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Original Research Article

To Evaluate the Relationship of High-Sensitivity Serum C-Reactive Protein and Lipid Profile in Women with Pregnancy Induced Hypertension

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Abstract

Aim: The aim of the present study was to evaluate the relationship of High-Sensitivity serum C-reactive protein and lipid profile in women with pregnancy induced hypertension.

Methods: This was a case-control study conducted in the Department of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna, Bihar, India for the period of 1 year. The study population was 18-35 years old pregnant women after 20 weeks of gestation.

Results: The age of the respondents of case (28.02±5.25) years and control (27.73±5.02) years groups was almost similar. Majority of the respondents both in case (60%) and control (76%) groups were educated below SSC level. Most of them were housewife (case vs control: 88% vs 98%) and belonged from lower middle-class family. All these findings were statistically non-significant (p≥0.05). A significant finding was observed in regards of area of residence where majority among case came from rural (48%) area and among control more than half came from semi-urban (66%) area. There were non-significant findings in regards of past medical history of respondents among case and control. Among case 18 (36%) and among control 20 (40%) had positive family history of DM. Among case 21 (42%) and among control 20 (40%) had positive family history of HTN. Among case (2%) and among control none of the respondents (0.0%) had positive family history of renal disease. Among the case 17 (34%) had positive history of proteinuria and none of the control had positive history of proteinuria. This finding was statistically significant (<0.001). The mean serum total cholesterol, serum LDL, serum triglycerides and CRP were higher in case compared to that in control. Mean serum HDL was lower in case compared to that in control.

Conclusion: The present study concluded that high hs-CRP and dyslipidemia were associated with pregnancy induced hypertension.

Keywords: C-reactive protein, high-sensitivity, dyslipidemia, pregnancy, hypertension

Introduction

Hypertension (HTN) in pregnancy is an elevation of systolic (BP ≥ 140 mmHg) or diastolic (BP ≥ 90 mmHg) blood pressures. Pregnancy-induced hypertension (PIH) is characterized by high blood pressure, with/without protein in the urine, and pathological edema during pregnancy. [1] Elevated diastolic or systolic blood pressure is an important marker of PIH and its reduction helps reduce the risk of HTN. [2] The American society of hypertension guidelines classified hypertensive disorder of pregnancy as follows [3]: Pre-eclampsia–eclampsia, chronic HTN (of any cause), gestational HTN, and chronic HTN with superimposed pre-eclampsia.

PIH is one of the top three leading causes of maternal, fetal, and neonatal morbidity and mortality. [4] The World Health Organization (WHO) states that severe HTN in pregnancy will increase both the mother's and fetus' risks [5,6] such as poor placenta transfer, growth restrictions, preterm birth, placenta abortion, and neonatal death. Even though PIH has multifarious risk factors, its pathophysiology and etiology are not well understood. Placental implantation with abnormal tissue layer invasion of uterine vessels and immunologic intolerance between maternal, placental, and fetal tissues are a number of the etiological factors for PIH. [7]

Reduction in placenta blood flow results in ischemia and hypoxia, which releases ischemic factors and dysregulates immune cells. Placental ischemic factors released on the maternal endothelial system cause vascular endothelial dysfunction that enhances the formation of vasoconstrictors (endothelin-1 and thromboxane), increased vascular sensitivity to angiotensin II, increased free-radical (superoxide), and decreased formation of vasodilators (nitric oxide and prostacyclin).[6] Metabolic disturbances of lipids are believed as the risk of PIH by inducing endothelial cell dysfunction next to oxidative stress and insulin resistance. Insulin resistance reduces lipoprotein lipase activity resulting in decreasing the hydrolysis of triglycerides from lipoproteins. [8] Thus, women with PIH are at greater risk of developing HTN, cardiovascular disease (CVD), diabetes mellitus (DM), and kidney diseases in later life. [9-11]

The aim of the present study was to evaluate the relationship of High-Sensitivity serum C-reactive protein and lipid profile in women with pregnancy induced hypertension.

Materials and Methods

This was a case-control study conducted in the Department of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna, Bihar, India for the period of 1 year. The study population was 18-35 years old pregnant women after 20 weeks of gestation.

Case:Women with pregnancy-induced hypertension with age 18-35 years after 20 weeks of gestation. Case includes- Gestational hypertension, Pre-eclampsia and Eclampsia.

Control: Pregnant normotensive women with same age group and gestation.

Inclusion Criteria

- For case: Pregnant women after 20 weeks of gestation with age group 18-35 years diagnosed as pregnancy-induced hypertension.
- For control: Pregnant normotensive women with the same above-mentioned age and gestation.

Exclusion Criteria for Both Groups

- Women in labor.
- Women with ruptured membranes.
- Women with multiple pregnancies.
- Women with Molar pregnancy.
- Pre-existing hyperlipidemia before 20 weeks of pregnancy.
- Women receiving any drug that interferes with serum lipid profile.
- Smoker and alcoholic women.
- History of receiving aspirin or any other medication known to interfere with inflammation.
- Auto immune disease.

Medical disease like DM, chronic hypertension, renal disease, thyroid disease.

- Mistaken date.
- Obesity.

Study Procedure

All the pregnant mothers fulfilling the inclusion attending at obstetrics department were enrolled in the study by purposive sampling. After obtaining an informed written consent 100 subjects were grouped into 2 groups according to criteria. Case were 50 patients with pregnancy induced hypertension which includes pre-eclampsia (N=20), eclampsia (N=20), and gestational hypertension (N=10). Control were 50 normotensive pregnant women with blood pressure < 140/90 mm of Hg without any signs of pre-eclampsia. Blood pressure was measured by standard procedure with sphygmomanometer. Korotk off phase-1 (1st beat heard) and phase-v (disappearance of sound) were used for systolic and diastolic blood pressure. It was measured on right arm, sitting comfortably, legs uncrossed with back and arm supported or lying on her back 45 degrees to horizontal. In both cases occluded brachial artery was kept at the level of the heart. Proteinuria is measured by Dipstick method, when proteinuria found ≥1+ in collected urine sample then diagnosis of preeclampsia was established. After taking all aseptic precaution the blood samples were collected from median antecubital vein into two separate red top vacutainer blood collection tube. Then it was kept stand for about 45 minutes at room temperature to allow complete clotting and clot retraction, then sera were separated as quickly as possible and centrifugation was done for 5-10 minutes at 3000 rpm. Component of lipid profile was measured using automated analyzer and hs-CRP was measured by Latex turbidimetry method with hs-CRP latex reagent by Atellica CH Analyzer. Normal reference values of serum total cholesterol, triglycerides, HDL, LDL and hs-CRP during pregnancy were taken.[12] The following precautions were taken while sampling the blood as far as possible:

1. Preferably the patient was fasting for overnight for at least 12 hours.

2. It was made sure that the patient was not receiving any drug that interferes with serum lipid levels or their estimation.

3. The patient was afebrile for the last one week.

4. The patient was on near normal diet.

All the above precautions cannot be applied strictly in cases of eclampsia due to inherent difficulties associated in such cases.

Data Collection

Detailed Obstetric and medical history and clinical examinations were done in all study subjects. Data was collected from the patient on variables of interest using the preformed structured questionnaire. For each and every subject separate data sheet was used. With all aseptic precaution blood samples were collected after overnight fasting from median antecubital vein. Then the serum hs-C-reactive Protein and lipid profile were measured.

Data analysis

Statistical analyses were carried out by using Windows based Statistical Package for Social Sciences (SPSS-26). For continuous variables distribution was expressed by mean and standard deviation. Mean comparison between two groups was done by unpaired t-test. For qualitative variables distribution was expressed by frequency and their percentages. Chi square test was done to see the significance of difference between two groups. Scatterplot diagram was used to show the relationship with blood pressure and biochemical variables. ANOVA test was carried out to compare means between 4 groups and to see relationship with the pregnancy induced hypertension. Cut-off values were used according to the literatures. The p value <0.05 was considered as statistically significant.

Results

Table 1: Categorization of the respondents according to their socio demographic characteristics

Sociodemographic characteristics	Case		Control		P-Value
	N	%	N	%	
Age of the respondents					
Up to 20 years	6	12	7	14	0.856
21-30 years	32	64	30	60	
More than 30 years	12	24	13	26	
Mean ± SD	28.02±5.25		27.73±5.02		0.743
Educational qualification					
Below SSC	30	60	38	76	0.072
SSC and above	20	40	12	24	
Occupation					
Housewife	44	88	49	98	0.064
Service	6	12	1	2	
Area of residence					
Urban	8	16	2	4	0.007
Semi-urban	18	36	33	66	
Rural	24	48	15	30	

The age of the respondents of case (28.02±5.25) years and control (27.73±5.02) years groups was almost similar. Majority of the respondents both in case (60%) and control (76%) groups were educated below SSC level. Most of them were housewife (case vs control: 88% vs 98%) and belonged from lower middle-class family. All these findings were statistically non-significant (p≥0.05). A significant finding was observed in regards of area of residence where majority among case came from rural (48%) area and among control more than half came from semi-urban (66%) area.

Table 2: Categorization of the respondents according to past medical history

Past medical history	Case		Control		P-Value
	N	%	N	%	
H/O GDM					
Yes	3	6	1	2	0.614
No	47	94	49	98	
H/O preeclampsia					
Yes	5	10	3	6	0.424
No	45	90	47	94	
H/O of IUD					
Yes	3	6	1	2	0.654
No	47	94	49	98	
H/O birth weight > 4kg					
Yes	1	2	0	0	0.316
No	49	98	50	100	

There were non-significant findings in regards of past medical history of respondents among case and control.

Table 3: Categorization of the respondents according to family history

Family history	Case		Control		P-Value
	N	%	N	%	
Family H/O DM					
Yes	18	36	20	40	0.525
No	32	64	30	60	
Family H/O HTN					
Yes	21	42	20	40	0.812
No	29	58	30	60	
Family H/O renal disease					
Yes	1	2	0	0	0.316
No	49	98	50	100	

Among case 18 (36%) and among control 20 (40%) had positive family history of DM. Among case 21 (42%) and among control 20 (40%) had positive family history of HTN. Among case (2%) and among control none of the respondents (0.0%) had positive family history of renal disease.

Table 4: Categorization of the respondents according to present medical condition

Present medical condition	Case		Control		P-value
	n	%	n	%	
Oedema					
Yes	38	76	33	66	0.220
No	12	24	17	34	
Proteinuria					
Yes	17	34	0	0	<0.001
No	33	68	50	100	
IUGR					
Present	8	16	3	6	0.140
Absent	42	84	47	94	

Among the case 17 (34%) had positive history of proteinuria and none of the control had positive history of proteinuria. This finding was statistically significant (<0.001).

Table 5: Distribution of the respondents according to lipid profile and C reactive protein

Lipid profile and C reactive protein	Case (Mean ± SD)	Control (Mean ± SD)	P-value
Serum Total Cholesterol	262.12±66.64	222.4±54.16	<0.001
Serum HDL	46.84±15.20	55.05±12.04	<0.001
Serum LDL	184.76±64.56	122.88±32.38	<0.001
Serum Triglycerides	286.94±124.66	188.02±64.36	<0.001
hs-CRP	6.94±4.20	5.25±2.72	0.007

The mean serum total cholesterol, serum LDL, serum triglycerides and CRP were higher in case compared to that in control. Mean serum HDL was lower in case compared to that in control.

Discussion

Pregnancy Induced Hypertension is most common medical complication of pregnancy and its incidence is increasing worldwide. It complicates about 6-10% of pregnancies. 20% of all maternal death occurs in our country due to preeclampsia and eclampsia and is the second cause of maternal death. [13] According to the WHO, Pregnancy Induced Hypertension is one of the main causes of maternal, fetal and neonatal mortality and morbidity. [14] It is the most common cause of maternal death in Europe. [15] In a retrospective study over the period 2000-2009 in a tertiary center in India, PIH was the third cause of maternal death. [16] Pregnancy-induced hypertension (PIH) is a hypertensive disorder in pregnancy that occurs as a direct result of a gravid state after 20 weeks of pregnancy in the absence of other causes of elevated blood pressure (BP ≥140/90 mm of Hg) measured 2 times with at least 4 hours interval. PIH includes (1) Gestational hypertension; (2) Pre-eclampsia and (3) Eclampsia. Pre-eclampsia is a multisystem disorder characterized by new onset of hypertension and proteinuria after 20 weeks of gestation.

The age of the respondents of case (28.02±5.25) years and control (27.73±5.02) years groups was almost similar. In a study by Rout and Mahalik et al [17], mean age in study group with gestational hypertension was 27.41 compared to 26.19 years in control group with pregnant normotensive women. Majority of the respondents both in case (60%) and control (76%) groups were educated below SSC level. A study conducted by Koppula and Sawant, demonstrated that 97% of case belonged to the rural background, and most of them were literate (71.33%). 52% belonged to Class I status. Sociodemographic parameters and PIH showed no association in another study conducted by Koppula and Sawant et al [18] which did not fully support present study and these dissimilarities might be due to geographical variation and small sample size. Most of them were housewife (case vs control: 88% vs 98%) and belonged from lower middle-class family. All these findings were statistically non-significant (p≥0.05). A significant finding was observed in regards of area of residence where majority among case came from rural (48%) area and among control more than half came from semi-urban (66%) area. There were non-significant findings in regards of past medical history of respondents among case and control. Among case 18 (36%) and among control 20 (40%) had positive family history of DM. Among case 21 (42%) and among control 20 (40%) had positive family history of HTN. Among case (2%) and among control none of the respondents (0.0%) had positive family history of renal disease. Among the case 17 (34%) had positive history of proteinuria and none of the control had positive history of proteinuria. This finding was statistically significant (<0.001). In a similar study Stepan et al [19] demonstrated patients with proteinuria showed the highest blood pressure value.

The mean serum total cholesterol, serum LDL, serum triglycerides and CRP were higher in case compared to that in control. Mean serum HDL was lower in case compared to that in control. The significantly high levels of TG and cholesterol with significantly low HDL-c could reflect a compromised vascular function. These explanations agree with a study by Catarino et al [20] who reported that preeclampsia is associated with an enhanced hyperlipidemia which seems to have a negative impact on fetal lipid profile as reflected by an atherogenic LDL-c/HDL-c ratio and higher TG level. A study conducted by Das et al [21] showed that in preeclamptic group mean TG 212.75±50.29 mg/dl was increased significantly than other parameter compared to mormotensive pregnant 185.60±40.67mg/dl. Among the case 58.3% and among control 31.7% had serum cholesterol ≥ 299 mg/dl and respondents with serum total cholesterol ≥ 299 mg/dl had 3.02 times more chance to develop pregnancy induced hypertension which was statistically significant (p=0.003).

Conclusion

The present study concluded that high hs-CRP and dyslipidemia were associated with pregnancy induced hypertension.

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