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Factors Associated with Maternal Death Due to Preeclampsia at the University Hospital Center (CHU) Kara

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Abstract

Introduction: Preeclampsia is a major cause of maternal mortality worldwide. The objective of this study was to investigate the factors associated with maternal mortality during preeclampsia at CHU-Kara. **Patients and Methods:** This was a case-control study with retrospective data collection, conducted from January 1, 2020, to June 30, 2025, in the gynecology-obstetrics department. All cases of maternal deaths in patients with preeclampsia (n = 23) were compared to 92 controls based on a 4:1 ratio. A univariate analysis was performed to determine the relationship of a single risk factor with maternal mortality. Subsequently, a multivariate analysis was conducted to examine the effect of multiple associated risk factors in order to control for confounding variables. **Results:** The mean age of the deceased patients was 26.6 ± 5.7 years. The univariate analysis identified the following risk factors for maternal mortality during preeclampsia: fewer than 4 prenatal visits, postpartum onset of preeclampsia, occurrence of eclampsia, renal failure, acute pulmonary edema, HELLP syndrome, and admission to the intensive care unit. In the multivariate analysis, only fewer than 4 prenatal visits, the occurrence of eclampsia, and acute pulmonary edema were retained as predictors of maternal mortality during preeclampsia. **Conclusion:** Maternal mortality related to preeclampsia is multifactorial. The main risk factors for death in women with preeclampsia are fewer than 4 prenatal visits, eclampsia, and acute pulmonary edema.

Keywords

Preeclampsia, Maternal Death, Associated Factors, CHU-Kara (Togo)

1. Introduction

The causes of maternal deaths are multiple and have long been dominated by obstetric hemorrhages, particularly those occurring in the postpartum period [1]-[3]. The profile of these causes appears to be evolving in favor of cardiovascular diseases, including preeclampsia [4] [5]. According to the World Health Organization (WHO) and the International Society for the Study of Hypertension in Pregnancy, preeclampsia is defined as blood pressure exceeding 140/90 mm Hg after 20 weeks of amenorrhea, associated with significant proteinuria greater than 0.3 g/24 h [6]. Globally, it accounts for approximately 16% of maternal deaths [7]. In France, it ranks alongside suicide as one of the two leading causes of maternal deaths [8]. In Sub-Saharan Africa, particularly in Gambia (2022), it is the primary cause [5]. Several studies have attempted to identify risk factors that could predict an unfavorable outcome in preeclamptic patients [5] [9], but very few have specifically focused on mortality.

This study, conducted to better understand the determinants of maternal mortality related to preeclampsia in our context of limited resources, would help guide prevention strategies, optimize available resources, and improve the monitoring of high-risk patients.

2. Patients and Methods

This study was conducted in the gynecology-obstetrics department of the University Hospital Center (CHU) of Kara, over a period of 4 and a half years (66 months), from January 1, 2020, to June 30, 2025. It was a retrospective, analytical matched case-control study aimed at identifying factors associated with maternal death in patients presenting with preeclampsia.

The study focused on all women admitted for preeclampsia during pregnancy or postpartum, regardless of the route of admission. Preeclampsia was defined according to the criteria of the World Health Organization (WHO) and the International Society for the Study of Hypertension in Pregnancy as blood pressure ≥ 140/90 mmHg after 20 weeks of amenorrhea, associated with proteinuria ≥ 0.3 g/24 h.

The case group included all patients who died as a result of preeclampsia during the study period, totaling 23 cases. For each case, four living controls were randomly selected using a matching strategy based on two criteria:

- Maternal age ± 5 years
- Timing of preeclampsia onset (before or after 34 weeks of gestation)

A total of 92 controls were thus included, bringing the overall sample size to 115 patients.

The dependent variable studied was maternal outcome (death versus survival). The independent variables included sociodemographic data (age, occupation, marital status, place of residence, and education level), clinical and paraclinical data (medical history, parity, type of pregnancy, gestational age, preeclampsia-related complications, hemoglobin level, serum creatinine, AST, ALT), and ther-

apeutic interventions (admission to intensive care, antihypertensive therapy, magnesium sulfate administration, and mode of delivery).

The data, extracted from medical records, were entered via an electronic form in XLSX format on the Kobo Toolbox platform, then cleaned and analyzed using R software (version 4.5.1) in the RStudio environment. A univariate descriptive analysis was performed. Qualitative variables were presented as counts and percentages with their 95% confidence intervals. Comparisons of proportions were conducted using the Chi^2 test or Fisher's exact test, depending on sample size, with a significance threshold set at $p < 0.05$. Quantitative variables were summarized by their mean and standard deviation. To investigate the association between factors and the occurrence of maternal death, odds ratios (OR) with 95% confidence intervals were calculated. Finally, a multivariate analysis using logistic regression was performed to identify factors independently associated with maternal death.

The anonymity and confidentiality of patients were strictly maintained throughout the study.

3. Results

3.1. Sociodemographic, Clinical, and Therapeutic Characteristics of the Patients

The mean age was 26.6 ± 5.7 years in cases and 27.2 ± 6.6 years in controls. The 25 - 35 age group was the most represented (52.17%) in cases, while the 15 - 25 group was the most common (44.57%) in controls. The majority were multiparous (39.13% versus 52.18%), and educated (82.61% versus 88.04%). Cases had fewer than 4 prenatal visits (69.57%), whereas controls had at least 4 (60.87%). The majority of patients were referred/evacuated (82.61% versus 88.04%) and came from rural areas (56.52% versus 54.35%) (Table 1).

Table 1. Sociodemographic characteristics.

	Cases, n/N (%)	Controls, n/N (%)	p
Age (in years)			
Mean	26.6 +/- 5.7	27.2 +/- 6.6	0.70
Age group			
15 - 25	9 (39.13)	41 (44.57)	0.68
25 - 35	11(52.17)	40 (43.48)	
35 - 41	2 (8.70)	10(10.87)	
Parity			
Nulliparous	8 (34.78)	32 (34.78)	
Primiparous	6 (26.09)	12 (13.04)	0.60
Multiparous	9 (39.13)	48 (52.18)	
Education level			
No formal education	4 (17.39)	11 (11.96)	
Primary	11 (47.83)	32 (34.78)	0.09
Secondary	7 (30.43)	42 (45.65)	
Higher	1 (4.35)	7 (7.61)	
Prenatal visits			

Continued

Fewer than 4 visits	16 (69.57)	36 (39.13)	0.01
4 or more visits	7 (30.43)	56 (60.87)	
Mode of admission			
Direct admission	4 (17.39)	11 (11.96)	0.10
Referred/evacuated	19 (82.61)	81 (88.04)	
Residence			
Urban	10 (43.48)	42 (45.65)	1
Rural	13 (56.52)	50 (54.35)	

The mean gestational age in the case group was 31.9 ± 6.9 weeks; it was 34.6 ± 4.4 weeks for the controls. Singleton pregnancy was more frequently represented in both groups, *i.e.*, 100.0% versus 89.13% (Table 2).

Table 2. Clinical and paraclinical data.

	Cases, n/N (%)	Controls, n/N (%)	p
Mean gestational age (weeks)	31.9 ± 6.9	34.6 ± 4.4	0.02
Personal history of sickle cell disease	3 (13.04)	0(0.00)	0.9
Type of pregnancy			
Singleton	23 (100.00)	82 (89.13)	0.2
Twin	0 (0.00)	10 (10.87)	
Blood pressure			
SBP ≥160	11 (47.82)	53 (57.60)	1
DBP ≥110	10 (43.48)	47 (51.09)	0.6
Hemoglobin level			
Mean	9.8 ± 3.1	11.2 ± 2.1	0.02
< 10.5 g/dL	9 (60.00)	23 (29.87)	0.08

The patients in the case group were more frequently admitted to the intensive care unit (86.96%) compared to the control group (38.04%). Magnesium sulfate was administered to the majority of patients (86.96% versus 38.04%) (Table 3).

Table 3. Therapeutic data.

Administration of Magnesium Sulfate	17 (73.9)	80 (87.0)	0.1
Admission to Intensive Care	20 (86.96)	35 (38.04)	< 0.001

3.2. Factors Associated with Mortality (Univariate Analysis)

The univariate analysis allowed for the evaluation of the crude association of each potential risk factor with death due to preeclampsia. The results are presented in Table 4.

The factors significantly associated with maternal mortality during preeclampsia were:

- Fewer than 4 prenatal visits
- Onset of preeclampsia in the postpartum period
- Occurrence of maternal complications such as eclampsia, renal failure, acute

pulmonary edema, and HELLP syndrome
- Admission to the intensive care unit

Table 4. Factors associated with maternal mortality due to preeclampsia. (Univariate Analysis)

Risk Factors	Cases, n/N (%)	Controls, n/N (%)	Crude OR	95% CI	p-value
Fewer than 4 prenatal visits	16 (69.57)	36 (39.13)	03	1.4 - 10.0	0.01
Timing of preeclampsia onset:					
Postpartum	3 (13.04)	1 (1.09)	19	2.2 - 414.6	0.01
Complications/Clinical Elements:					
Eclampsia (seizures)	12 (52.17)	4 (4.35)	24	7.1 - 98.8	< 0.0001
Oliguria / Renal Failure	7 (0.30)	3 (3.26)	13	3.5 - 70.0	0.0004
Acute Pulmonary Edema	4(17.40)	1 (1.09)	20	2.8 - 408.3	0.009
AVC	2 (8.70)	1 (1.09)	9	0.83 - 201.5	0.08
HELLP Syndrome	5 (21.73)	1 (1.09)	27	4.0 - 530.2	0.004
DPPNI	2 (2.17)	7 (7.61)	1	0.2 - 5.5	0.8
Factors Related to Management:					
Admission to intensive care	20 (86.96)	35 (38.04)	10	3.4 - 48.5	0.0002

3.3. Independent Factors Associated with Mortality (Multivariate Analysis)

A multivariate logistic regression model was constructed to adjust for the factors significant in the univariate analysis ($p < 0.05$). The final model includes variables that have an independent association with mortality (**Table 5**).

Patients who had fewer than 4 prenatal visits had a 5 times higher risk of death compared to those who had at least 4. The occurrence of acute pulmonary edema multiplied the risk of maternal death by 5.

The factor most strongly associated with death was the occurrence of eclampsia, which increased the risk of death by 31 times.

Table 5. Factors associated with maternal mortality due to preeclampsia. (Multivariate Analysis)

Risk Factors	Adjusted OR	95% CI	p-value
Inadequate Prenatal Care (<4 visits)	5	1.2 - 34	0.03
Acute Pulmonary Edema (OAP)	5	3.8 - 1559.4	0.006
Eclampsia	31	5.6 - 256	<0.001

4. Discussion

Our multivariate logistic regression model highlighted three independent and strong prognostic factors: insufficient prenatal care, acute pulmonary edema (OAP), and,

most significantly, the occurrence of eclampsia.

4.1. Insufficient Prenatal Care

The univariate analysis established that inadequate prenatal care, defined as fewer than 4 prenatal visits (CPN), was associated with mortality. The multivariate logistic regression model confirmed that this factor independently increased the risk of death by 5 times.

This result is a marker of delayed or inadequate access to care [10]. Prenatal care plays a crucial role in safe monitoring and ensuring the well-being of the mother and fetus during pregnancy, ultimately leading to the best possible perinatal outcomes [11] [12]. It is essential for the early screening of arterial hypertension and the initiation of preventive measures or targeted follow-up. Historically, prenatal care programs were developed to detect arterial hypertension and proteinuria [13]. The absence of regular follow-up often leads to late presentation of the disease, directly at the stage of severe complications [3]. This finding is particularly alarming in low-resource regions [14]. Kayentao *et al.* in Mali, and Bhutada *et al.* in Uganda, have reported barriers to prenatal care attendance, including financial constraints, distance from healthcare facilities, and family reluctance [15]-[18].

Improving the coverage and quality of prenatal visits therefore remains important for preventing maternal mortality in general and preeclampsia-related mortality in particular.

4.2. Acute Pulmonary Edema

The occurrence of acute pulmonary edema (OAP) remained an independent risk factor, multiplying the risk of death by 5. OAP is defined as pulmonary edema caused by excessive accumulation of fluid in the interstitial and alveolar spaces of the lung due to an increase in capillary hydrostatic pressure secondary to elevated pulmonary venous pressure, itself resulting from high cardiac filling pressures [19]. It is associated with high mortality [20] [21]. Several studies have established the relationship between high mortality during preeclampsia when OAP occurs [22] [23]. It is most often caused by severe preeclampsia [24], which is associated with OAP in 2.9% of cases [25]. Since most cases of pulmonary edema in pregnant women are highly fatal and associated with difficult-to-control hypertension, prevention of this complication involves preventing preeclampsia to reduce maternal mortality [26].

4.3. Eclampsia

Eclampsia proved to be the factor most strongly and independently associated with mortality, dramatically increasing the risk of death by 31 times.

This extremely high odds ratio places eclampsia at the center of survival efforts. Eclampsia is the endpoint of the pathology, representing the most severe cerebral involvement of preeclampsia, often in the form of hypertensive encephalopathy

or intracranial hemorrhage [27]. Systematic reviews and studies in sub-Saharan Africa have also shown that eclampsia is the complication that confers the highest risk of mortality [28]. Adequate management and, above all, prevention of eclampsia therefore remain a key pillar in reducing maternal mortality.

4.4. HELLP Syndrome and Renal Failure

Although HELLP syndrome and renal failure were significantly associated with the studied outcome in univariate analysis, they were not retained in the final multivariate model. Their low frequency may partly explain this finding. However, caution is warranted in interpreting these results. The fact that they do not remain independent predictors in the multivariate model should not lead to underestimating their clinical importance, as they remain major complications.

5. Conclusion

The present study confirms that preeclampsia remains a major cause of maternal deaths. An insufficient number of prenatal visits, the occurrence of acute pulmonary edema, and especially eclampsia are independent and powerful factors of mortality. It is urgent to strengthen prenatal follow-up, improve emergency obstetric care, and target high-risk areas and patients to reduce this preventable mortality. In this context, community-based initiatives such as raising awareness among women and their families, organizing mobile prenatal clinics in remote areas, and providing continuous training for healthcare professionals could help detect at-risk patients earlier and thereby reduce preventable maternal deaths.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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