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Original Research Article

## Epidemiological determinants and clinical profile of eclampsia: a case control study

Ritam De, Amit Dutta\*

Department of Obstetrics and Gynecology, Gouri Devi Institute of Medical Sciences and Hospital, Durgapur, West Bengal, India

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**\*Correspondence:**

Dr. Amit Dutta,

E-mail: [dr.amitdutta49@gmail.com](mailto:dr.amitdutta49@gmail.com)

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### ABSTRACT

**Background:** The incidence of eclampsia has reduced considerably in the developing countries due to good antenatal care and increased awareness within the population. To determine the magnitude of the problem, to assess trends and to identify risk factors and risk groups, it is worthwhile to periodically review this problem.

**Methods:** A study using one control for each case of eclampsia was conducted among women who were admitted at Burdwan Medical College and Hospital between July 2014 and June 2015. Cases were women with a confirmed diagnosis of eclampsia. Eclampsia cases were identified by daily monitoring of all new admissions to Eclampsia ward of Burdwan Medical College and hospital. After strict exclusion criteria, a total of 500 eclampsia cases were studied along with same number of controls for identifying the epidemiological determinants.

**Results:** Maternal age at extremes (<20 and >30 years) was identified as a risk factor of eclampsia. Nulliparity has been identified as a risk factor for eclampsia in present study. About 74.6% mothers were nulliparous. Most of the patients 66.6% were admitted during the antenatal period i.e. presented with antenatal eclampsia. 62.2% of them were at between 34-37 weeks of gestational age during admission.

**Conclusions:** Authors observed increased eclampsia risk among women with a prior history of pregnancies complicated by hypertensive disorders. Positive personal histories of hypertensive disorders of pregnancy and family history of hypertensive disorders are well known risk factors of eclampsia. Our findings point to public health and clinical measures that may be taken to potentially attenuate the incidence of eclampsia and mitigate associated maternal-fetal complications resulting from the disorder.

**Keywords:** Eclampsia, Epidemiological determinants, Outcomes, Pregnancy, Risk factors

### INTRODUCTION

The term “eclampsia” is derived from a word meaning “like a flash of lightning”. This is the occurrences of generalized convulsions, associated with signs of pre-eclampsia during pregnancy, labour or within seven days of delivery and not caused by epilepsy or other convulsive disorders. Some authors considered that eclampsia can occur up to ten days following delivery. Eclampsia remains an important cause of maternal and perinatal morbidity and mortality worldwide.<sup>1-3</sup> It is

estimated that it accounts for more than 50,000 maternal deaths globally.<sup>2</sup> A large majority of these deaths occur in low-income countries where the quality of maternity care is often inadequate. Although it affects around 1-2% of the pregnant women population, it contributes approximately 10% of maternal morbidity in India and other developing countries. In Europe and other developed countries eclampsia complicates about 1 in 2000 deliveries, while in developing countries estimates vary widely from 1 in 100 to 1 in 1700.<sup>4</sup> The incidence of eclampsia has reduced considerably in the developing

countries due to good antenatal care and increased awareness within the population. The incidence quoted from the leading centres of India varies from 0.18% to 4.6% and approximately 75% cases occur in primigravidae. Maternal mortality according to various Indian authors is 8-14% but a low maternal mortality was reported by Menon.<sup>5-7</sup> In fact worldwide maternal morbidity varies widely at different places with almost identical management indicating that there may be important differences in socio-economic condition of a nation and the quality of obstetric care. To determine the magnitude of the problem, to assess trends and to identify risk factors and risk groups, it is worthwhile to periodically review this problem. In our medical college a significant number of eclampsia patients are referred from health centers. Although it is a tertiary teaching hospital and designed in a semi-urban set up it mainly serves a huge rural part of West Bengal and unfortunately, it is those villages where all the etiological conditions (both medical, economic and social) for eclampsia are prevailing. Only a few thorough research works regarding epidemiological determinants and clinical profile of eclampsia has been conducted previously in this institution. The aim of the present study was to determine the epidemiological determinants and risk factors of eclampsia, to correlate these risk factors with maternal and fetal outcome and to do a critical analysis in order to implement a preventive strategy.

## METHODS

The prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Burdwan Medical College and Hospital, Burdwan, West Bengal over a period of one year (July 2014-June 2015). Study population was consisting of women admitted with eclampsia antenatal, intranatal or postnatal period). A total of 500 cases of eclampsia (approximately) were included.

A predesigned and pre-tested schedule/proforma was used to collect all data.

### Inclusion criteria

All cases of eclampsia-antepartum, intrapartum, postpartum with following diagnostic criteria

- Convulsion/coma occurring at gestational age >20 weeks, or within 48h of delivery
- Hypertension where BP 140/90 of Hg or more
- Proteinuria (more than 0.3gm/24h or more than +1 in semiquantitative dipstick testing).

In most cases, the patients fulfil all the above criteria. But in several occasions according to the British Eclampsia Study 19958, hypertension and proteinuria may be absent, still the patient have convulsion and receives

magnesium sulphate. They will also be included in this study.

### Exclusion criteria

- Patients who have other causes of convulsions such as epilepsy, meningitis, trauma, cerebral malaria etc.
- Diagnosis is doubtful such as convulsion occurs before 20 weeks of gestation or after 48 hours of delivery.

Data was collected with predesigned and pre-tested schedule after taking informed consent. The schedule was containing of details regarding patients' particulars, past obstetric history, past history of hypertension/convulsion, personal history, age of marriage, duration of marriage, marriage-current pregnancy interval, age of menarche, family history, details of current pregnancy, details of antenatal check-up, details of convulsion (whether referred from somewhere or not, timing, number, place, gestational age at that time, convulsion-initial treatment interval etc), details of treatment received, method of induction, mode of delivery, outcome of both mothers (morbidity and mortality) and babies (perinatal morbidity and mortality).

The data was assumed to be normally distributed. Their distribution parameters are expressed in terms of their mean value and standard deviation. The level of variations were compared by student's 't' test. Nominal data was expressed in percentage (%) and was compared with chi-square test. Risk factors/causes were expressed in odd's ratio. P value less than 0.05 ( $p < 0.05$ ) was considered statistically significant. The study proposal along with other relevant documents was submitted in the institution review board for review and approval. The study commenced after such approval was obtained in writing from institution Ethics Committee.

## RESULTS

Table 1 shows a strong and significant increased eclampsia among women who were

- $\leq 20$  years age 33.4% (OR=1.2278, 95% CI 0.9391-1.0653).
- 30-34 years of age 15.6% (OR=1.1354; 95% CI 0.8005-1.6105).
- $\geq 35$  years of age 6.4% (OR=1.641; 95% CI 0.9253-2.9105).

**Table 1: Distribution according to age.**

Age (years)	Control (n=500)	Eclampsia (n=500)
<20	145 (29%)	167 (33.4%)
20-24	125 (25%)	94 (18.8%)
25-29	140 (28%)	129 (25.8%)
30-34	70 (14%)	78 (15.6%)
>35	20 (4%)	32 (6.4%)

Table 2 shows significant increased risk of eclampsia is in nulliparous women 74.6% (OR=1.4862, 95% CI 1.1302-1.9543).

**Table 2: Distribution according to parity.**

Parity	Control (n=500)	Eclampsia (n=500)
Nulliparous	332 (66.4%)	373 (74.6%)
Multiparous	168 (33.6%)	127 (25.4%)

Table 3 signified that a potential risk associated with those mothers who have <7 (primary) standard educational level 55.6% (OR=1.293, 95% CI 1.0083-1.6581) and lowered risk in mothers with higher education.

**Table 3: Distribution according to maternal education level.**

Maternal	Control (n=500)	Eclampsia (n=500)
>12 standard	86 (17.2%)	58 (11.6%)
7-12 standard	168 (33.6%)	164 (32.8%)
<7 standard	246 (49.2%)	278 (55.6%)

Table 4 shows short height mothers (<150cms) have more propensity for eclampsia 34.6% (OR= 1.3064, 95% CI 1.0401-1.7793).

**Table 4: Distribution according to height.**

Height (CMs)	Control (n=500)	Eclampsia (n=500)
<150	140 (28%)	173 (34.6%)
150-168	270 (54%)	260 (52%)
>168	90 (18%)	67 (13.4%)

Table 5 found that positive risk of eclampsia in relation to maternal pre-pregnancy BMI.

Women who were underweight (<18.5 kg/m<sup>2</sup>) had reduced risk of eclampsia 19% (OR=0.7249, 95% CI 0.535-0.981) as compared with their counterparts who had a normal pre-pregnancy BMI (18.5-24.9 kg/m<sup>2</sup>).

**Table 5: Distribution according to BMI (body mass index).**

Body mass index	Control (n=500)	Eclampsia (n=500)
<18.5	120 (24%)	95 (19%)
18.5-24.9	293 (58.6%)	294 (58.8%)
25-29.9	54 (10.8%)	57 (11.4%)
>30	33 (6.6%)	54 (10.8%)

Conversely, obese women (≥30 kg/m<sup>2</sup>) had increased risk of eclampsia 10.8% (OR=1.7357, 95% CI 1.0987-2.7420).

In Table 6, authors observed that nulliparous women have statistically significant increased risk of eclampsia

74.6% (OR=1.8185, 95% CI 1.1392-2.9026). Among multiparous women with prior history of pregnancy associated hypertensive disorders also had a statistically significant increased risk of eclampsia 10.4% (OR=1.0671, 95% CI: 1.756-2.636).

**Table 6: History of hypertensive disorders of pregnancy.**

History of hypertensive disorders of pregnancy	Control (n=500)	Eclampsia (n=500)
Parous with no prior history	138 (27.6%)	75 (15%)
Parous with prior history	30 (6%)	52 (10.4%)
Nulliparous	332 (66.4%)	373 (74.6%)

Table 7 shows Family history of hypertension was also associated with increased eclampsia risk 19.6% (OR=1.4034, 95% CI: 1.007-1.954).

**Table 7: Family history of hypertension.**

Family history of hypertension	Control (n=500)	Eclampsia (n=500)
Yes	74 (14.8%)	98 (19.6%)
No	426 (85.2%)	402 (80.4%)

Table 8 shows 12.2 % patients had no antenatal visits who had increased risk of eclampsia during pregnancy (OR 1.5152, 95% CI 1.001-2.292).

**Table 8: Distribution according to antenatal care.**

Antenatal care	Control (n=500)	Eclampsia (n=500)
>3 antenatal visits	253 (50.6%)	201 (40.2%)
<3 antenatal visits	205 (41%)	238 (47.6%)
No visit	42 (8.4%)	61 (12.2%)

Similar increased risk of eclampsia for women who received <3 antenatal visits 47.6% (OR=1.3072, 95% CI 1.017-1.678).

Table 9 shows increased risk of eclampsia in women who have prior history of more 1 abortion 13.2% (OR 1.3687, 95% CI 0.9263-2.0223) and also who have more than 2 abortions 4.6% (OR 1.2912, 95% CI 0.6879-2.4235).

**Table 9: Number of abortions.**

Number of abortions	Control (n=500)	Eclampsia (n=500)
0	432 (86.4%)	411 (82.2%)
1	50 (10%)	66 (13.2%)
≥2	18 (3.6%)	23 (4.6%)

Table 10 shows most of the eclamptic fits occurred during antenatal period 66.6% compared to intranatal and postnatal period. Table 11 shows that the blood pressure

of most to the patients during admission was high. 43.8% of the patients had systolic blood pressure above 160 mm of Hg and 42.8% patients have diastolic blood pressure between 90-109 mm of Hg.

**Table 10: Types of eclampsia (n=500).**

Types	Frequency	Percentage
Antepartum	333	66.60
Intrapartum	90	18
Postpartum	77	15.40

Table 12 shows most of the patients 62.2% admitted with eclampsia had their first convulsion at gestational age between 34-37 weeks.

**Table 11: Blood Pressure on admission (n=500).**

SBP (mm of Hg)	Frequency	Percentage
≥160	219	43.80
140-159	196	39.20
≤140	85	17.00
DBP (mm of Hg)	Frequency	Percentage
≥110	183	36.60
90-109	214	42.80
<90	103	20.60

**Table 12: Gestational age of 1<sup>st</sup> convulsion (n=500).**

Gestational age (weeks)	Frequency	Percentage
<34	53	10.60
34 - 37	311	62.20
>37	136	27.20

Table 13 shows that 69.2% of the eclamptic patients in present study had an average of 2-5 convulsions during their hospital stay.

**Table 13: Number of convulsions (n=500).**

Number of convulsions	Frequency	Percentage
1	98	19.60
2-5	346	69.20
> 5	56	11.20

Table 14 shows that there is significantly increased rate of caesarean section 29% in the eclamptic patients in present study compared to the control group.

**Table 14: Mode of delivery.**

Mode of Delivery	Frequency	Percentage
Vaginal	396 (79.2)	349 (69.8)
LSCS	93 (18.6)	145 (29)
Forceps	11 (2.2)	16 (3.2)

Table 15 illustrates major complication that occurred in present study population was postpartum haemorrhage (16.4%).

**Table 15: Complication of mother**

Complication	Frequency	Percentage
Nil	311	62.20
Pulmonary Oedema	58	11.60
CVA	31	6.20
PPH	82	16.40
ARF	9	1.80
HELLP	2	0.40
Septicaemia	4	0.80
DIC	3	0.60

Table 16 shows that most babies 90.8% of the eclamptic mothers were born alive.

**Table 16: Outcome of the baby (n=500).**

Outcome of baby	Frequency	Percentage
Live Birth	454	90.80
Stillborn	36	7.20
IUFD	10	2.00

## DISCUSSION

Eclampsia is still a significant cause of morbidity and mortality for both the mother and fetus. Eclampsia remains a problem that is not preventable and treatable beyond supportive measures and delivery. Unlike pre-eclampsia, considering the wide gap in the incidence rates, eclampsia is considered a preventable condition. The incidence of eclampsia and the total number of deaths from eclampsia have come down dramatically in developed countries. This has been achieved with improvements in prenatal care and management. However, in developing countries, it still stands as one of the major complications of pregnancy. After obtaining informed consent, enrolled participants were asked to participate in a 30 minute in-person interview in which trained research personnel used a structured questionnaire to elicit information regarding maternal socio-demographic, lifestyle, medical and reproductive characteristics. Participants' prenatal medical records, labor and delivery medical records were also reviewed by trained obstetric research interns and me, using a standardized abstraction form. Information abstracted from medical records included participants pre-pregnancy weight, height, blood pressure, pregnancy complications and condition of the newborn. This study indicates that young and advanced maternal age, pre-pregnancy obesity status, no utilization of prenatal care, hypertensive disorder during pregnancy, family history of hypertension are associated with a significantly increased risk of eclampsia.

### **Maternal age**

Socio-demographic and behavioral characteristics of eclampsia cases and normotensive controls are presented in (Table 1). Evidence of a strong and significant increased eclampsia among women who were a)  $\leq 20$  years age 33.4% (OR=1.2278, 95% CI 0.9391-1.0653); b) 30–34 years of age 15.6% (OR=1.1354; 95% CI 0.8005-1.6105); and c)  $\geq 35$  years of age 6.4% (OR=1.641; 95% CI 0.9253-2.9105). Chakraborty et al reported that patients suffering from eclampsia had mean age of 20. Al-Mulhim AA, Abu-Heija et al reported maternal age at extremes ( $<20$  and  $>40$  years) was identified as a risk factor of eclampsia.<sup>9,10</sup> Advanced maternal age ( $>35$  years) had also been shown to be associated with increased risk of eclampsia.<sup>11</sup>

### **Parity**

Nulliparity has been identified as a risk factor for eclampsia in several populations. From Table 2 in present study it is clear that significant increased risk of eclampsia is in nulliparous women 74.6% (OR=1.4862, 95% CI 1.1302-1.9543). Pal et al (1996)<sup>12</sup> found 62.5% of nulliparous women in their study.

### **Socio-economic status and educational status**

In this study most of the women has come from the low socio-economic status and poor educational status. None of the patient has come from higher socio-economic status. In present study (Table 3) signified that a potential risk associated with those mothers who have  $<7$  (primary) standard educational level 55.6% (OR=1.293, 95% CI 1.0083-1.6581) and lowered risk in mothers with higher education. According to Majhi majority of the patients (82%) belonged to poor socio-economic status and poor educational status which is largely related with health consciousness and family welfare program among the people.<sup>13</sup> This indicates that socio-economic status, poor nutrition, illiteracy, lack of awareness and inadequate antenatal care has close relationship with eclampsia.

### **Maternal height**

Table 4 shows short height mothers ( $<150$ cms) have more propensity for eclampsia 34.6% (OR= 1.3064, 95% CI 1.0401-1.7793).

### **Pre pregnancy body mass index**

Obesity is perhaps the most consistently reported modifiable risk factor of eclampsia.<sup>15</sup> In present study Table 5 found positive risk of eclampsia in relation to maternal pre-pregnancy BMI. Women who were underweight ( $<18.5$  kg/m<sup>2</sup>) had reduced risk of eclampsia 19% (OR=0.7249, 95% CI 0.535-0.981) as compared with their counterparts who had a normal pre-pregnancy BMI (18.5–24.9 kg/m<sup>2</sup>). Conversely, obese women ( $\geq 30$  kg/m<sup>2</sup>) had increased risk of eclampsia 10.8%

(OR=1.7357, 95% CI 1.0987-2.7420). Although precise biologic mechanisms for associations of eclampsia risk with maternal adiposity are unknown, several possible mechanisms have been proposed. Investigators have speculated that hyperlipidemia, oxidative stress and diffuse endothelial dysfunction are more common among obese versus lean pregnant women. Others have postulated that the association is secondary to alterations in cardiac output.<sup>15</sup> Although compelling, these hypothesized mechanisms have yet to be evaluated in carefully-designed cohort studies of pregnant women. Mahomed et al. reported that women with eclampsia had a higher BMI ( $27.6 \pm 4.4$  kg/m<sup>2</sup>) compared with normotensive women ( $25.2 \pm 3.8$  kg/m<sup>2</sup>).<sup>16</sup> Mittendorf et al. reported a 2.7-fold increased risk of eclampsia in obese women compared to women with a pre-pregnancy BMI between 18-30 kg/m<sup>2</sup>.<sup>17</sup>

Mostello D, et al Reported that recurrence of preeclampsia effects of gestational age at delivery of the first pregnancy, body mass index, paternity and interval between births.<sup>6,7,18</sup>

### **History of hypertensive disorder during pregnancy and family history of hypertension**

Positive personal histories of hypertensive disorders of pregnancy and family history of hypertensive disorders are well known risk factors of eclampsia. Eclampsia is reported to recur in 13-18% of subsequent pregnancies.<sup>18,19</sup> In accordance with previous studies; authors observed increased eclampsia risk among women with a prior history of pregnancies complicated by hypertensive disorders. In present study (Table 6 and Table 7) authors observed that nulliparous women associated hypertensive disorders during pregnancy statistically significant increased risk of eclampsia 74.6% (OR=1.8185, 95% CI 1.1392-2.9026). Among multiparous women with prior history of pregnancy associated hypertensive disorders had a statistically significant increased risk of eclampsia 10.4% (OR=1.0671, 95% CI: 1.756-13.636). Positive personal histories of hypertensive disorders of pregnancy and family history of hypertensive disorders are well known risk factors of eclampsia. The high recurrence risk of eclampsia, and evidence of familial aggregation of hypertensive disorders supports the concept that a subgroup of women may be predisposed to developing this very dangerous complication of pregnancy. Family history of hypertension was also associated with increased eclampsia risk 19.6% (OR=1.4034, 95% CI: 1.007-1.954). Odegard et al in their study reported that those with a prior history of eclampsia, compared with women without such a history, had increased risk of the disorder in another pregnancy.<sup>20</sup>

### **Antenatal care**

In the present study (Table 8), 12.2% patients had no antenatal visits who had increased risk of eclampsia

during pregnancy (OR 1.5152, 95% CI 1.001-2.292). Similar increased risk of eclampsia for women who received <3 antenatal visits 47.6% (OR=1.3072, 95% CI 1.017-1.678). Pal et al found 93.35% of the cases were un-booked for antenatal care in their study.<sup>12</sup> According to Majhi, 82.3% of patients had no antenatal visits.<sup>13</sup> It has been universally accepted that adequate standard antenatal care has immense value in reducing the incidence of eclampsia by early detection of eclampsia and its prompt management.

### ***Number of abortions***

Table 9 shows increased risk of eclampsia in women who have prior history of more 1 abortion 13.2% (OR 1.3687, 95% CI 0.9263-2.0223) and also who have more than 2 abortions 4.6% (OR 1.2912, 95% CI 0.6879-2.4235). Authors observed no significant evidence of associations of eclampsia with maternal addiction (e.g. smoking, alcohol consumptions) and diet.

### ***Types of eclampsia***

In present study (Table 10) shows most of the convulsions occurred during antenatal period 66.6% compared to intranatal and postnatal period.

### ***Blood pressure during admission***

In present study (Table 11) authors found that most of the patients were admitted with high blood pressure. 43.8% had systolic blood pressure above 160 mm of Hg and 42.8% had diastolic blood pressure between 90-109 mm of Hg. Some patients were also normotensive. High blood pressure was managed with oral nifedipine or injection labetalol according to the individual situations.

### ***Gestational age of first convulsion***

From present study authors found that the 62.2% of the eclamptic patients were admitted at 34-37 weeks of gestational age, during which the first convulsion has occurred. 27.2% crossed 37 weeks i.e. term pregnancy during admission. Most antepartum eclampsia occurs in third trimester (90%).<sup>21</sup>

### ***Number of convulsions***

In present study most of the patients 69.2% had a total of 2-5 episodes of convulsion during their hospital stay or before being admitted in our hospital. Convulsions were effectively managed with loading and maintenance dose of magnesium sulphate along with additional dose of magnesium sulphate where required.

### ***Mode of delivery***

Though majority of the patients 69.8% were delivered vaginally there was a significantly increased rate of Caesarean section 29% among the patients compared

with the controlled group 18.6%. Delivery is the only definitive treatment of eclampsia and it must be performed within 12 hours of convulsion.<sup>22</sup> However, every attempt should be made to stabilize the patient before attempting to deliver. Presence of eclampsia itself is not an indication of caesarean section.

### ***Complications of the mother***

In present study authors found a wide range of complications developed to the mothers during admission, during intrapartum period or after delivery. 16.4% of the patients developed PPH just after delivery. 11.6% developed pulmonary oedema cause being unknown. A few patients developed grave complications like HELLP, ARF, DIC and Septicaemia. During present study 26 patients died due to any of these complications. Ten patients died of pulmonary oedema, 8 patients due to CVA, 3 of PPH, 2 in Septicaemia, 2 due to ARF and 1 patient in DIC.

### ***Outcome of the baby***

In present study authors found that most of the babies 90.8% were born alive owing to prompt management of the mother and prompt delivery. Out of these most of the babies could be salvaged though a number of them were either born pre-term, some of them suffered from birth asphyxia or some were born IUGR. Mothers who delivered pre-term babies were given corticosteroids before delivery for fetal lung maturity.

## **CONCLUSION**

This study was undertaken as an initial step towards better understanding the epidemiological determinants and clinical profile of eclampsia within a population that is undergoing rapid social, economic, and demographic changes. In conclusion, young and advanced maternal age, obesity, no utilization of prenatal care, history of one or  $\geq 2$  abortion, histories of hypertensive disorders of pregnancy and family history of hypertension, short height mothers, nullipara as well as multiparous women from the low socio-economic-educational status without proper or no antenatal care, was identified as epidemiological determinants for eclampsia.

Therefore, the present study provides strong support to find out the epidemiological determinants of eclampsia as well as their clinical profile in a low resource rural set up. To reduce morbidity and mortality resulting from this disease, lifestyle changes and prevention should be the main aim. The early detection of a high-risk factor has the potential to be a predictive tool also for other health disorders with meaningful consequences for the mothers, their offspring and health care systems. Our findings point to public health and clinical measures that may be taken to potentially attenuate the incidence of eclampsia and mitigate associated maternal-fetal complications resulting from the disorder.

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