9 (18)	0(0)	0.00072*
RDS	16 (32)	3(6)	0.00038*
Birth Trauma	2 (4)	0(0)	0.078
Congenital anomaly	2 (4)	0(0)	0.078

Table 3. Comparison of Neonatal Outcomes between Hypertensive and Control Groups

*Statistically significant at P-value < 0.05; LBW- low birth weight; IUGR- Intrauterine Growth Restriction; NICU- Neonatal Intensive Care Unit; RDS- Respiratory Distress Syndrome; Data are given as number (percentage) and mean $\pm$ standard deviation.

Diagram 1. Comparison of Maternal Outcomes between Hypertensive and Control Groups

Diagram 2. Comparison of Neonatal Outcomes between Hypertensive and Control Groups

DISCUSSION

Hypertensive Disorders of Pregnancy (HDP) is a global problem and complicates approximately 10 - 17% of all pregnancies.^[3] The incidence of PIH in India ranges from 5 - 15%.^[4] Obesity is a risk factor for preeclampsia. Even in women of normal weight, there is a linear relationship between pre-pregnancy body mass index and the frequency of preeclampsia.^[5]

In the present study, low birth weight and IUGR babies were statistically significant in the study group, viz. 60% and 54% respectively ($p < 0.05$). This is in accordance with the result of Fatemeh et al (2010),^[6] who studied 100 hypertensive and 100 normotensive mothers and revealed a difference in the birth weight.

Neonatal intensive care unit admission and duration of stay was higher in the study group (62% in study group vs. 8% in the control group). This observation is similar to that of Fatemah et al (2010).^[6] The reason for the prolonged stay in NICU was prematurity and its associated complications. Sheffer-Mimoum et al (2002)^[7] also observed that SGA, LBW and preterm delivery was significantly higher in woman with HDP. The perinatal mortality was higher in the study group than control in the present study (18% in the study group v/s 0% in the control group). Vandenbosche and Kirchner (1998)^[8] also stated that the infants of hypertensive mothers have three-fold increase in perinatal mortality as compared to infants with IUGR who are born to normotensive mothers. The incidence of Post-Partum Haemorrhage is found to be 6% in our study. The incidence rate correlates with 10.20% for Leduc et al (1992).^[9] The incidence of maternal mortality in our study was 4%, which well co-relates with that conducted by Hagraji (2006)^[10] was found to be 2.3%. The incidence of perinatal mortality in our study was 18%, which is comparable to Gaddi et al (2001)^[11] 22.3%.

Our study records a mean GA of new-borns of 37.11 ± 4.33 weeks (not significantly different from that of the control group). Maternal Body Mass Index (BMI) is a strong risk factor for HDP during pregnancy, leading to complications during pregnancy, delivery and post-partum for both mother and offspring.^[12,13] The mean BMI of the hypertensive mothers in our study was 26.74 ± 11.38 , which was statistically significant. Evidence suggests a significant reduction in neonatal respiratory morbidity when gestation is extended beyond 34 weeks, a benefit seen for each week increase in gestational age up to term.^[14,15] In our study, the

incidence of RDS was 32% (vs 6% in the control group) which is significant.

In present study, prevalence of hypertension in pregnancy was found significantly higher in women with history of hypertension in previous pregnancy (2%). Similarly, Nisar et al^[16] and Tebeu et al^[17] found significant association between history of hypertension during previous pregnancy and hypertension in current pregnancy. Preeclampsia is a progressive disorder and the only definitive management is the delivery of the foetus^[18] to minimise the maternal morbidity and mortality. However, this increases the chance of premature delivery with low odds of child survival.^[19] As noted, preterm babies are more likely to be admitted to the neonatal intensive care unit, have assisted ventilation, to be of low birth weight and small for gestational age and to develop respiratory distress syndrome than term infants.^[20,14] 62% of the new-borns in the study group were admitted in NICU, which by far is the most common neonatal complication in our study vs. only 8% in the control group. In the present study, rate of caesarean delivery and induction of labour were 82% and 2% respectively. Similar studies by Oladokun A et al,^[21] Miguil M et al^[22] and Dissanayake VH et al^[23] revealed caesarean section rates as 60%, 71% and 78% respectively.

Masodkar et al (1985)^[24] also observed a low Apgar score in toxemia of pregnancy. The present study has got similar findings as well. Apgar score < 7 at 5 minutes is 12% in the hypertensive group vs 0% in the control group, which is significant.

Young and nulliparous women are particularly vulnerable to developing preeclampsia, whereas older women are at greater risk for chronic hypertension with superimposed preeclampsia. The incidence is markedly influenced by race and ethnicity and thus by genetic predisposition. The incidence of preeclampsia in multiparas is also variable, but is less than that for nulliparas.^[25]

Although smoking during pregnancy causes various adverse pregnancy outcomes; ironically, it has consistently been associated with a reduced risk for hypertension during pregnancy (Bainbridge, 2005; Zhang, 1999).^[1] Women with preeclampsia in the first pregnancy are at greater risk in a second pregnancy compared with women normotensive during their first pregnancy (McDonald, 2009).^[1] The hospital incidence of Eclampsia in India ranges from 1 in 500 to 1 in 30. It is more common in primigravidae (75%), five times

more common in twins than in singleton pregnancies and occurs between the 36th week and term in more than 50%.

CONCLUSION

Hypertensive disorders of pregnancy are a common complication in antenatal women and are a major cause of maternal and foetal morbidity and mortality. Age > 25 years and obesity are significant risk factors. Our study concludes that there is a significant rise of caesarean sections and PPH in mothers having HDP and also there is an increased risk of delivering low birth weight, IUGR and preterm babies increasing their NICU admission rate. It also increases RDS and perinatal mortality rate. The study highlights the importance of Institutional deliveries of women combined with effective antenatal care. Hence, health education and awareness among the people and primary health workers regarding this health issue is necessary in bringing down the maternal and neonatal morbidity and mortality.

Limitations

Small sample size and lack of followup of the mothers and their babies were the limitation of this study. However, this study shows the direction of further long-term follow-up study to gauge the scourge of this disease in the society.

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