

SEASONAL VARIATION IN THE OCCURRENCE OF ECLAMPSIA: A THREE YEAR RETROSPECTIVE COHORT STUDY IN A TERTIARY CENTRE IN EASTERN INDIA.

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ABSTRACT: BACKGROUND: There are ample evidences in the scientific literature that various weather parameters have their influences on hypertensive disorders of pregnancy. Eclampsia is a major cause of maternal mortality, morbidity and adverse fetal and neonatal outcome. This part of the country with a high incidence of eclampsia experiences extreme variations in weather parameters in different seasons of the year and thus demands scientific research and correlation if any. **OBJECTIVE:** To study the seasonal trends of occurrence of eclampsia and feto-maternal outcomes of eclampsia in different seasons and to find correlations between different weather parameters and eclampsia, if any. **STUDY POPULATION:** All the patients who have developed eclampsia during antenatal, intranatal or postnatal period in Department of Gynaecology and Obstetrics, Bankura Sammilani Medical College from 2010 to 2012. **METHODS:** It is a retrospective cohort study. We have analysed retrospectively all data from our hospital database, over 36 months of study period, from January 2010 to December 2012. Meteorological data (monthly mean temperature, monthly mean relative humidity, monthly mean barometric pressure, and monthly mean amount of precipitation) was acquired from regional weather stations and has been cross checked with other data available in the literature. Each year has been divided in three seasons winter (November to February), summer (March to June), monsoon- post monsoon (July to October). The occurrence of eclampsia and the different weather parameters among the three seasons were compared and analysed. **RESULTS:** During 36 months study period from January 2010 to December 2012 total 59150 deliveries were recorded. Out of which 1048 patients developed eclampsia (1.76%). Highest incidence of eclampsia was recorded in winter, 411(39.21%), followed by monsoon- post monsoon, 376(35.87%) and was lowest in summer, 261(24.09%). Difference in incidence, between summer and winter, summer and monsoon - post monsoon was statistically significant (P=0.016 and P=0.011) respectively but it was insignificant between winter and monsoon-post monsoon. **CONCLUSION:** Incidence of eclampsia varies significantly over various seasons in Bankura, eastern India. Highest incidence was recorded in winter followed by monsoon-post monsoon, strengthening the association of low temperature and increased humidity with eclampsia.

KEY WORDS: Seasonal variability, Humidity, Eclampsia.

INTRODUCTION: Eclampsia is a systemic disorder of pregnancy with multifactorial etiology and a leading cause of maternal mortality with adverse pregnancy outcome worldwide. Hypertensive disorder in pregnancy is following a secular trend of increased incidence. Association of various weather parameters with the occurrence of eclampsia has been found in various studies with conflicting reports. Two such studies suggest that there is no association between various

meteorological factors and incidences of eclampsia^[1,2]. On the other hand, a number of other studies suggest that incidence of eclampsia increases in cooler and humid condition^[3-5]. Magnus et al (2001) found increase incidence of eclampsia in winter. In USA, it is seen that incidence of eclampsia increases during the time of hurricane, which is associated with increased temperature, increased relative humidity^[6]. There is a lot of confusion regarding the influences of various weather parameters on the incidence of eclampsia and other hypertensive disorder in pregnancy. Some studies claim that incidence of hypertensive disorder in the form of preeclampsia and eclampsia is more in winter^[7-10], where as other investigators such as Tan et al suggested increased incidence of the same in favour of summer^[11]. One study found no differences in incidence of hypertensive disorder in pregnancy in dry and wet season in Zimbabwe^[12]. This part of the country where the study had been conducted experiences a wide range of variability among various weather parameters in different seasons. The mean temperature in the month of May, 2012 was 32.3°C, whereas in December, 2012 it was only 18.4°C, showing a huge difference. Other weather parameters also vary widely like that of temperature.

Such wide range of variability among weather parameters in this part of the country provide opportunity to follow and study the seasonal trend of occurrence of eclampsia and influences of various weather parameters on the incidence of eclampsia, if any. In the face of worldwide drastic climatic change the investigation of influences of weather parameters on eclampsia becomes more relevant.

In our study we have tried to address all these issues. We have tried to find out the seasonal trend of eclampsia in this institution and tried to find out the association of eclampsia with various weather parameters, in this unique as well as extreme weather condition.

MATERIAL AND METHODS: This study was a retrospective cohort study. Study period January 2010 to December 2012 and study population was all antenatal, intranatal and postnatal patients of Department of Gynaecology and Obstetrics, Bankura Sammilani Medical College, West Bengal. For diagnosis of eclampsia, recommendation of National High Blood Pressure Education Program (NHBPEP'2000) was the standard ("seizures that cannot be attributed to other causes in a woman with preeclampsia" is eclampsia). NHBPEP (2000) recommendation was the standard for diagnosis of hypertensive disorder in pregnancy during entire study. Hospital database that is maintaining all the records of the patients attending department of Gynaecology and Obstetrics was used, for a retrospective analysis for study period from 2010 to 2012.

From meteorological point of view each year was divided in three seasons depending upon the dominant weather parameters. Divisions were, winter (November to February), summer (March to June), monsoon and post monsoon (July to October). Monthly averages of meteorological parameters (monthly mean temperature, mean relative humidity, mean sea level pressure, and monthly average precipitation) were acquired from the local weather stations.

Incidence of eclampsia and weather parameters of three seasons were compared and analysed. Software used for statistical analysis SPSS, version 20 (SPSS Inc., Chicago, IL, USA).

RESULTS: We have analysed data for the study period of January 2010 to December 2012, a total span of 36 months. Total delivery during this period was 59150 and total number of eclamptic

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patients was 1048, incidence was 1.7610%. Number of maternal death due to eclampsia was 20 and perinatal death was 16.

Year	Number of deliveries	Number of eclamptic patients	No of maternal death due to eclampsia	No of perinatal death due to eclampsia.	Incidence of eclampsia.(%)
2010	18799	311	12	10	1.6543
2011	19941	337	4	02	1.6899
2012	20410	400	4	04	1.9598
2010-2012(Total)	59150	1048	20	16	1.7610

Table 1: Showing year wise distribution of total deliveries, eclamptic patients and fetomaternal outcomes of eclampsia and incidence of eclampsia.

There is a progressive increase in the incidence of eclampsia over three years. Occurrence of eclampsia in summer and monsoon seasons increased progressively over three years, though highest incidence was observed in winter. Together winter and monsoon and postmonsoon season comprises almost 75% of the total cases, intra year variability also corroborate this finding.

YR	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2010	31	16	9	16	30	9	28	21	23	28	51	49
2011	23	12	13	24	20	27	27	35	22	46	43	45
2012	18	29	26	26	29	32	28	40	32	46	46	48

Table 2: Showing month wise distribution of occurrence of eclampsia.

Year	Winter (Nov -Feb)	Summer (March-June)	Monsoon & Post monsoon (July-Oct)	Total
2010	147	64	100	311
2011	123	84	130	337
2012	141	113	146	400
2010-2012	411(39.21%)	261(24.09%)	376(35.87%)	1048(100%)

Table 3: Showing season wise distribution of eclampsia (From 2010 to 2012).

Mean occurrence of eclampsia per month was 34.25, 21.75, and 31.33 in winter, summer and monsoon and post monsoon season respectively.

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Seasons	Mean temp. (in °C)	Mean relative humidity	Total rain fall (in mm)	Mean sea level pressure (hPa)
Winter (2010-2012)	20.55	63.41%	219.45	1012.90
Summer (2010-2012)	30.21	60.13%	1176.54	1003.408
Monsoon (2010-2012)	28.117	84.40%	2582.43	1003.058

Table 4: Showing various weather parameters in winter, summer and monsoon and post monsoon season (2010-2012).

Parameters	Winter: Summer	Winter: Monsoon post monsoon.	Summer: Monsoon & post monsoon.
Occurrence of eclampsia.	P=0.016	P=0.554	P=0.011
Mean temperature	P=0.000	P=0.000	P=0.002
Mean relative humidity	P=0.479	P=0.000	P=0.000
Average rainfall	P=0.005	P=0.000	P=0.023
Mean sea level pressure.	P=0.000	P=0.000	P=0.834

Table 5: showing p values of different seasonal comparison

Incidence of eclampsia was highest in winter (Nov to Feb), followed by monsoon and post monsoon (July to Oct) and lowest in summer (March to June) during the study period (2010-2012), but there is a trend of progressively higher incidence in each monsoon and post monsoon season, as well as in summer. The difference of incidence between winter and summer as well as monsoon and summer is statistically significant ($p < 0.05$) but it is insignificant ($p = 0.554$) when winter and monsoon were compared.

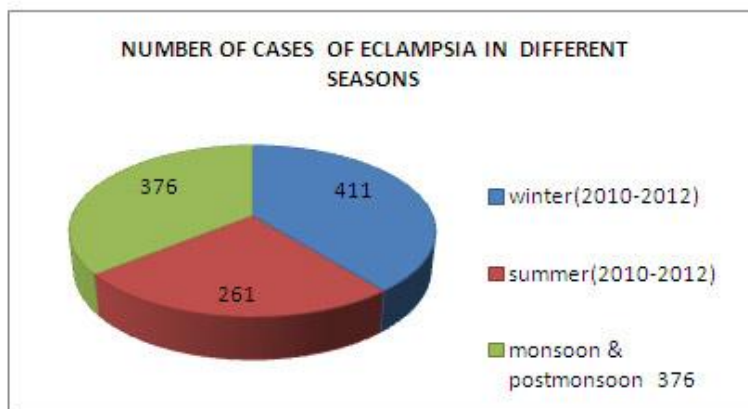


Chart 1: Distribution of incidence of eclampsia in different season.

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There was a trend of rise of incidence of eclampsia in each year. Weather parameters (monthly mean temperature, relative humidity, average rain fall, and mean sea level pressure) differed significantly when compared among seasons.

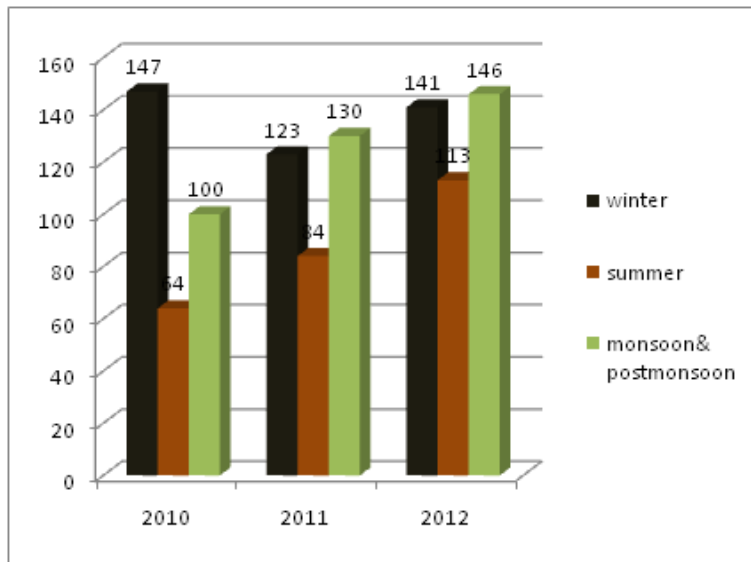


Chart-2: Showing seasonal distribution of eclampsia in each year.

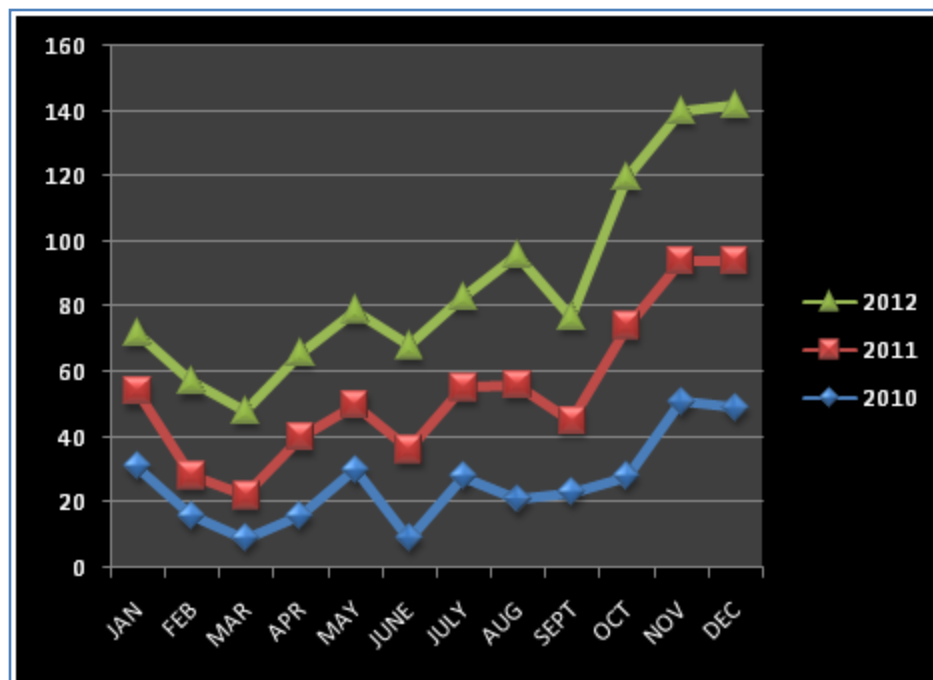


Chart 3: Showing month wise distribution of eclampsia throughout study period

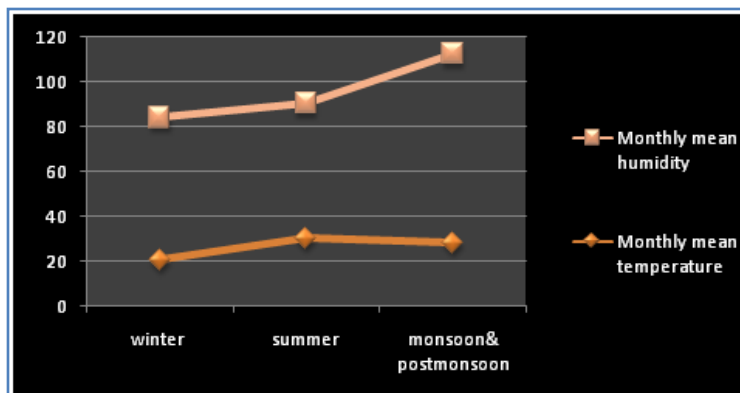


Chart 4: showing variation of monthly mean temperature and mean relative humidity in different seasons over entire study period

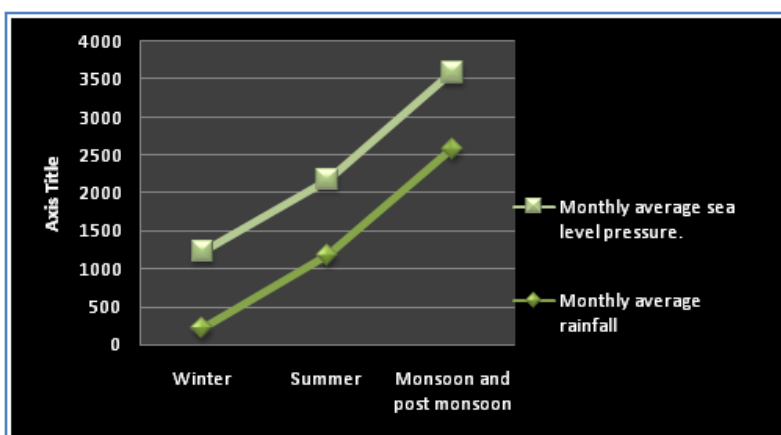


Chart 5: shows difference in monthly mean sea level pressure and monthly average rain fall in different seasons throughout study period.

DISCUSSION: Eclampsia or pre eclampsia still remains one of the leading causes of maternal mortality, morbidity as well as adverse pregnancy outcome. Aetiology of this grave condition is still not clear and thought to be multifactorial. Worldwide preeclampsia and eclampsia is following a secular trend of increased incidence. Environmental, dietary and lifestyle may have influence in the disease process and is a matter of research for long time.

Our study had covered a large number of populations over a period of 36 months. Total number of delivery during this period was 59150 and total number of eclamptic patients was 1048(1.76%). Incidence rose every year. Highest incidence was in winter followed by monsoon – postmonsoon and the lowest was in summer. Weather parameters varied significantly among the seasons over the study period and so did the incidence. Suppose the humidity is significantly ($p < 0.000$) different between winter and monsoon – post monsoon season, likewise other parameters

varied significantly among different seasons and the comparison has been given in Table 5. It is obvious from our study that incidence of eclampsia differs significantly among various seasons.

Other study results corroborate our result but whether there is any causal relationship between weather parameters and eclampsia and pre eclampsia is a matter of controversy and research for long time. Various hypotheses had been put forwarded to explain this. Asa Reylander et al (2010) in their study found that incidence of preeclampsia and eclampsia is more in winter, in Sweden. They proposed that decrease availability of sunlight may be a probable cause of increase incidence preeclampsia and eclampsia. Sunlight helps vitamin D synthesis which helps calcium metabolism. Activated vitamin D has inverse relationship with tissue plasminogen activator antigen (tPA-Ag) which is a marker of endothelial damage and eclampsia has generally been described as an endothelial disease. Various dietary factors such as vitamin, micro nutrients have their influences on pathogenesis of eclampsia. Dietary deficiency of these in various seasons may be a cause of seasonal variation of eclampsia. Even season of conception may be an important factor^[13]. Literature on seasonal variation in the incidence of eclampsia and other hypertensive disorders in pregnancy is much divided in its logical conclusion^[1-14]. Evidences in the literature suggest that dehydration may be a protective factor for convulsion^[15]. Insensible water loss is much higher in dry and warmer temperature. In their study Westerterp et al demonstrated that physical activity-adjusted values of water loss were higher, in female. It is truer in summer^[16]. So this kind of season related may be a cause of decreased incidence of eclampsia in summer.

On the other hand volume expansion and hyponatremia are thought to be triggering agent. Hyponatremia and over hydration causes influx of fluid into the neurones causing swelling of the same and make it vulnerable for injury and seizure activity. It has been already demonstrated in pregnant women where decrease in serum osmolality increased the seizure frequency. Monsoon has profound influence on human body fluid balance though the mechanism of which is ill understood^[16]. Chakrapani and colleagues in their study demonstrated that hyponatremia in hospital patients is significantly higher in monsoons with a significant correlation to increased rain fall^[17]. In winter vasospasm may be a triggering agent for increased incidence of eclampsia which may have resemblance with increased incidence of myocardial infarction in winter. Whatever may be the hypothesis in our study there is significant variation in incidence of eclampsia over various seasons.

CONCLUSION: Statistically significant variation is observed in the incidence of eclampsia over various seasons, in our study. Highest incidence was recorded in winter followed by monsoon-post monsoon, strengthening the association of low temperature and increased humidity with eclampsia.

Considering that eclampsia is an important cause of maternal mortality, morbidity and adverse foetal and neonatal outcomes, it becomes more important to know whether there is any association in the incidence of eclampsia and season change. Exploring the association between various weather parameters and incidence of eclampsia will help us to understand the pathophysiology better, and understanding the trend of seasonal variation of eclampsia will help the health planner in formulating health care strategy as it is a treatable but a life threatening disease.

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