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Serum High-Sensitivity C-Reactive Protein (hs-CRP) Levels in Pregnant Women with Preeclampsia Compared to Normotensive Pregnant Women: A Prospective Cohort Study

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ABSTRACT

This prospective cohort study investigated the role of high-sensitivity C-reactive protein (hs-CRP) as a biomarker in preeclampsia by comparing serum hs-CRP levels between preeclamptic and normotensive pregnant women, and assessing its association with disease severity and fetomaternal outcomes. Conducted at AIIMS Raipur over 18 months, the study included 92 pregnant women aged 21–40 years with singleton pregnancies between 20 and 40 weeks of gestation. Participants were divided into two groups: preeclamptic (n=46) and normotensive controls (n=46). Results revealed significantly elevated hs-CRP levels in preeclamptic patients (mean 12.36 ± 9.71 mg/L) compared to normotensives (mean 3.54 ± 2.41 mg/L), with 100% of the preeclamptic group showing hs-CRP >3 mg/L. hs-CRP levels were higher in those with severe preeclampsia, early-onset disease, and preterm deliveries, although the associations were not always statistically significant. A meaningful difference was noted in preterm versus term preeclampsia, with higher median hs-CRP in preterm cases (p = 0.032). Preeclamptic patients also had significantly more adverse maternal and neonatal outcomes, including increased rates of cesarean deliveries, preterm births, lower APGAR scores, and fetal growth restriction. Among maternal complications, hs-CRP was significantly elevated in those with liver dysfunction and premonitoring symptoms. Although no consistent correlation was found between hs-CRP and NICU admission, non-reassuring NST, or meconium-stained liquor, the study highlights the inflammatory nature of preeclampsia and the potential of hs-CRP as a reliable biomarker. Elevated hs-CRP (>4.4 mg/L) was associated with a 31.67-fold higher risk of preeclampsia. These findings underscore the utility of hs-CRP in early risk stratification, suggesting its relevance not only for predicting disease severity but also for identifying women at risk for future cardiovascular complications.

INTRODUCTION

Hypertensive disorders remain one of the most dangerous complications in pregnancy, significantly contributing to maternal and perinatal mortality and morbidity. Among these, preeclampsia stands out as a critical condition, acting as a clinical marker of systemic endothelial dysfunction. It is responsible for nearly half of all hypertensive disorders during pregnancy. In developing countries, preeclampsia affects approximately 4–18% of pregnancies, while in India, the prevalence ranges between 8–10%. A substantial proportion of maternal deaths in India, estimated at 12–15%, is attributed to preeclampsia. In Bangladesh, eclampsia, a severe progression of preeclampsia, accounts for about 24% of maternal deaths, emphasizing the condition's dire consequences. Besides maternal mortality, preeclampsia frequently leads to preterm birth and increased NICU admissions, both of which carry additional risks for neonatal health [1-3].

In about 10% of preeclamptic or eclamptic women, HELLP syndrome develops, a life-threatening variant of the disorder. More recently, studies have highlighted the connection between hypertensive pregnancy disorders and early cardiovascular complications in later life, such as ischemic heart disease, stroke, venous thromboembolism, and persistent hypertension. The long-term cardiovascular risk appears to correlate directly with the severity of the hypertensive condition, and preeclampsia poses a greater risk than

gestational hypertension. The exact mechanisms linking preeclampsia and future cardiovascular disease remain unclear, but shared risk factors and inflammatory processes are considered likely contributors. Chronic low-grade inflammation is emerging as a critical factor, potentially linking hypertensive disorders in pregnancy with atherosclerosis and broader cardiovascular disease [4,5].

Despite decades of research, the exact pathogenesis of preeclampsia is not fully understood. Endothelial dysfunction and systemic inflammation are central to the disease's progression, largely due to abnormal placentation and resulting placental ischemia. This ischemia activates an exaggerated inflammatory response from the maternal immune system, giving rise to the clinical symptoms of preeclampsia. Although the underlying cause remains elusive, growing evidence suggests that disruption in normal endothelial function plays a primary role. One key biomarker that has received increasing attention in this context is C-reactive protein (CRP), particularly its high-sensitivity form, hs-CRP. This protein, produced by the liver during acute inflammatory states, is a crucial element of the immune response and rises rapidly following tissue damage or infection [6,7].

High-sensitivity CRP (hs-CRP) has become one of the most widely studied inflammatory markers. It was initially discovered in 1930 and was later recognized as an acute-phase protein produced in the liver in response to systemic inflammation. Its levels rise sharply in response to pathological stimuli, and because of its stable half-life, its concentration in blood largely reflects the rate of synthesis. By the mid-20th century, elevated CRP levels were noted during myocardial infarction, and subsequent studies linked even mildly elevated hs-CRP levels with increased risk of stroke and cardiovascular disease. High-sensitivity assays enabled more accurate detection of this protein, leading organizations like the CDC and AHA to adopt hs-CRP as a standard cardiovascular risk marker in 2003. Similarly, in 2016, the European Society of Cardiology recognized hs-CRP levels as a reliable cardiovascular risk stratification tool, comparable in utility to conventional risk factors [8-10].

In pregnancy, hs-CRP levels tend to be naturally higher than in non-pregnant women, reflecting physiological changes such as heightened immune activity. Research indicates that hs-CRP levels gradually rise during gestation, peaking in the third trimester. Median hs-CRP values range from 2–5 mg/L in early pregnancy to as high as 10–15 mg/L in later stages, compared to <1 mg/L in non-pregnant women. These elevations are even more pronounced in women with pregnancy complications such as preeclampsia and gesta - tional diabetes. Notably, the inflammatory state associated with preeclampsia may persist even after delivery, contributing to long-term cardiovascular risks [11,12].

Hs-CRP is considered more sensitive than standard CRP tests for detecting underlying low-grade inflammation and tissue injury. Since it can be measured through routine blood samples collected during pregnancy, it offers a practical method for early detection and risk assessment. However, research on the association between hs-CRP levels and adverse fetomaternal outcomes in preeclampsia remains limited. Previous studies have often failed to control for confounding variables like age, socioeconomic status, and body mass index. The present study aims to bridge these gaps, exploring the relationship between elevated hs-CRP levels, hypertensive disorders of pregnancy, and future cardiovascular risk in women. It also examines the potential role of hs-CRP as a predictive marker for assessing the severity of preeclampsia, moving beyond isolated analyses of inflammatory markers to present a comprehensive evaluation [13,14].

The primary objective of this study is to estimate and compare the serum high-sensitivity C-reactive protein (hs-CRP) levels between pregnant women diagnosed with preeclampsia and those who are normotensive. Additionally, the secondary objective is to determine the association between hs-CRP levels and the severity of adverse fetomaternal outcomes in women affected by preeclampsia.

MATERIALAND METHODS

This Prospective cohort study was conducted at the Department of Obstetrics and Gynecology, All India Institute of Medical Sciences, Raipur for 18 months. Ethical approval has been obtained from the Ethical Approval Committee of All India Institute of Medical Sciences, Raipur.

Study Population

The study population comprised antenatal women aged 21 to 40 years with singleton pregnancies between 20+0 and 40+0 weeks of gestation, attending the Obstetrics and Gynecology OPD/IPD at AIIMS and willing to participate. It included women diagnosed with preeclampsia per ISSHP 2018 criteria and matched normotensive controls. Exclusion criteria included multiple pregnancies, obesity, chronic medical conditions, infections, substance use, and unwillingness to follow up. The study duration was 18 months.

Data Analysis

Data analysis will be performed using SPSS 20 for Windows. Continuous variables will be expressed as mean ± standard deviation, and categorical variables as percentages. An Independent T-test will be applied to compare differences between the two groups, and Pearson correlation will assess the association between serum hs-CRP levels and fetomaternal outcomes. A two-sided p-value of less than 0.05 will be considered statistically significant in all analyses.

RESULTS

The prospective cohort study titled “Serum high-sensitivity C-Reactive Protein (hs-CRP) levels in Pregnant women with Preeclampsia compared to Normotensive pregnant women” was conducted by the Department of

Obstetrics and Gynecology at AIIMS Raipur between March 2023 and October 2024. It initially enrolled 130 pregnant women between 20+0 to 40+0 weeks of gestation, but after excluding 27 participants due to gestational hypertension and diabetes, and losing 11 to follow-up, data from 92 women were analyzed. Participants,aged 21–40 years with singleton pregnancies, were divided into two groups: those with preeclampsia and normotensive controls. All underwent standard clinical evaluations and were followed until delivery. Age distribution was statistically comparable between the groups, with a mean age of 29.67 years in the preeclampsia group and 28.22 years in the normotensive group. However, significant differences were observed in BMI, with a higher proportion of overweight and obese individuals in the preeclampsia group (p=0.037), and a higher mean BMI (21.47 kg/m² vs. 20.51 kg/m²; p=0.025). Educational levels, socioeconomic status (as per Modified B.G. Prasad Scale 2024), residential area (rural vs. urban), and religious affiliation were broadly similar across both groups with no statistically significant differences. The findings suggest a potential link between higher BMI and preeclampsia, while other demographic factors remained comparable.

Among the 92 participants, the period of gestation at enrolment showed no statistically significant difference between the preeclampsia and normotensive groups (p = 0.128). Most women in both groups enrolled during 28^{+0} to 31^{+6} weeks of gestation (50% in the preeclampsia group and 30.43% in the normotensive group). The mean gestational age at enrolment was 30.5 ± 3.81 weeks in the preeclampsia group and 31.54 ± 4.47 weeks in the normotensive group (p = 0.234), suggesting no meaningful difference. Regarding onset, 60.87% of preeclampsia cases were classified as late-onset (after 34 weeks), while 39.13% were early-onset (at or before 34 weeks). Additionally, 56.52% of preeclampsia cases were preterm (delivered at or before 36^{+6} weeks), and 43.48% were term (delivered at or beyond 37 weeks). Among those with preeclampsia, 76.09% exhibited severe features, while 23.91% did not.

Table 1: Distribution of pregnant women with Preeclampsia with severe features and pregnant women with Preeclampsia without severe features based on blood pressure at the time of enrolment

Blood pressure at the time of enrolment	PE* with severe features(N1=35)	PE without severe features(N2=11)	Total(N= 46)	P value‡
(A) Systolic blood pressure (mmHg)				
Mean ± SD	150 ± 15.15	137.82 ± 6.72	147.09 ± 14.53	0.014
Median(25th-75th percentile)	150(140-158)	140(130-141)	145(140-150)	
Range	130-200	130-148	130-200	
(B) Diastolic blood pressure (mmHg)				
Mean ± SD	98 ± 10.02	90.91 ± 10.44	96.3 ± 10.46	0.049
Median(25th-75th percentile)	100(90-100)	90(85-100)	100(90-100)	
Range	74-130	70-100	70-130	
(C) Mean arterial pressure (mmHg)				
Mean ± SD	132.67 ± 12.46	122.18 ± 5.19	130.16 ± 11.99	0.01
Median(25th-75th percentile)	130(126.667-138.333)	121.33(118.333-126.667)	128(122.833-133.333)	
Range	111.33-176.67	113.33-128.67	111.33-176.67	

‡ Independent t test *Preeclampsia

At the time of enrolment, pregnant women with preeclampsia with severe features had significantly higher mean systolic (150 ± 15.15 mmHg), diastolic (98 ± 10.02 mmHg), and mean arterial pressure (132.67 ± 12.46 mmHg) compared to those without severe features (137.82 ± 6.72 mmHg, 90.91 ± 10.44 mmHg, and 122.18 ± 5.19 mmHg respectively), with all differences being statistically significant (p < 0.05).

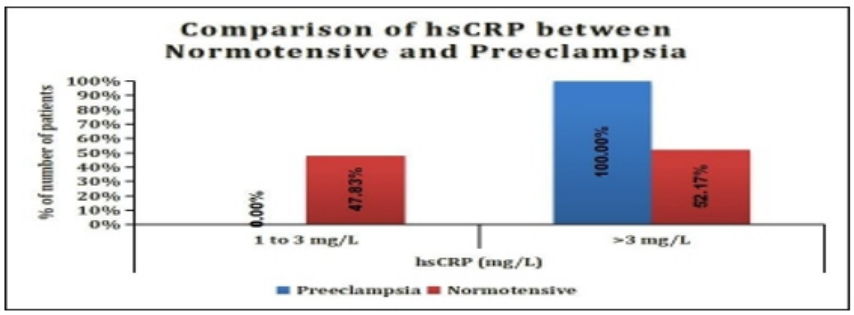

Figure 1: Comparison of high-sensitivity C-Reactive Protein (hs-CRP) between Normotensive and Preeclampsia

High-sensitivity C-reactive protein (hs-CRP) levels were significantly elevated in preeclamptic patients compared to normotensive patients, with 100% of preeclamptic cases showing hs-CRP > 3 mg/L versus 52.17% in normotensives ($p < 0.0001$); mean hs-CRP was 12.36 ± 9.71 mg/L in preeclampsia and 3.54 ± 2.41 mg/L in normotensives, also showing a statistically significant difference.

High-sensitivity C-Reactive Protein (hs-CRP) levels were elevated (>3 mg/L) in all cases of Preeclampsia (PE), irrespective of the presence or absence of severe features, early or late onset, or term versus preterm classification. Although hs-CRP levels were higher in PE cases with severe features (median 9.23 mg/L) compared to those without severe features (median 8.64 mg/L), the difference was not statistically significant ($p = 0.263$). Similarly, early-onset PE cases showed a higher median hs-CRP level (11.58 mg/L) than late-onset cases (8.88 mg/L), but this difference also lacked statistical significance ($p = 0.087$). However, a statistically significant difference was observed when comparing preterm and term PE; the preterm group had a notably higher median hs-CRP level of 9.33 mg/L compared to 7.27 mg/L in the term group ($p = 0.032$), suggesting a stronger inflammatory response in preterm Preeclampsia.

Compared to normotensive women, those with preeclampsia had significantly more adverse delivery outcomes. A much higher proportion of preeclamptic patients delivered preterm (56.52% vs. 6.52%) and fewer reached term gestation (43.48% vs. 93.48%), with the difference being highly significant ($p < 0.0001$). The onset of labor in preeclamptic women was less likely to be spontaneous (21.74% vs. 58.70%) and more often required induction (41.30% vs. 36.96%) or led directly to cesarean section (LSCS) (36.96% vs. 4.35%) ($p < 0.0001$). Regarding the mode of delivery, vaginal births were significantly lower in preeclamptic patients (32.61% vs. 63.04%), while both elective (19.57% vs. 4.35%) and emergency cesarean sections (47.83% vs. 32.61%) were more common ($p = 0.006$). These findings collectively suggest that preeclampsia is strongly associated with increased obstetric interventions and unfavorable delivery patterns.

Preeclamptic patients had a significantly higher incidence of early deliveries, with 26.09% delivering between 28^{+0} to 31^{+6} weeks compared to none in the normotensive group, and 30.43% delivering between 32^{+0} to 36^{+6} weeks versus only 6.52% in the normotensive group. Conversely, a significantly lower proportion of preeclamptic patients delivered at term (37^{+0} to 40^{+0} weeks) compared to normotensive patients (43.48% vs. 93.48%), with a p value of < 0.0001. The mean gestational age at delivery was also significantly lower in the preeclampsia group (35.06 ± 3.4 weeks) compared to the normotensive group (38.44 ± 1.42 weeks), further highlighting the association between preeclampsia and preterm delivery ($p < 0.0001$).

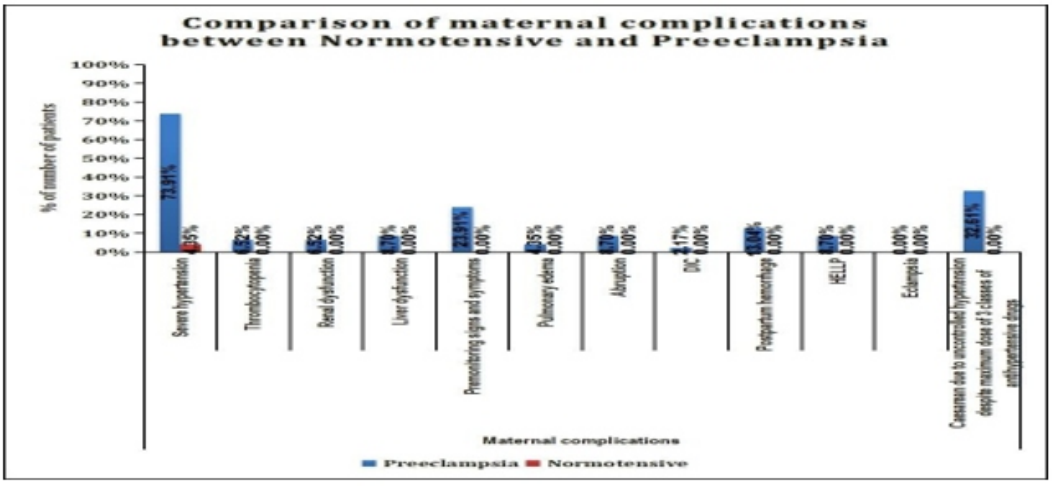

Figure 2: Comparison based on maternal complication between pregnant women with Preterm Preeclampsia and Term Preeclampsia

Preeclamptic women had significantly higher rates of severe hypertension (73.91%), premonitoring signs and symptoms (23.91%), postpartum hemorrhage (13.04%), and caesarean delivery due to uncontrolled hypertension (32. 61%) compared to normotensive women, while other complications like thrombocytopenia, renal or liver dysfunction, and HELLP syndrome were not statistically different between the groups.

The analysis of high-sensitivity C-Reactive Protein (hs-CRP) levels among 46 preeclampsia (PE) patients showed no statistically significant association with severe hypertension, thrombocytopenia, renal dysfunction, pulmonary edema, placental abruption, or disseminated intravascular coagu - lation (DIC), as indicated by p-values above 0.05 in each comparison. The median hs-CRP levels were slightly higher in PE patients with these complications compared to those without, but differences were not statistically meaningful. However, significantly elevated hs-CRP levels were observed in PE patients with liver dysfunction and those presenting premonitoring signs and symptoms. Specifically, the median hs-CRP was 22.86 mg/L in those with liver dysfunction versus 8.97 mg/L in those without (p = 0.005), and 19.22 mg/L in those with premonitoring signs versus 8.23 mg/L in those without (p = 0.003), suggesting a possible link between systemic inflammation and these specific complications in preeclampsia.

Table 2: Association of hs-CRP with Short for gestational age (SGA) & with Fetal Growth Restriction (FGR)& with Intrauterine Fetal demise (IUFD)^ babies in Preeclampsia(PE) group**

Hs- CRP (mg/dl)	PE with SGA babies (N1=1)	PE without SGA babies (N2=45)	P value	PE with FGR babies (N1=21)	PE without FGR babies (N2=25)	P value	PE with IUFD babies (N1=4)	PE without IUFD babies (N2=42)	P value
Mean ± SD	45.22 ± 0	11.63 ± 8.44	0.092§	15.13 ± 10.3	10.03 ± 8.71	0.046§	8.63 ± 7.45	12.72 ± 9.89	0.311§
Median(25th-75th percentile)	45.22 (45.22-45.22)	9.2 (5.5-14.22)		11.23 (7.88-22.5)	8.64 (5.32-11.11)		6.28 (3.188-11.72)	9.21 (6.23-14.715)	
Range	45.22-45.22	3.06-37.82		3.23-37.82	3.06-45.22		3.06-18.92	3.2-45.22	

§ Mann Whitney test

In the preeclampsia group, hs-CRP levels were significantly higher in those with fetal growth restriction (mean 15.13 mg/L vs. 10.03 mg/L, p = 0.046), while no statistically significant associations were found with short for gestational age (SGA) babies (p = 0.092) or intrauterine fetal demise (IUFD) (p = 0.311).

Table 3: Association of hs-CRP with Non reassuring Non stress test (NST)$ & with meconium stained liquor (MSL)# & with Neonatal Intensive Care Unit(NICU) admission! in pregnant women with Preeclampsia(PE)

Hs- CRP (mg/dl)	PE with non reassuring NST (N1=13)	PE without non reassuring NST (N2=33)	P value	PE with MSL (N1=8)	PE without MSL(N2=38)	P value	PE with NICU admission (N1=23)	PE without NICU admission(N2=19)	P value
Mean ± SD	14.48 ± 13.3	11.53 ± 7.98	0.826§	16.13 ± 13.56	11.57 ± 8.72	0.451§	15.86 ± 11.98	8.91 ± 4.42	0.095§
Median(25th-75th percentile)	9.12 (5.02-20)	9.22 (6.2-14.22)		14.02 (6.25-19.925)	9.21 (5.675-13.538)		9.34 (7.785-22.86)	8.64 (5.85-11.17)	
Range	3.22-45.22	3.06-37.82		4.2-45.22	3.06-37.82		3.22-45.22	3.2-19.9	

**SGA= Short for Gestational Age(95) , &FGR = fetal growth retardation(96)

^IUFD = intrauterine fetal demise(97), $ Nonreassuring NST (non stress test)(98)

MSL = meconium stained liquor, ! NICU= neonatal intensive care unit

In pregnant women with preeclampsia, no significant association was found between hs-CRP levels and non-reassuring NST (p = 0.826), meconium-stained liquor (p = 0.451), or NICU admission (p = 0.095).

Table 4: Association of fetal growth retardation (FGR) (96) stage between Preeclampsia and Normotensive group

FGR stage (99)	**Preeclampsia(N1=21) n (%)**	**Normotensive(N2=3) n (%)**	**Total (N= 24) n(%)**	**P value**
Stage 1	11 (52.38%)	3 (100%)	14 (58.33%)	0.73*
Stage 2	6 (28.57%)	0 (0%)	6 (25%)	
Stage 3	3 (14.29%)	0 (0%)	3 (12.50%)	
Stage 4	1 (4.76%)	0 (0%)	1 (4.17%)	
Total	21 (100%)	3 (100%)	24 (100%)	

* Fisher's exact test

In comparing the fetal growth retardation (FGR) stages between preeclamptic and normotensive groups, no significant difference was observed across stages 1 to 4, with both groups showing a similar distribution (p = 0.73).

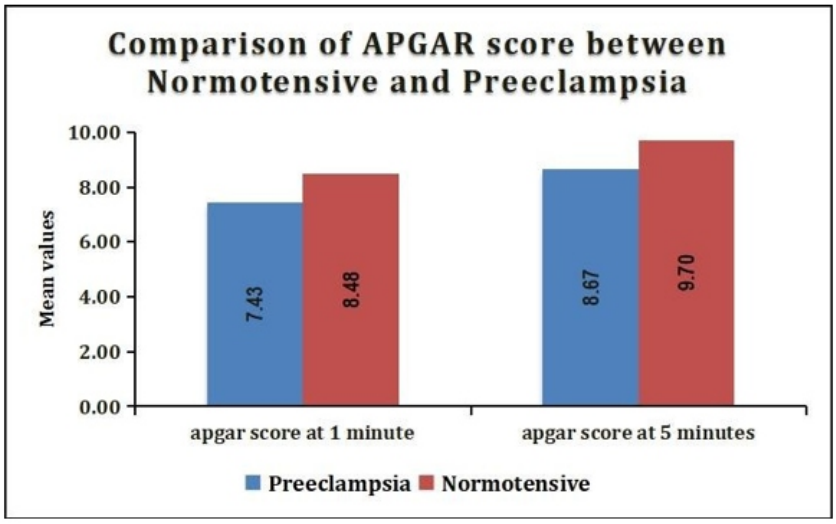

Figure 3: Association of APGAR score in Preeclampsia and Normotensive group

The APGAR scores at 1 and 5 minutes were significantly lower in the preeclamptic group compared to the normotensive group. The mean scores at 1 minute were 7.43 ± 1.56 vs. 8.48 ± 1.09 (p = 0.0005), and at 5 minutes were 8.67 ± 1.43 vs. 9.7 ± 0.84 (p = 0.0001).

Table 5: Comparison of hs-CRP between Preeclampsia and Normotensive group

hsCRP (mg/L)	**Preeclampsia (n=46)**	**Normotensive (n=46)**	**Total**	**P value**	**Odds ratio (95% CI)**
≤4.4 mg/L	8 (17.39%)	40 (86.96%)	48 (52.17%)	<.0001†	31.667(10.048 to 99.796)
>4.4 mg/L	38 (82.61%)	6 (13.04%)	44 (47.83%)		
Total	46 (100%)	46 (100%)	92 (100%)		

† Chi square test

The proportion of patients with hs-CRP levels >4.4 mg/L was significantly higher in the preeclampsia group compared to the normotensive group (82.61% vs. 13.04%), with an odds ratio of 31.667 (10.048 to 99.796). Additionally, hs-CRP >4.4 mg/L had excellent discriminatory power for predicting preeclampsia, with an AUC of 0.889.

DISCUSSION

Preeclampsia is a significant complication during pregnancy, arising from an exaggerated systemic inflammatory response and immune activation. While the exact origin of this inflammatory state is not fully understood, it plays a central role in the disease's development. Among the hypertensive disorders of pregnancy, preeclampsia is the most prevalent, accounting for nearly half of the cases and presenting serious risks to both mothers and fetuses. Globally, its prevalence varies between 4% and 18%, with rates in India reported at approximately 8–10% [15,16].

The underlying cause of preeclampsia is believed to be poor placental development, leading to placental ischemia and a heightened maternal inflammatory response. This cascade results in systemic inflammation and endothelial dysfunction, which are core features of the disease and explain its broad range of clinical manifestations. The resulting endothelial damage contributes to maternal complications like multiorgan dysfunction and adverse fetal outcomes such as intrauterine growth restriction and preterm delivery. The severity of preeclampsia is directly linked to the risk of future cardiovascular diseases, highlighting the importance of understanding this condition not only in the context of pregnancy but also for long-term maternal health [17,18].

A key marker that has gained attention in the study of preeclampsia is high-sensitivity C-reactive protein (hs-CRP), an acute-phase protein produced by the liver in response to inflammatory cytokines such as interleukin-6. Hs-CRP is widely recognized for its role in indicating systemic inflammation in conditions like infections, cancers, and cardiovascular diseases. Elevated levels of hs-CRP are strongly associated with the inflammatory and endothelial disturbances observed in preeclampsia. Given its stable half-life and sensitivity to inflammatory stimuli, hs-CRP serves as a reliable biomarker for assessing the severity and progression of preeclampsia [19,20].

Studies have shown significantly higher serum hs-CRP levels in preeclamptic women compared to those with normotensive pregnancies. These elevated levels reflect the heightened inflammatory state and endothelial dysfunction, correlating with disease severity and poor perinatal outcomes. Furthermore, elevated hs-CRP during pregnancy may serve as a predictor of future cardiovascular risk in women with a history of preeclampsia, underscoring its relevance in both immediate and long-term maternal care [21].

A recent prospective cohort study was conducted to explore the role of serum hs-CRP as a predictor and marker of severity in preeclampsia. It also examined the influence of demographic factors on the condition. In this study, non-severe preeclampsia was observed in 23.91% of cases, while severe preeclampsia accounted for 76.09%. The mean age of participants in the preeclampsia group was 29.67 years, similar to the normotensive group, indicating that age was not a distinguishing factor [22].

Hs-CRP levels varied significantly across groups, with normal pregnant women showing mean levels of 6.7 mg/L, mild preeclamptics at 9.2 mg/L, and those with severe features reaching 12.8 mg/L, illustrating a strong link between hs-CRP and disease severity. The body mass index (BMI) was another distinguishing factor; women in the preeclampsia group had significantly higher BMIs than their normotensive counterparts. Overweight and obese women were more frequently represented in the preeclampsia group, suggesting a correlation between increased BMI and risk of developing the condition [23].

Educational level, socioeconomic status, religion, and area of residence showed no significant differences between preeclamptic and normotensive women, indicating that these factors may not independently contribute to the risk. Similarly, gravidity patterns were evenly distributed in both groups, with no notable statistical variations. The gestational age at enrollment was also comparable, showing no significant deviation between the two groups [24].

Overall, the study reinforces the critical role of systemic inflammation in preeclampsia and highlights hs-CRP as a promising biomarker for diagnosis and prognostication. It emphasizes the need to monitor women with elevated hs-CRP levels during pregnancy, not only to manage immediate risks but also to assess potential long-term cardiovascular health implications [25].

CONCLUSION

This study underscores the significance of high-sensitivity C-reactive protein (hs-CRP) as a biomarker for predicting preeclampsia and its complications. Elevated Hs-CRP levels in preeclamptic pregnancies are associated with severe outcomes such as preterm births, fetal growth restriction, NICU admissions, maternal thrombocytopenia, and hepatic and renal dysfunction, highlighting its potential utility in early risk assessment and management. Given the role of low-grade inflammation in cardiovascular disorders and the fact that absence of proteinuria does not imply lower risk, all hypertensive pregnant women should be monitored closely. These findings emphasize the need for further research into anti-inflammatory interventions.

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