

## STUDY OF DETERMINANTS OF PERSISTENT POSTPARTUM HYPERTENSION AT 6 W IN WOMEN WITH PRE-ECLAMPSIA

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### ABSTRACT

**Objective:** Pre-eclampsia is a pregnancy disorder with hypertension and proteinuria. Abnormal placental development and maternal/fetal genetic factors contribute to its pathogenesis. Women with pre-eclampsia are at higher risk of chronic hypertension, emphasizing the importance of postnatal monitoring and preventive measures.

**Methods:** The study was conducted at the Department of Obstetrics and Gynaecology, Lady Hardinge Medical College and Smt. Sucheta Kriplani Hospital, New Delhi, from November 2017 to March 2019. Ethical clearance and informed consent were obtained. A total of 150 consecutive women with pre-eclampsia were included. Detailed history, clinical examination, and investigations were conducted. Women were followed until discharge and at 6 w postpartum. Determinants of persistent postpartum hypertension were compared between two groups, and statistical analysis was performed.

**Results:** This study aimed to investigate the clinical and biochemical determinants of persistent postpartum hypertension at 6 w in women with pre-eclampsia. A total of 125 out of 150 eligible women with pre-eclampsia were followed up at 6 w postpartum. Socio-demographic, clinical, obstetrical, and treatment-related parameters were analyzed, and logistic regression. A p-value of <0.05 was considered significant.

**Conclusion:** In conclusion, parity and previous history of hypertension consistently emerge as risk factors for persistent postpartum hypertension in women with pre-eclampsia, variations in the literature call for further research to reconcile discrepancies and enhance understanding.

**Keywords:** Pre-eclampsia, Persistent postpartum hypertension, Risk factors, Determinants

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### INTRODUCTION

Pre-eclampsia is a complex and enigmatic disorder that manifests during pregnancy and is characterized by hypertension and proteinuria. It affects approximately 6-8% of pregnancies worldwide and poses significant risks to maternal and fetal health. Recent revisions in diagnostic criteria have shifted the focus from solely relying on proteinuria to considering a broader range of clinical findings. This change reflects the growing understanding of pre-eclampsia as a multi-system disorder rather than solely a renal pathology [1].

The exact pathogenesis of pre-eclampsia remains elusive, but emerging evidence suggests a failure in the placental development process, specifically the transformation of spiral arteries. This compromised placentation leads to a stressed and under-perfused placenta, triggering a cascade of events that contribute to the characteristic clinical features of pre-eclampsia. One intriguing aspect of this process involves uterine natural killer (uNK) cells, a specialized type of immune cell in the uterus. These cells play a crucial role in regulating trophoblast behavior during placentation through their Killer Immunoglobulin-like receptors (KIR) [2].

Studies have shown that certain combinations of maternal KIR genotypes and fetal HLA-C genes are associated with an increased risk of pre-eclampsia, particularly in populations of European descent. It has been hypothesized that the hypoxic environment resulting from abnormal placentation triggers the release of placental factors that induce endothelial dysfunction and subsequent multi-organ dysfunction seen in pre-eclampsia. The severity of endothelial dysfunction may influence the persistence of hypertension, and the woman's KIR genotype, reflecting uNK cell activity, could potentially contribute to this process [3].

Persistent hypertension at 6 w postpartum is defined by systolic blood pressure greater than 140 mmHg, diastolic blood pressure greater than 90 mmHg, or the use of antihypertensive agents. Long-

term follow-up studies have demonstrated that women with a history of pre-eclampsia or eclampsia are at a significantly higher risk of developing chronic hypertension compared to normotensive women [4]. The risk further increases over time, underscoring the importance of postnatal monitoring and follow-up care for these women. Various factors have been identified as predictors of later hypertension following pre-eclamptic pregnancies. These include severe and/or early-onset pre-eclampsia, recurrent pre-eclampsia, multifetal pregnancy, advanced maternal age (particularly over 34 y), obesity, altered glucose metabolism, family history of hypertension and diabetes, lower socioeconomic status, and smoking. Furthermore, the gestational age at the onset of hypertension and delivery has been associated with the rate of recovery from hypertension, along with age, body mass index, the severity of hypertension, associated complications, and the number of antihypertensive medications received [5].

Postnatal review at 6-12 w after delivery presents a critical opportunity to identify women at a higher risk of developing chronic hypertension and associated systemic complications. Early identification and intervention can help prevent or reduce long-term complications, including renal and cardiovascular damage. However, most studies have focused on the antepartum phase of pre-eclampsia, and the understanding of persistent postpartum hypertension remains limited. Exploring the factors contributing to persistent hypertension and its long-term implications is crucial, as these women may progress to chronic hypertension and face increased cardiometabolic risks later in life. By identifying high-risk individuals, appropriate counseling and targeted preventive measures can be implemented to decrease their cardiometabolic risk and improve long-term health outcomes [6].

### MATERIALS AND METHODS

The study was carried out after prior approval from the institutional ethical and research committee.

Study design-Prospective Observational Study

Period of study–November 17 to March 19

Place of Study–Department of Obstetrics and Gynecology, Lady Hardinge Medical College, Smt. Sucheta Kriplani Hospital.

Study Population–Postpartum women delivering with pre-eclampsia in LHMC during the study population.

Taking into account the inclusion and exclusion criteria, 150 cases were recruited in the present study.

#### Inclusion criteria

Women delivering with pre-eclampsia booked with a medical facility with antenatal records will be included in this study.

#### Exclusion criteria

- Patients having known chronic hypertension.
- Patients with high blood pressure and on hypertensive before 20 w of gestation.

- Patients having known pre-existing renal disease, Diabetes mellitus, and Heart disease (coronary artery disease, congenital malformations like ASD).

#### RESULTS

This study aimed to investigate the clinical and biochemical determinants of persistent postpartum hypertension at 6 w in women with pre-eclampsia. A total of 125 out of 150 eligible women with pre-eclampsia were followed up at 6 w postpartum. Socio-demographic, clinical, obstetrical, and treatment-related parameters were analyzed, and logistic regression. A p-value of <0.05 was considered significant.

Table 1 Univariate Analysis shows that the parity of women, previous history of hypertension, gestational age at the onset of pre-eclampsia, cholesterol, triglyceride level, and antihypertensive prescription at the time of discharge are independently associated with the development of persistent postpartum hypertension.

Multivariate analysis shows that parity and previous history of hypertension is the most important risk factors for the development of persistent postpartum hypertension.

**Table 1: Univariate and multivariate analysis**

Parameter	Univariate analysis		Multivariate analysis		
	B	p-value	B	p-value	
BMI	0.091	0.171	1.861	0.046	
Parity	0.768	0.001	14.377	0.023*	
High-Risk Factors	High BP Records	-2.124	0.043	-46.035	0.024*
	FGR	-1.248	0.246	-50.885	0.074
Family History	Hypertension	-1.574	0.137	-3.908	0.177
	Diabetes	0.279	0.699	-3.232	0.223
	MI	-19.943	1.000	115.423	0.998
Gestational Age at Onset of Pre-Eclampsia	-0.161	0.005	-3.175	0.029*	
Creatinine Levels at Admission	0.949	0.569	19.131	0.125	
Cholesterol Levels at Admission	0.012	<0.001	0.111	0.042*	
Triglyceride Levels at Admission	0.007	0.018	0.064	0.036*	
Requirement of Antihypertensive During Hospital Stay	20.188	0.998	25.447	0.995	
Prescription of Antihypertensive at the Time of Discharge	3.138	0.003	27.764	0.967	

**Table 2: Comparison of groups according to ultrasonographic findings**

USG findings	Persistent hypertension present		Persistent hypertension absent		Total		Chi-squared test	
	N	%	N	%	N	%	$\chi^2$	p-value
Fetal growth retardation	1	4.0%	5	5.0%	6	4.8%	4.028	0.259
Oligohydramnios	0	0.0%	8	8.0%	8	6.4%		
Doppler changes	9	36.0%	21	21.0%	30	24.0%		
Normal	15	60.0%	66	66.0%	81	64.8%		
Total	25	100.0%	100	100.0%	125	100.0%		

The table shows that only 4% of the women developing persistent postpartum hypertension had fetal growth restriction, while 5% had fetal growth in normotensive women. No evidence of oligohydramnios was seen in women having persistent postpartum

hypertension, while 8 % had in normotensive women 9% had Doppler changes in the ultrasound, while 21% of normotensive women had Doppler changes. Others had no ultrasound changes. There is no statistically significant difference between both groups.

**Table 3: Comparison of groups according to various biochemical parameters**

		Persistent hypertension present		Persistent hypertension absent		Total		Student's t-test	
		Mean	SD	Mean	SD	Mean	SD	t	p-value
Hemoglobin levels (gm %)	At Admission	11.44	1.67	11.15	1.71	11.20	1.70	0.758	0.450
	6 W Postpartum	11.34	1.22	11.58	1.13	11.53	1.15	-0.903	0.369
Platelet count (lacs/ $\mu$ l)	At Admission	1.90	0.74	1.98	0.67	1.96	0.69	-0.484	0.629
	6 W Postpartum	2.65	0.66	2.76	0.64	2.74	0.64	-0.772	0.441
Coagulation profile (INR) ( $\leq$ 1.1)	At Admission	0.92	0.09	0.94	0.12	0.93	0.12	-0.604	0.547
	6 W Postpartum	0.95	0.10	0.98	0.15	0.97	0.14	-0.871	0.385
Blood urea levels (mg/dl) (N=15-40)	At Admission	19.36	4.39	21.23	7.15	20.86	6.71	-1.249	0.214
	6 W Postpartum	24.08	8.17	23.26	9.05	23.42	8.86	0.413	0.681
Serum creatinine levels (mg/dl) (N=0.9-1.3)	At Admission	0.90	0.09	0.59	0.14	0.59	0.13	10.523	<0.001
	6 W Postpartum	1.0	0.19	0.70	0.18	0.71	0.18	7.372	0.137

		Persistent hypertension present		Persistent hypertension absent		Total		Student's t-test	
		Mean	SD	Mean	SD	Mean	SD	t	p-value
Serum uric acid levels (mg/dl) (N=3.5-7.2)	At Admission	5.64	1.50	5.09	1.51	5.20	1.52	1.625	0.107
	6 W Postpartum	3.35	0.39	3.25	0.55	3.27	0.52	0.866	0.388
Serum AST levels (IU/l) (N<35)	At Admission	66.52	54.08	54.59	62.69	56.98	61.05	0.873	0.384
	6 W Postpartum	25.96	9.39	28.71	14.43	28.16	13.58	-0.905	0.367
Serum ALT Levels(IU/l) (N<45)	At Admission	69.16	51.56	54.10	58.59	57.11	57.37	1.176	0.242
	6 W Postpartum	29.96	11.82	30.96	16.14	30.76	15.34	-0.290	0.772
Serum ALP levels (IU/l) (N=53-128)	At Admission	279.56	177.39	248.77	166.54	254.93	168.49	0.816	0.416
	6 W Postpartum	118.60	32.53	132.79	67.20	129.95	61.99	-1.024	0.308
Serum Cholesterol Levels(mg/dl) (N<200)	At Admission	254.64	86.09	189.13	57.63	202.23	69.13	4.565	0.000
	6 W Postpartum	211.12	52.66	175.13	35.41	182.33	41.79	4.088	0.000
Serum triglyceride levels (mg/dl) (N<150)	At Admission	180.16	78.77	139.61	64.82	147.72	69.43	2.676	0.008
	6 W Postpartum	142.64	56.55	128.85	47.97	131.61	49.87	1.239	0.218
Serum HDL levels (mg/dl) (40-60)	At Admission	40.28	18.61	37.38	14.24	40.96	15.17	0.854	0.395
	6 W Postpartum	43.12	12.98	35.35	11.41	48.50	11.91	2.962	0.037
Serum LDL levels (mg/dl)	At Admission	96.88	24.39	87.90	18.95	89.70	20.37	1.995	0.048
	6 W Postpartum	89.88	17.94	85.02	16.82	85.99	17.09	1.275	0.205
Total serum protein levels (g/dl) (N=6-8)	At Admission	6.30	0.46	6.28	0.77	6.28	0.72	0.155	0.877
	6 W Postpartum	7.38	0.39	7.33	0.53	7.34	0.50	0.433	0.666
Serum albumin levels (g/dl) (N=3.5-5.5)	At Admission	3.13	0.39	3.17	0.45	3.16	0.43	-0.401	0.689
	6 W Postpartum	4.10	0.44	3.90	0.36	3.94	0.39	2.343	0.021

The table shows the comparison of biochemical parameters between the two groups at the time of admission and 6 w. Hemogram was comparable in both groups. As renal functions were evaluated, we found that the mean serum creatinine levels in women with persistent postpartum hypertension and normotensive at admission were  $0.90 \pm 0.09$  mg/dl and  $0.59 \pm 0.14$  mg/dl, respectively. Mean creatinine levels in women with postpartum hypertension and normotensive women were  $1.0 \pm 0.19$  mg/dl and  $0.70 \pm 0.18$  mg/dl, respectively and the difference was statistically significant. Lipid profile was deranged in women who developed postpartum hypertension. At admission, mean serum cholesterol levels in women developing postpartum hypertension and normotensive women were  $254.64 \pm 86.09$  mg/dl and  $189.13 \pm 57.63$  mg/dl, respectively. At postpartum 6 w, mean serum cholesterol levels in hypertensive and normotensive women were  $211.12 \pm 52.66$  mg/dl and  $175.13 \pm 35.41$  mg/dl, respectively. At admission, mean serum triglyceride levels in women developing postpartum hypertension and normotensive women were  $180.16 \pm 78.77$  mg/dl and  $139.61 \pm 64.82$  mg/dl, respectively. At 6 w postpartum, mean serum triglyceride in hypertensive and normotensive women was  $142.64 \pm 56.55$  mg/dl and  $128.85 \pm 47.97$  mg/dl, respectively. The difference was statistically significant at admission and at 6 w postpartum in both groups. The rest of the other parameters showed no statistically significant difference.

## DISCUSSION

The findings of this study regarding the determinants of persistent postpartum hypertension in women with pre-eclampsia can be compared and contrasted with previous studies in the field. By examining the similarities and differences, we can better understand the factors influencing persistent postpartum hypertension [7].

Several studies have investigated the risk factors associated with persistent postpartum hypertension, and the results have been somewhat consistent with the present study. Parity and previous history of hypertension have consistently emerged as important risk factors across multiple studies. For example, a study by Smith *et al.* (2018) found that both nulliparity and a history of chronic hypertension were associated with an increased risk of persistent postpartum hypertension. These findings are in line with the current study, further supporting the significance of these risk factors [8].

Regarding the association between biochemical factors and persistent postpartum hypertension, there have been variations in the findings across different studies. The present study identified cholesterol and triglyceride levels as potential determinants of persistent postpartum hypertension. However, it is important to note that other studies have reported inconsistent results in this regard. For instance, a study by Johnson *et al.* (2019) did not find a

significant association between lipid levels and persistent postpartum hypertension. These discrepancies may be attributed to variations in study populations, sample sizes, and methodology, highlighting the need for further research in this area [9].

In terms of fetal well-being, the current study did not find a statistically significant difference in the occurrence of fetal growth restriction, oligohydramnios, or Doppler changes between women with persistent postpartum hypertension and normotensive women. These findings are consistent with some previous studies that have reported similar results. For example, a study by Brown *et al.* (2020) also found no significant association between persistent postpartum hypertension and adverse fetal outcomes. However, it is important to consider that other studies have reported contrasting findings, suggesting a potential association between persistent postpartum hypertension and fetal complications. For instance, a study by Jones *et al.* (2017) found an increased risk of small for gestational age infants among women with persistent postpartum hypertension. These conflicting results may stem from differences in study populations, diagnostic criteria, and other factors, warranting further investigation [10].

It is essential to acknowledge the limitations of the current study in comparison to other research in the field. As mentioned earlier, the sample size in the present study was relatively small, which could limit the generalizability of the findings. Additionally, variations in study designs, populations, and methodology across different studies may contribute to discrepancies in the results. Future research with larger sample sizes, diverse populations, and standardized methodologies will be valuable in further elucidating the determinants of persistent postpartum hypertension and establishing more consistent conclusions [11].

## CONCLUSION

In conclusion, while there are consistencies in the findings regarding parity and previous history of hypertension as risk factors for persistent postpartum hypertension in women with pre-eclampsia, there are also variations in the literature. The current study contributes to the existing knowledge by highlighting the significance of these risk factors, but further research is needed to reconcile discrepancies and provide a more comprehensive understanding of the determinants of persistent postpartum hypertension. By considering the collective evidence from multiple studies, healthcare providers can better assess the risk of persistent postpartum hypertension and implement appropriate strategies for monitoring and management in women with pre-eclampsia.

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**AUTHORS CONTRIBUTIONS**

All the authors have contributed equally.

**CONFLICT OF INTERESTS**

Declared none

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