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Seasonal Influence on Pattern of Admission of Preeclampsia with Severe Features in Southeast Region of Bangladesh

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Abstract

Introduction: ***Preeclampsia (PE) is the second most common cause of maternal death worldwide. Geographic, sociodemographic, racial, and economic factors have all been proposed as contributors to the rate variations of PE. Among them, seasonal factors (temperature and humidity) may influence PE. Climate change has been connected to the global pattern of PE. The study was conducted to find out the hospital prevalence of SPE in different seasons in a tertiary hospital in the Southeastern part of Bangladesh and its influence on feto-maternal outcomes.***

Methods: ***This cross-sectional study was performed in the Department of Obstetrics and Gynecology, Chittagong Medical College Hospital (CMCH) from February 2021 to January 2022. The study year was divided into four seasons: Summer (March to May), Monsoon (June to August), Autumn (September to November), and Winter (December to February) according to the seasons of Bangladesh. The prevalence of SPE and meteorological differences in the four seasons and over the English calendar month was compared.***

Results: ***In the past year, 19183 obstetrics patients were hospitalized, 14661 births were documented, and 8,908 CS occurred. Pregnancy-related hypertension was 2150, PE was 1597 (8.33% of all hospitalizations), and SPE was 1315 (6.80% hospital prevalence). Eclampsia was 552 Winter has the most SPE (8.01%) and Autumn the least (5.97%). Winter SPE risk was much higher than Autumn (OR + 1.37, 95% CI: 1.18-1.59). Summer had 22.44% delivery rates, whereas Autumn had 53%. SPE-related CS was lowest in Monsoon (9.78%) and highest in Winter (13.54%). SPE-related CS was 1.38 times higher in winter using the Monsoon as the reference season. Monthly SPE prevalence was 5.23%–9.28%. Average monthly temperature was adversely connected with S. PE admission (r= -0.71; P=0.01). Of 1,315 SPE admissions, 27 women died (2.05%). Others were released alive. There were 64 maternal deaths during the research. SPE killed 42.19% of mothers in four seasons. SPE caused 33 stillbirths (2.92%) out of 1132 deliveries. SPE accounted for 12.09% of 273 SB from all sources in four seasons.***

Conclusion: ***This study supports the concept of seasonal influence on the admittance of preeclampsia patients. In the tropical climate, the incidence appeared to be higher in the Winter, with peaks at inter-seasonal periods, when the weather is cooler than the rest of the year. So, a lower temperature is linked to severe Preeclampsia. Understanding the relationship of SPE with Bangladesh's different seasons will help identify the triggering factors of PE and eclampsia(EC).***

Keywords: ***Preeclampsia, Severe Preeclampsia, Seasonal variation.***

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Introduction

Hypertensive disorder in pregnancy (HDP) is a major cause of maternal mortality worldwide[1]. Among the types of HDP, the incidence of Preeclampsia (PE) worldwide is 5-7%[2]. PE is a common complication during pregnancy and causes 10-15% of maternal deaths globally[3], Preeclampsia/eclampsia (PE/EC) complicates 4.6% and 1.4% of pregnancies worldwide. PE women account for 4.6% (95% CI;2.7% to 8.2%) of all deliveries worldwide [4]. The incidence of PE/EC varies from one part of the world to another. The incidence is low in Western countries with excellent antenatal care (ANC)[5]. However, PE/EC are reported to be more common in developing nations (2.8% of live deliveries) than in developed nations (0.4%)[6]. PE in Asia is 100 to 200 times higher than in Europe and North America.[Duley L.2009] Geographic, sociodemographic, racial, and economic factors have all been proposed as contributors to rate variations[7].

The cause of PE is still not clearly understood. Among the proposed genetic and environmental factors, nutritional, immunological, and infectious theories are common[8]. There are various risk factors for the development of PE. They are - Nuliparity, Multifetal gestations, PE in a previous pregnancy, chronic hypertension, pre-gestational diabetes, gestational diabetes mellitus(GDM), thrombophilia, systemic lupus erythematosus, pre-pregnancy body mass index greater than 30, anti-phospholipid antibody syndrome, maternal age 35 years or older, kidney disease, assisted reproductive technology, obstructive sleep apnea[9].

There has recently been mounting data suggesting that PE/EC may be influenced by the season[10]. Climate change has been connected to the global pattern PE/EC. Some studies have linked increased PE incidence to wet, humid seasons in tropical and non-tropical regions [11], while others have found no link[7]. Others have noticed increased incidence due to the hot weather and low humidity throughout the summer[12]. Low atmospheric temperature and barometric pressure and excessive humidity and rainfall have been linked to EC and possibly the trigger of seizures in the presence of PE in the literature[13].

So, Identifying the cause of disease and reducing maternal mortality is an important indicator of health worldwide. The current study aimed to determine seasonal trends of SPE admission to the hospital to see whether the prevalence of SPE depends on the season or English calendar month and whether temperature and humidity influence SPE.

Methodology

Study type:

It was a cross-sectional study conducted in the Department of Obstetrics and Gynecology, Chattogram Medical College Hospital, over one year (February 2021 to January 2022). All women diagnosed with PE/EC or HELLP syndrome(Together, PE group) admitted to the hospital were recruited.

Study Procedure:

All pregnant women with suspected PE were seen on the presentation by attending doctors at the Department of Obstetrics and Gynaecology. A bedside urinary strip test for detecting albumin in pregnant women with raised blood pressure during pregnancy beyond 28 weeks was done to confirm PE. If the urinary strip test was positive and the patient/relative had approved research work. The women were then categorized into mild or SPE. Consent was sought for recruitment if the women fulfilled the criteria of S. PE.

Data collection, processing, and analysis:

All data extracted from hospital registers were entered into SPSS (version 23.0) for analysis. Categorical variables were expressed as frequency and percentage. Seasonal prevalence of pre-eclampsia (PE) was calculated as the number of PE cases divided by total obstetric admissions in each season; winter served as the reference season. Prevalence ratios and Odds Ratios (OR) with 95% CIs were computed to compare the risk of PE, severe PE, eclampsia, and HELLP across seasons and months. Associations between categorical variables were tested using the Chi-square test, with statistical significance set at $p < 0.05$. Seasonal classification followed the Bangladesh Meteorological Department: Winter (Dec–Feb), Summer/Pre-Monsoon (Mar–May), Monsoon (Jun–Aug), and Autumn/Post-Monsoon (Sep–Nov) (Climate Division; 2.https://seasonsyear.com/Bangladesh)[14].

Ethical consideration:

The Institutional Ethical Review Committee (ERC) approved the study protocol for Medical Research

Ethics. The study was conducted following the Declaration of Helsinki. Written informed consent was obtained from the patients and legal guardians as necessary.

Results:

Seasonal Trends of Admission of Severe Preeclampsia (SPE):

Over twelve months, 19183 obstetrics patients were admitted, and 14661 deliveries were recorded in this tertiary care hospital. Among them, hypertensive disease in pregnancy (HDP) was 2150 (11.20%), PE was diagnosed in 1597 patients (8.33% of all admissions), and SPE was 1315, giving a 6.80% hospital prevalence of SPE. Eclampsia(a major complication of SPE) was recorded in 552 (2.88%) women (369 antepartum eclampsia[APE] and 183 post-partum eclampsia[PPE]).

Prevalence of SPE:

The monthly prevalence of SPE ranged from 5.23 to 9.28% over the year. The peak monthly prevalence of the year was recorded in January, July, and February, and dips of prevalence were recorded in June, September, and October.

Figure 1 depicts, Prevalence was highest in February-9.28 %(a month of Winter) and lowest in June-5.23%(a month of Summer). EC admissions were peak in July, February, and October and lowest in December, June, and March.Table 1 shows the distribution of total admission and HDP per month from February 2021 to January 2022.

Correlation of temperature and humidity with admission frequency of SPE

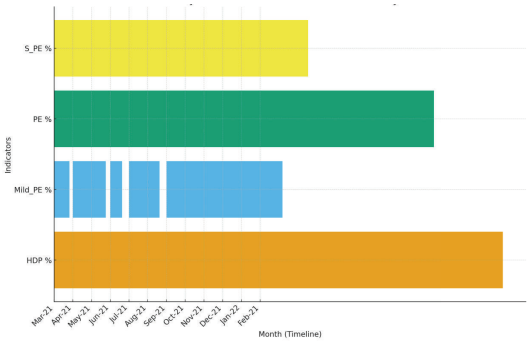

Figure 1: *Monthly percentages for HDP, Mild PE, PE, and Severe PE.(from Mar-21 to Feb-22)*

Figure-2A & B depict the correlation between average monthly temperature with admission frequency of SPE and HDP. There was a significant negative correlation between average monthly temperature and admission of S. PE(r= -0.71; *P*=0.01). (Fig.2A) However, the number of HDP admissions did not correlate with the average monthly temperature(r= -0.06; *P*=-0.55). (Fig-2B).

There was no correlation between average monthly humidity and admission of S. PE(r= -0.35; *P*=0.26). There was also no significant correlation between the number of admissions of SPE with humidity.

Seasonal Variation in Prevalence of SPE

The result showed that the prevalence of SPE changed in different seasons and temperatures in Bangladesh. The prevalence of SPE varied slightly by the delivery season and was found to be lowest in the Autumn (5.97%) and highest in the Winter (8.01%). The prevalence ratio for SPE in Winter (1.34) was significantly higher using Autumn as the reference season (the highest obstetrics admission occurred in this season).

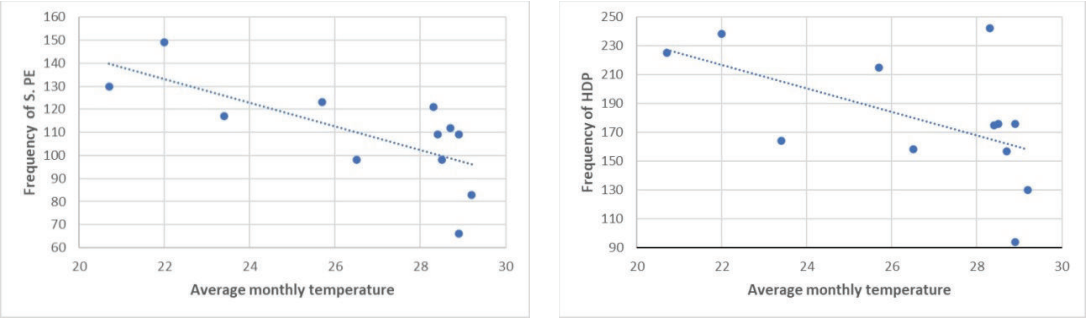

Figure-2A & 2B: *Correlation of Average monthly temperature with admission frequency of SPE and HDP*

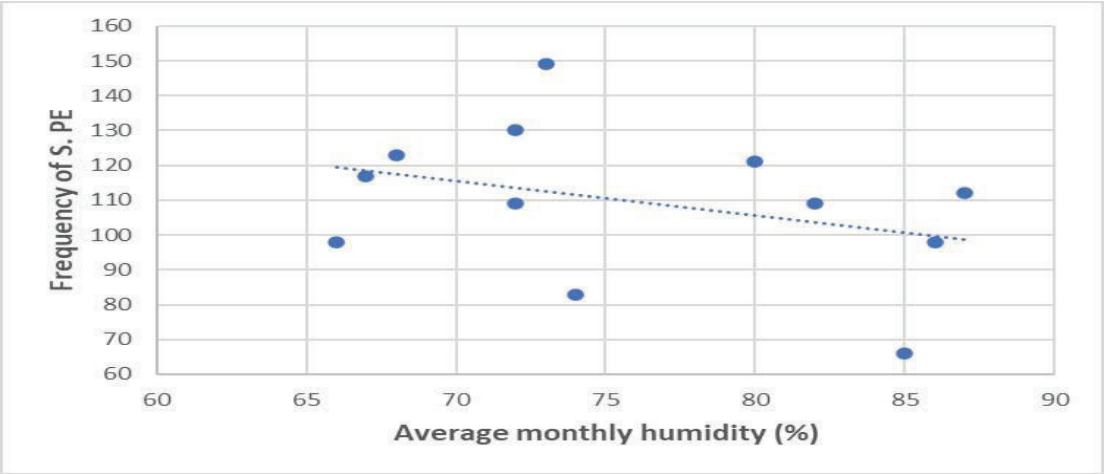

Figure 3: *Correlation of Monthly average humidity with SPE admission*

There were significantly more cases of SPE in Winter. The risk of developing SPE in Winter was significantly higher than that of developing SPE in Autumn (OR + 1.37, 95% CI: 1.18-1.59). (Table 3) SPE incidence did not differ between the Monsoon and Summer. Admission due to EC was more in Winter (167,30.25%) and less in summer (109,19.75%) (table 1)

Seasonal variation of the mode of delivery of SPE

The total deliveries in the study period were 14,661, and the operative deliveries were 8,908(60.76%). The most deliveries (2,720,30.53%) occurred in Autumn, and the lowest in summer (1,946,22.44%). The prevalence of SPE among all HDP admissions varied by the delivery season and was found to be lowest in the Autumn (74%) and highest in the Winter (2.46%). The prevalence ratio for SPE in Winter (1.34) was significantly higher using Autumn as the reference season. There were significantly more cases of SPE in Winter. The risk of developing SPE in Winter was significantly higher than that of developing SPE in Autumn (OR + 1.37, 95% CI: 1.18-1.59). (Table-2)

Table-I

*Prevalence and prevalence ratio of Severe pre-eclampsia patients admitted in CMCH per season and Odds Ratios (OR) with 95% confidence interval (CI)**

Seasons	Total obs. admission (19183)	Total S. PE cases (n=1315)	Prevalence of S. PE in comparison to total obs. admission	Prevalence Ratio	OR of SPE (95% CI for OR)
Autumn (Sept.-Nov.)	5913 30.82%	353	5.97	1	1
Winter (Dec.-Feb.)	4944 25.77%	396	8.01	1.34	1.37 (1.18-1.59)
Summer (March-May)	4264 22.23%	290	6.80	1.14	1.15 (0.98-1.34)
Monsoon (June– Aug.)	4062 21.18%	276	6.79	1.14	1.15 (0.97-1.35)

Table-II

*Prevalence and prevalence ratio of CS due to Severe pre-eclampsia in CMCH per season and Odds Ratios (OR) with 95% confidence interval (CI)**

Seasons	Total operative delivery(n)(%)	Total CS due to S PE(%)	Prevalence of CS due to SPE comparison to total operative delivery	Prevalence ratio	OR (95% CI for OR)
Monsoon (June– Aug.)	1923 (28.59)	188 (46.88)	9.78	1	1
Autumn (Sept.-Nov.)	2720 (30.53)	307 (54.34)	11.29	1.15	1.17 (0.96-1.42)
Winter (Dec.-Feb.)	2319 (26.03)	314 (54.6)	13.54	1.38	1.44 (1.19-1.75)
Summer (March-May)	1966 (22.44)	217 (50.2)	11.04	1.13	1.11 (0.91-1.37)

*Monsoon is the reference season

Seasonal variation of feto-maternal death:

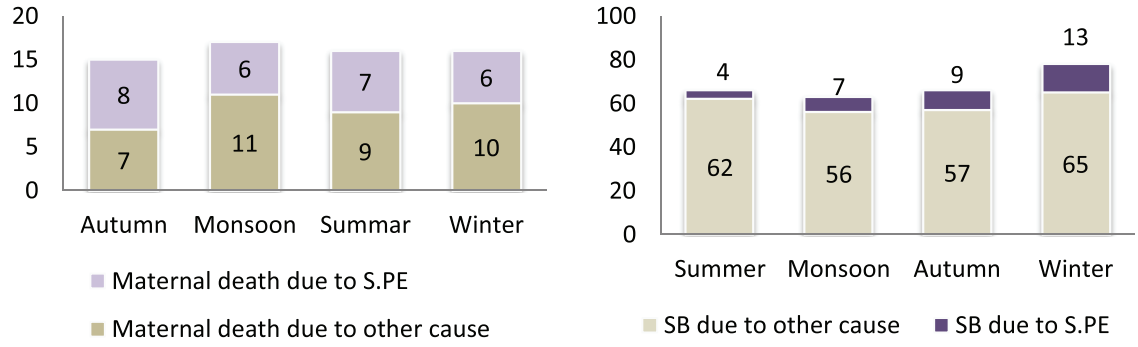

Fig 4A &4B: Seasonal distribution of Feto-Maternal outcome(death), CMCH, Bangladesh

Figure 4A depicts maternal death due to SPE. twenty-seven (2.05%) women died from SPE among 1,315 SPE admissions, and the rest were discharged home alive. The total number of maternal deaths in four seasons was 64, and the contribution of maternal death due to SPE was 42.19%. Figure 5 B reflects that SB due to SPE was 33(2.92%) among 1132(excluding 183 PPE) SPE deliveries. The total SB in four seasons was 273, and the contribution of SB due to SPE was 12.09%.

Discussion

This study, conducted in the largest tertiary care hospital in southeast Bangladesh, identified a PE prevalence of 8.33%, comparable to reports from M. Eugene I et al.(7.2%) and Singh et al. (6.0%), yet lower than the 14.4% noted in another Bangladeshi cohort [15-17]. Global estimates demonstrate substantial geographical variation, with prevalence ranging from 0.2–6.7% in Asia to 1.8–7.7% in South America and the Caribbean [18]. WHO further highlights that PE is up to seven times more common in developing than in developed regions, with reported ranges of 1.8–16.7% [4,19-20]. In this study, SPE and eclampsia prevalence (6.8% and 2.6%) exceeded figures observed in Thailand and Europe, where eclampsia rates are as low as 0.71–3 per 10,000 births [21-22]. These discrepancies likely reflect the hospital's role as a tertiary referral center receiving high-risk, late-presenting cases from rural and socioeconomically disadvantaged populations.

Seasonal variation emerged as a notable factor, with SPE admissions peaking in the colder Winter months and demonstrating a significantly higher risk compared with Autumn (OR 1.37, 95% CI: 1.18–1.59). This pattern aligns with large-scale studies from Norway and U.S. cohorts, indicating increased PE incidence during colder periods or transitional seasons [23-25]. Hypothesized mechanisms include cold-induced vasospasm, haemoconcentration, alterations in neurohormonal response—particularly vasopressin—and seasonal fluctuations in diet and infection patterns. The high cesarean rate among SPE cases mirrors findings from other tertiary centers, attributed largely to late referral with complications necessitating operative delivery [26-27]. Maternal and perinatal outcomes were poorer than in several regional studies, underscoring the substantial contribution of hypertensive disorders of pregnancy to morbidity and mortality in resource-limited settings [28]. Overall, the study highlights the interplay of environmental, sociodemographic, and health-system factors in shaping the burden of SPE and emphasizes the need for strengthened antenatal surveillance and timely referral pathways.

Conclusion and Recommendation:

The overall magnitude of severe pre-eclampsia admission was comparable to the global average in the study setting. This study supports the concept of seasonal influence on the admittance of pre-eclampsia patients. In the tropical climate, the incidence appeared to be higher in the Winter, with peaks at inter-seasonal periods, when the weather is cooler than the rest of the year. SPE significantly impacts maternal morbidity and mortality in Bangladesh. Future epidemiologic studies of seasonal trends in SPE should strive to capture detailed maternal environmental exposure data such as the time spent outdoors and related factors such as maternal serum vitamin D, low levels of which have been linked to SPE.

Limitations

This study has some limitations. Demographic data collection was limited to the women who developed SPE and did not assess other possible confounding factors such as nutritional variation. Factors affecting hypertension during pregnancy were not assessed in the study.

Conflict of interest: None

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