SEASONAL VARIATION IN THE INCIDENCE OF ECLAMPSIA

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Abstract:
Introduction Hypertensive disorders of pregnancy complicate 5-10 percent of all pregnancies and cause maternal mortality. Changes in osmolality due to low temperature and high humidity during monsoon season may trigger the onset of eclampsia. Elucidating its association with meteorological factors may help us to understand the etiopathology of this disorder and prevent its occurrence. Aim and objectives To compare the seasonal variation in incidence of eclampsia during monsoon season (June - December) with the rest of the year (January - May) in Madurai, Tamil Nadu. Study Design and study period Retrospective study. January 2009- December 2010. Materials and Methods After obtaining Institutional ethical clearance, data was collected from records of cases admitted to Department of Obstetrics and Gynaecology, Government Rajaji Hospital, Madurai from January 2009- December 2010. Depending on the date of onset of convulsions the cases were allotted to monsoon season and rest of the year. Meteorological data was acquired from the Regional Centre, Indian Meteorological Department. Inclusion Criteria Pregnant women more than 20 weeks gestation, blood pressure more than 140/90 mm of Hg, bilateral pitting pedal edema, proteinuria, with eclampsia were included for the study. Patients with disorders like chronic hypertension, psychiatric disorders, etc which can be confounding factor for fits were excluded from the study. Statistical Analysis The results were analyzed using chi square test. Significance was drawn at a p value of less than 0.05. RESULTS The incidence of eclampsia during monsoon season was 1.12 percent and the rest of the year was 1.02 percent for the study duration. But it is not statistically significant. Conclusion Evaluation of the influence of weather in triggering eclampsia may give an insight to this less understood disorder and prevent its occurrence. Keyword: Pre-eclampsia, eclampsia, monsoon season, temperature, convulsions.
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Introduction:
Hypertensive disorders of pregnancy are one of the leading causes of maternal and fetal morbidity and mortality. This group of disorders complicates 5-10% of all pregnancies. Eclampsia is one of the leading causes for maternal and perinatal mortality in developing countries. Goswami A, Kalita H, 1996. WHO Review and studies by Khan KS et al., 2006 suggest that 16% of the maternal mortality in developed countries is due to hypertensive disorders complicating pregnancy. Eclampsia is a preventable complication of preeclampsia. With regular institutional antenatal checkups, proper management of fluid and electrolyte balance and appropriate antihypertensive therapy, preeclampsia can be managed without maternal morbidity and mortality.

Sudden meteorological changes may trigger eclampsia in a susceptible patient. Dieckmann, Arnell. Various studies have been carried out to elucidate the correlation between eclampsia and various biochemical factors. Observational studies by Agobe JT, Good W, Hancock KW, 1981; Neela J, Raman L, 1993, have established a variety of factors linking gestational hypertensive disorders and weather parameters. Incidence:

With improvement in health care facilities and increased awareness among the patients, the incidence of eclampsia has reduced greatly. Studies by Sibai et al., 1997 and ACOG, 2002 have found the incidence of preeclampsia to be 5-8% of all pregnancies. In developed countries, eclampsia complicates in 2000 deliveries Douglas and Redman, 1994; National vital statistics report, Ventura et al., 2000; RCOG, 2006. A study by Chesley LC et al., 1978 had reported that the incidence of eclampsia in India varies from 0.94% to 1.4%. Eclampsia is the onset of hypertension (BP > 140/90 mm of Hg) after 20 weeks of gestation accompanied by proteinuria and bilateral pitting pedal edema. The onset of generalized tonic, clonic convulsions or coma in a preeclamptic woman, which cannot be attributed to other causes is called eclampsia. It can occur in the ante partum, intra partum, or post partum period. Eclampsia dates back as far as 2200 B.C. Lindheimer et al., 2009. The term eclampsia is derived from Greek, meaning ‘to flash out’. Lever of Guy’s hospital in 1864 established the association of eclampsia with proteinuria. Chames et al., 2002, suggested that one fourth of preeclampsia patients developed convulsions 48 hours postpartum. Delayed postpartum (>48 hours) eclampsia occurred in <10% of cases Brown CEL et al., 1987; Alexander JM et al., 2006; Zwart JJ et al., 2008.

Etiopathogenesis:
Exposure to chorionic villi for the first time as in primigravida, twin gestation and genetic predisposition are some of the risk factors for preeclampsia. Trupin LS et al., 1996, has documented that change in paternity in a multipara is a risk factor for preeclampsia. Vascular endothelial damage causes intense vasospasm leading to transudation of plasma with ischemic/thrombotic sequelae. The pathogenesis is also divided into maternal - poor placentation (stage I) and placental - oxidative stress (stage II) preeclampsia Ness RB and Roberts JM, 1996. Subramaniyam V, 2007, had observed that monsoon season is associated with lower mean average temperature and higher average relative humidity. This leads to vasospasm and rise in blood pressure. This in turn decreases the insensible water loss, aggravating
the water retention, leading to the onset of eclampsia.

**Aim and objectives:**
This study was done to compare the incidence of eclampsia cases during monsoon season (June to December) and rest of the year (January to May) in the city of Madurai, Tamil Nadu.

**Study Design and study period**
Retrospective study (January 2009 to December 2010).

**Study population:**
Eclampsia cases and antenatal cases admitted to labour ward, Department of Obstetrics and Gynaecology, Government Rajaji Hospital, Madurai, for the study duration.

**Inclusion and Exclusion Criteria:**
Pregnant women > 20 weeks of gestation with bilateral pitting pedal edema, newer onset of hypertension with blood pressure > 140/90 mmHg, proteinuria, preeclampsia with or without treatment and antepartum, intra partum or post partum eclampsia were included for the study.

Patients with chronic hypertension, thyrotoxicosis, diabetes mellitus, epilepsy, psychiatric disorders, drug intake (thiazide diuretics, amphetamine, terbutaline, haloperidol, tricyclic antidepressants, phenothiazines, etc), electrolyte imbalance, head injury, systemic lupus erythematosus, hepatic and cardiac disorders, which can be confounding factors for fits or coma were excluded from the study.

**Materials and Methods:**
After obtaining institutional ethical clearance, data for the study was collected from case records and case sheets of eclampsia cases admitted to Department of Obstetrics and Gynaecology, Government Rajaji Hospital, Madurai from January 2009 to December 2010. Government Rajaji Hospital is a tertiary care centre receiving referral cases from 5 districts in South Tamil Nadu with around 1000-1200 deliveries per month. Detailed evaluation of the case records of all eclampsia cases admitted and details about age, parity, date of onset of convulsions, previous medical history, presence of preeclampsia and gestational age at the onset of convulsions were thoroughly evaluated. Depending on the date of onset of convulsions the cases were allotted to monsoon season (June to December) and rest of the year (January to May). Madurai is a tropical city receiving rainfall from **South West monsoon** during June to September and **North East monsoon** during October to December. The weather is relatively dry during the rest of the year.

The total no of deliveries in the monsoon season and rest of the year was calculated. Meteorological data like mean temperature, average rainfall and average relative humidity was obtained from the Regional centre, Indian Meteorological department for the study duration.

**Statistical Analysis:**
The results were analyzed using chi square test using SPSS software, sigma stat version 3.5. 'p' value < 0.05 was considered as statistically significant.

**RESULTS:**
The findings of the present study are summarized in the following table.

Table -1: Total no of eclampsia cases and the percentage incidence of eclampsia during monsoon and rest of the year during the study period.
During the two year study period, the percentage incidence of eclampsia cases during the monsoon season was slightly higher than during rest of the year. During the year 2009, the percentage incidence during the monsoon season was 1.13% and incidence during rest of the year was 1.01%.

Similarly from January 2010-December 2010, the percentage incidence of eclampsia was 1.10% during the monsoon season and 1.02% during rest of the year. Statistical analysis revealed that there is no statistically significant increase in percentage incidence during monsoon season when compared to the rest of the year with a ‘p’ value >0.05 throughout the entire study period.

The incidence of eclampsia during the study period from January 2009 to December 2010 is 1.075%, which correlates with the overall incidence of eclampsia in India which varies from 0.94% to 1.4%.

Chesley LC et al., 1978.
The percentage incidence of eclampsia cases in 2010, during monsoon season was 1.1% and during the rest of the year was 1.02%.

Figure-3: Mean average temperature in degree Celsius during the study period (2009-2010).
The monsoon period recorded relatively low mean average temperatures from June to December (2009 & 2010) when compared to January to May (2009 & 2010).

Figure-3: Mean average relative humidity during the study period (2009 & 2010).
The monsoon period (June - December, 2009&2010) recorded relatively higher average relative humidity when compared to rest of the year (January –May, 2009 & 2010).
Figure-4: Distribution of rainfall in percentage during 2009 & 2010:
The monsoon period recorded a higher mean average rainfall (1057mm) when compared to rest of the year (189mm) during 2009-2010.

Discussion:
The percentage incidence of eclampsia cases shows a marginal increase during monsoon season when compared to rest of the year during the study period. Meteorological parameters like temperature, relative humidity and rainfall may play a role in bringing about the onset of convulsions in preeclampsia. Studies by Chakrapani M, Shenoy D, Pillai A. 2002, have well documented the high incidence of hyponatremia cases during the monsoon period. Monsoon season has a direct effect on human fluid balance although the exact mechanism is unclear. Studies by Obed SA et al., 1994 and Subramanian V, 2004 have recorded the increased incidence of eclampsia in the monsoon season in Ghana and India respectively. This is supported in the studies done by Agobe JT, 1986 in Nigeria and Anya, 2004 in Gambia. The monsoon season recorded relatively low temperatures, high humidity and high rainfall which lead to vasospasm with increased blood pressure, reduced insensible water loss and water retention in an already waterlogged patient leading to dilutional hyponatremia. Andrew RD, 1991, Pasantes-Morales H, Tuz K, 2006 have observed that hyponatremia causes influx of fluid directly into neurons causing them to swell. This cellular volume change in neurons makes them hyperexcitable and more susceptible to injury. Studies by Magnus P, Eskild A, 2001, revealed a higher incidence of eclampsia during winter, due to intense vasospasm and ischemia. In a study Arnell had suggested that weather changes seem to be the only common factor linking the admission of eclampsia cases occurring in groups after a long gap without cases. The weather per se does not play a causal role, but precipitates a preeclamptic patient to throw convulsions. Vasospasm of the cutaneous vessels on exposure to low temperatures and high humidity leads to a rise in blood pressure and a decrease in insensible water loss, which in turn aggravate the edema. This sudden change in the milieu interior is beyond the capability of the decompensated preeclamptic patient’s adaptive mechanism to restore. This triggers the onset of convulsions. Contrarily studies by Tan et al., 1988, have suggested that preeclampsia is common in summer. Studies by Wacker et al., 1998, found no statistical significance in frequency of occurrence of preeclampsia in the dry and wet seasons in Zimbabwe. Plasma volume expands in summer when compared to winter months Kristal-Boneh E, 2007. Studies from different parts of the world frequently give opposing results. Contrarily studies by Alderman BW et al., 1988, suggested that the onset of eclampsia was not influenced by climatic factors. The effect of seasonal variation on fluid balance, plasma volume and osmolality needs to be evaluated fully. But studies conducted by Modesti PA et al., 2006 on hypertensive patients showed that there is an elevated blood pressure during night time and lower blood pressure during day time. The lowering of blood pressure during high environmental temperature is due to increased vasodilatation and loss of water and salt by sweating.
Rosenthal T, 2004, suggested that cold weather is known to cause the release of catecholamines, which increases the blood pressure. The high temperature in the dry season causes significant insensible water loss. A study by Westerterp KR et al., 2005, proved that in women the physical activity associated water loss is higher in summer. Such meteorological mild dehydration protects the brain from convulsions Bitterman N et al., 1997. In pregnant women decreasing serum osmolality was directly related to increasing seizure frequency Agobe JT et al., 1981.

The present study has identified that there is a marginal increase in incidence of eclampsia during monsoon season, which might be related to the climatic conditions in monsoon season. But the increased incidence is not statistically significant. Further exploration involving a wide range of hospitals over a long period is needed to elucidate the association between eclampsia and the weather.

**Conclusion:**
Percentage incidence of eclampsia is 1.075% over a period of 2 years from January 2009 to December 2010. The incidence of eclampsia cases was found to be slightly higher during monsoon season when compared to the rest of the year. But statistical analysis revealed that there is no statistical association with a ‘p’ value > 0.05. Meteorological parameters like low temperature, high relative humidity and high average rainfall may predispose to the onset of eclampsia. Exploring this association will help us to gain further insight into the pathophysiology of this condition. Hence it can be concluded that seasonal parameters may play a role in bringing about the onset of convulsions in preeclampsia. Detailed evaluation of the influence of weather on the fluid and electrolyte balance can be used to prevent the onset of eclampsia and its dreaded complications.

**References:**


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