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Original article

Factors Associated with Maternal-Fetal Mortality Related to Pre-eclampsia in the Four Major Public Hospitals of Bujumbura

Facteurs associés à la mortalité materno-fœtale liée à la pré-éclampsie dans les quatre grands hôpitaux publics de Bujumbura

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Résumé

Introduction : La prééclampsie est une pathologie vasculo-rénale grave, source de mortalité maternelle et fœtale. Cette étude vise à analyser les facteurs associés à cette mortalité dans quatre hôpitaux publics de Bujumbura afin d'améliorer le pronostic materno-fœtal.

Méthodologie : Etude multicentrique, rétrospective et analytique menée sur deux ans. Incluant toutes les patientes pré-éclamptiques, les données ont ete collectées via KoboCollect et analysées sur SPSS (seuil de significativité $p < 0,05$).

Résultats : Sur 29 515 accouchements, 384 cas de pré-éclampsie ont été recensés, dont 319 analyses. La pathologie prédomine chez les 19-34 ans (72,7 %). Les facteurs de risque sont la primigestité (41,4 %), la primiparité (19,3 %), l'âge > 35 ans (17,4 %) et les antécédents d'HTA gravidique (15,2 %). 54,5 % des patientes étaient des cas référés. Les complications maternelles sont dominées par l'éclampsie (12,5 %). Les patientes ayant réalisé moins de trois échographies présentent un risque de décès maternel 3,5 fois plus élevé et un risque de décès fœtal multiplie par 4,7, comparées à celles ayant effectué un suivi adéquat ($p < 0,001$). Les complications fœtales incluent la prématurité (69,5 %), l'hypotrophie (27,8 %), la mort in utero (19,1 %) et la souffrance fœtale aigue (15,0 %).

Conclusion : Véritable problème de santé publique, la pré-éclampsie expose à une forte morbidité. L'instauration d'un suivi prénatal rigoureux, le dépistage précoce des signes de gravite et une prise en charge rapide restent les moyens les plus efficaces pour améliorer le pronostic materno-fœtal.

Mots-clés : Pré-éclampsie, mortalité materno-fœtale, facteurs associes, Bujumbura.

Abstract

Introduction: Pre-eclampsia is a severe vascular-renal pathology and a significant source of maternal and fetal mortality. This study aims to analyze the factors associated with this mortality in four public hospitals in Bujumbura in order to improve maternal and fetal outcomes.

Methods: A multicenter, retrospective, and analytical study conducted over two years. Including all pre-eclamptic patients, data were collected via KoboCollect and analyzed using SPSS (significance threshold $p < 0.05$).

Results: Out of 29,515 deliveries, 384 cases of pre-eclampsia were identified, 319 of which were analyzed. The condition predominates in the 19-34 age group (72.7%). Risk factors include primigestity (41.4%), primiparity (19.3%), age > 35 years (17.4%), and a history of gestational hypertension (15.2%). 54.5% of patients were referred cases. Maternal complications were dominated by eclampsia (12.5%). Patients who had fewer than three ultrasounds had a 3.5 times higher risk of maternal death and a 4.7 times higher risk of fetal death compared to those with adequate follow-up ($p < 0.001$). Fetal complications included prematurity (69.5%), hypotrophy (27.8%), intrauterine death (19.1%), and acute fetal distress (15.0%).

Conclusion: A true public health problem, pre-eclampsia exposes patients to high morbidity. The implementation of rigorous prenatal care, early screening for signs of severity, and rapid management remain the most effective ways to improve maternal and fetal outcomes.

Keywords: Pre-eclampsia, maternal and fetal mortality, associated factors, Bujumbura.

Introduction

According to the World Health Organization (WHO), pre-eclampsia is defined as the association of arterial hypertension (systolic blood pressure greater than or equal to 140 mmHg and/or diastolic blood pressure greater than or equal to 90 mmHg) and proteinuria greater than or equal to 300 mg/24 hours or other signs of severity (renal, hepatic, neurological, hematological involvement, or fetal growth restriction) appearing beyond the 20th week of amenorrhea [1, 2]. This pathology exposes the mother to the risk of eclampsia, long-term complications such as arterial hypertension and cardiovascular diseases, and can even lead to death [2]. For the fetus, it is associated with an increased risk of intrauterine growth restriction, premature birth, fetal distress, and intrauterine death [3].

Worldwide, pre-eclampsia constitutes the third cause of maternal mortality [4, 5]. In Burundi, recent data reveal a maternal mortality rate of 12.1% linked to pre-eclampsia, placing this pathology in second rank of maternal causes of death after postpartum hemorrhages [6]. This study aims to analyze the factors associated with maternal-fetal mortality in cases of pre-eclampsia in the four major public hospitals of Bujumbura.

Methodology

This is a multicenter, retrospective, and analytical study conducted from January 1, 2023 to December 31, 2024 in the Gynecology-Obstetrics department of the four major public hospitals of Bujumbura: Kamenge University Hospital Center (CHUK), Prince Louis Rwagasore Clinic (CPLR), Kamenge Military Hospital (HMK), and Prince Regent Charles Hospital (HPRC).

All patients who presented with pre-eclampsia during the study period and were managed in one of the maternity units of these four hospitals were included. Excluded from our study were any pre-eclamptic patients whose records were untraceable, incomplete, or unusable at the time of the study.

The variables studied were, for the mother and the fetus, sociodemographic, clinical, therapeutic, and prognostic variables. Data were collected via KoboCollect, analyzed with SPSS software, and presented in tables. The Pearson Chi-square test was used for comparisons (a p-value < 0.05 was considered statistically significant). Logistic regression was used for statistically significant variables to determine the odds ratio. The managers of the target hospitals gave their agreement and the study has no conflicts of interest.

Results

During the study period, 384 cases of pre-eclampsia were collected out of a total of 29,515 deliveries, representing an overall frequency of 1.30%. Sixty-five records did not meet the inclusion criteria, reducing our study sample to 319 cases. Pre-eclampsia was frequent in the 19 to 34 years age group (72.70%). The youngest patient was 18 years old and the oldest was 44 years old.

The mean age of our patients was 32.9 years. Civil servants represented 13.8% and the urban environment was represented by 192 patients (60%). Ten patients out of 319 (3%) had a twin pregnancy. The risk factors identified in the patients were primigestity (41.4%), primiparity (19.3%), age > 35 years (17.4%), and history of pre-eclampsia or gestational arterial hypertension (15.2%). Regarding pregnancy follow-up, 169 patients (53%) had completed 3 ANC (Antenatal Care) visits and 184 patients (57.7%) had undergone at least 3 obstetric ultrasounds.

Our results showed that 174 patients (54.5%) were referred while 145 (45.5%) had come on their own, and the reason for consultation was headache and epigastric pain in respectively 123 (38.2%) and 59 (18.5%) patients. The majority of our patients, i.e., 55.5%, had lower limb edema (LLE) at the time of admission; 68.7% had a SBP (Systolic Blood Pressure) >= 160 mmHg and 57.7% had a DBP (Diastolic Blood Pressure) >= 110 mmHg, while severe thrombocytopenia < 100,000/mm3 was found in 9.4% of cases.

Antihypertensives were dominated by Methyldopa (70.2%) and Magnesium Sulfate was the most used anticonvulsant (52%). One hundred twenty-two patients (38.2%) were admitted to intensive care for severe pre-eclampsia, and cesarean section was the most used delivery mode (79.6%). Maternal complications were dominated by eclampsia (12.5%) and 40 patients (12.5%) died.

Birth weight was less than 1500 g in 90 newborns (27.4%). APGAR < 7 at the 5th minute was noted in 12.3% of newborns. The fetal complications found were dominated by prematurity (69.5%), hypotrophy (27.8%), intrauterine death (18.6%), and acute fetal distress (15.0%).

Table I: Link between maternal mortality and obstetric ultrasounds

Number of ultrasounds	Deaths	Favorable outcome	Total	OR	95% CI	p-value
None	0 (0.0%)	5 (100.0%)	5 (100%)	-	-	-
1	9 (27.3%)	24 (72.7%)	33 (100%)	3.45	[1.396 - 8.570]	0.007
2	13 (13.4%)	84 (86.6%)	97 (100%)	1.42	[0.667 - 3.052]	0.359
>= 3	18 (9.8%)	166 (90.2%)	184 (100%)	1	-	-
Total	40 (12.5%)	279 (87.5%)	319 (100%)	-	-	0.035

Table II: Link between maternal mortality and mode of admission

Mode of admission	Deaths	Favorable outcome	Total	OR	95% CI	p-value
Referred	30 (17.2%)	144 (82.8%)	174 (100%)	2.81	[1.32 - 5.99]	0.007
Self-referred	10 (6.9%)	135 (93.1%)	145 (100%)	Reference	-	-
Total	40 (12.5%)	279 (87.5%)	319 (100%)	-	-	0.005

Table III: Link between maternal mortality and intensive care admission

ICU admission	Deaths	Favorable outcome	Total	OR	95% CI	p-value
Yes	23 (20.5%)	99 (79.5%)	122 (100%)	3.78	[1.83 - 7.80]	<0.001
No (Reference)	13 (6.4%)	180 (93.6%)	193 (100%)	1 (Ref.)	-	-
Total	36 (11.4%)	279 (88.6%)	315 (100%)	-	-	<0.001

Four patients died before admission to intensive care.

Table IV: Status of newborns at birth

Status of newborns at birth	Number	%
Put to breast with adaptation to extra-uterine life	131	39.8
Hospitalized in Neonatology	118	35.9
Intrauterine death	61	18.6
Died before admission to neonatology	19	5.7
Total	329	100

Given that there were 10 cases of twin pregnancy, the total number of newborns was 329.

Table V: APGAR score of newborns

APGAR score	1st minute N	1st min %	5th minute N	5th min %	10th minute N	10th min %
< 7	48	17.9%	33	12.3%	28	10.4%
>= 7	220	82.1%	235	87.7%	240	89.6%
Total	268	100.0%	268	100.0%	268	100.0%

Table VI: Link between fetal mortality and birth weight

Birth weight (g)	Deaths (n=80)	Put to breast (n=131)	OR	95% CI	p-value
>= 2500 g (Ref.)	7 (7.1%)	83 (83.8%)	1	-	-
1500-2500 g	29 (20.7%)	46 (32.9%)	7.47	[7.47 - 18.39]	<0.001
< 1500 g	44 (48.9%)	2 (2.2%)	260.85	[51.96 - 309.48]	<0.001

Table VI (continued): Link between birth weight and neonatology hospitalization

Birth weight (g)	Hospitalized (n=118)	Put to breast (n=131)	OR	95% CI	p-value
>= 2500 g (Ref.)	9 (9.1%)	83 (83.8%)	1	-	-
1500-2500 g	65 (46.4%)	46 (32.9%)	13.03	[5.94 - 28.56]	<0.001
< 1500 g	44 (48.9%)	2 (2.2%)	202.88	[41.99 - 980.26]	<0.001

Table VII: Link between immediate neonatal death and APGAR score

APGAR score	Outcome	< 7	>=7 (Ref.)	OR	95% CI	p-value
1st minute	Death	15 (31.3%)	4 (1.8%)	20.97	[3.35 - 130.93]	<0.001
	Hospitalized	21 (43.8%)	97 (44.1%)	2.14	[1.006 - 4.58]	0.048
	Adaptation (Ref.)	12 (25.0%)	119 (54.1%)	-	-	-
5th minute	Death	13 (39.4%)	6 (2.6%)	32.80	[8.75 - 93.26]	<0.001
	Hospitalized	10 (30.3%)	108 (46.0%)	1.12	[0.44 - 2.79]	0.807
	Adaptation (Ref.)	10 (30.3%)	121 (51.5%)	-	-	-
10th minute	Death	13 (46.4%)	6 (2.5%)	32.80	[8.75 - 93.26]	<0.001
	Hospitalized	5 (17.9%)	113 (47.1%)	0.53	[0.17 - 1.61]	0.267
	Adaptation (Ref.)	10 (35.3%)	121 (50.4%)	-	-	-

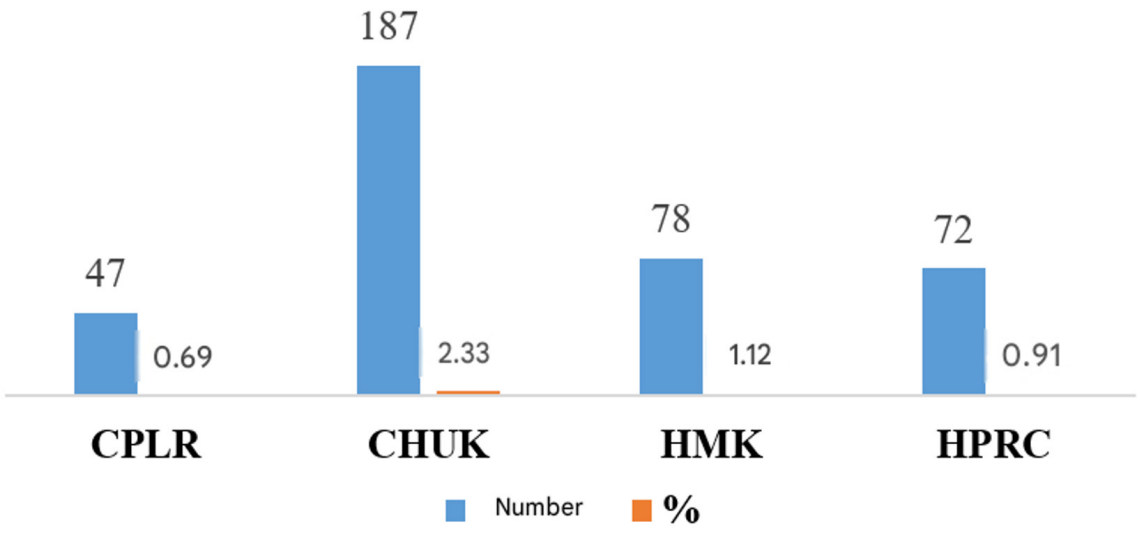


Figure 1: Frequency of pre-eclampsia by hospital

Discussion

During the study period, 384 cases of pre-eclampsia were collected out of a total of 29,515 deliveries, representing an overall frequency of 1.30%. Other African authors have also found similar results: Cisse C.T. et al. [7] (1.40%); Assogba S.C. [8] (4.9%).

The most affected age group was 19-34 years (72.7%) with a mean age of 32.9 years and extremes of 18 and 44 years. M'baye SM et al. [9] had found a mean age of 30 years with extremes ranging from 15 to 45 years, and 68.98% of patients were under 30 years old. These results could be explained by the fact that this category represents the active period of a woman's life when she has increased reproductive activity.

Civil servants represented 13.8% of cases while 86.2% included traders (10.7%), farmers (24.8%), students (2.8%), and the unemployed (48.0%). Assogba S.C [8] noted a proportion of 80.6% of vendors, housewives, and artisans. These results highlight that most patients belong to low-income categories and are exposed to significant precariousness. On the other hand, P. Kiondo et al. [10] reported a predominance of educated patients (59.9%) and those with a high socioeconomic level (35.3%). However, after statistical analysis, these authors concluded that patients with primary education or no education had 2 times more risk of developing pre-eclampsia than patients with secondary education or higher. Our result allows us to conclude that pre-eclampsia is more frequent in disadvantaged environments, as shown by most studies [11].

One hundred sixty-nine patients (53%) had completed 3 ANC visits. Newborns from mothers who had completed fewer than 4 ANC visits had an increased risk of death: it was multiplied by 5.05 in those who had completed 2 ANC visits with P-value < 0.001; OR = 5.05 and 95% CI [2.02 - 12.59]. M'baye SM et al. [9] had found that 57.32% of patients had completed fewer than 4 ANC visits (minimum required by WHO); M. Nayama et al [12] had reported 45%. R. Fang et al. [13] reported that poor pregnancy follow-up constitutes a risk factor for pre-eclampsia; a frequent situation in poor countries [11, 14, 15, 16, 17].

One hundred eighty-four patients (57.7%) had undergone at least 3 obstetric ultrasounds. The risk of maternal death was approximately 3.5 times higher in patients who had undergone only one ultrasound compared to those with at least 3 ultrasounds. P-value = 0.007; OR = 3.458; 95% CI [1.396 - 8.570]. Similarly, newborns from mothers who had undergone only one obstetric ultrasound had a risk of death approximately 4 times higher compared to the reference group. P-value < 0.001; OR = 4.74; 95% CI [1.94 - 11.57]. However, no maternal death was recorded among the five who had not undergone any obstetric ultrasound, and this is due to the small sample size, especially since the Odds Ratio was not calculable.

The vast majority of patients (54.5%) were referred and had a risk of death approximately 3 times higher than those who came for consultation on their own with P-value = 0.007; OR = 2.81; 95% CI [1.32 - 5.99]. A clear difference is apparent between our results and those reported by M'baye SM et al. [9] (66.7%) and Nayama M. et al. [12] (72%). This disparity between our study and that of M'baye SM and Nayama M. would be explained by improved access to quality health care in health facilities and district hospitals of Burundi.

Regarding reasons for consultation, headaches dominated the functional signs (38.2%). The presence of functional signs constitutes a sign of severity of pre-eclampsia. Convulsions were observed in 9.4% of cases, and these patients were exposed to a risk of death approximately 6 times higher than those without convulsions with P-value < 0.001; OR = 6.21; 95% CI [2.72 - 14.22]. Patients with a Glasgow score <= 11 had a risk of maternal death approximately 3 times higher than those with a normal score. P-value = 0.025; OR = 2.69; 95% CI [1.13 - 6.38].

SBP >= 160 mmHg was found in 68.7% of cases and DBP beyond 110 mmHg in 57.7% of cases. M'baye SM et al. [9] had found that 87.33% had a DBP > 100 mmHg and 72.75% had a SBP >= 160 mmHg. Hypertension with SBP >= 160 mmHg and/

or DBP >= 110 mmHg defines severe pre-eclampsia [18]. These figures show that patients were exposed to severe pre-eclampsia in most cases, which could indicate delayed diagnosis and late management. This diagnostic delay would be linked to poor pregnancy follow-up or poor quality antenatal consultations.

Severe thrombocytopenia < 100,000/mm3 was found in 9.4% of cases. Proteinuria testing was performed in 254 patients, of whom 89% presented significant proteinuria, 11% severe proteinuria. Tchaou B. [19] identified significant proteinuria in 52.9% of his pre-eclamptic patients. In other studies, proteinuria quantification was done with urinary dipstick, as was the case for Moudjahid H. [20] who found proteinuria >= 2 crosses in 73.3% of patients with pre-eclampsia. The difficulties in performing paraclinical assessment did not allow for a complete assessment in cases of pre-eclampsia. We believe that performing this assessment is of crucial importance in adequate maternal-fetal follow-up and enables therapeutic decisions beneficial for both the mother and the fetus.

One hundred twenty-two patients (38.2%) were admitted to intensive care for severe pre-eclampsia, and the risk of maternal death was 3.78 times higher than in patients not admitted to intensive care. P-value < 0.001; OR = 3.78; 95% CI [1.83 - 7.80]. Maternal complications were dominated by eclampsia (12.5%). Abruptio placentae (AP) and acute pulmonary edema (APE) were present in respectively 2.3% and 2.9% of cases. According to Audibert F. et al. [21], AP complicates 3 to 5% of pre-eclampsias.

Cesarean section was the most used delivery mode (79.6%), a result similar to those of M'baye SM et al. [9] (59.80%), M. Nayama et al. [12] (92.6%); and 87.3% for Saadat M. et al. [22]. Rapid mother-child separation is necessary in severe forms of pre-eclampsia, which justifies significant recourse to cesarean section.

One hundred eighteen newborns (35.9%) were admitted to neonatology immediately after birth. The perinatal mortality rate was 24.3%, including 18.6% intrauterine death and 5.7% death before admission to neonatology. On the contrary, 131 newborns (39.8%) were returned to their mothers with good adaptation to extra-uterine life. Our results are still low compared to those of Moudjahid H. [20] who found a mortality rate of 41.2%, including 26.8% of IUFD (Intrauterine Fetal Death) and 14.4% of perinatal death. Ninety newborns (27.4%) had a birth weight below 1500 g and had a risk of neonatology hospitalization and death multiplied by 202.88 and 260.85 respectively, with very wide but significant confidence intervals (p < 0.001), thus confirming an association between low birth weight and a poor prognosis.

Induced prematurity and intrauterine growth restriction would explain the low birth weight observed in pre-eclampsia. 17.9% of newborns had an APGAR < 7 at the 1st minute and presented 20.97 times more risk of dying compared to those with a score >= 7 (p < 0.001). OR = 20.97; 95% CI [3.35 - 130.93]. This low APGAR score at birth would be linked to the severity of pre-eclampsia and induced prematurity for maternal-fetal rescue.

Prematurity (69.5%), hypotrophy (27.8%), intrauterine death (18.6%), and acute fetal distress (15.0%) were the most common fetal complications. Newborns with a gestational age < 28 weeks + 6 days had a risk of death 234.56 times higher than those who were at term with P-value < 0.001; OR = 234.56 and 95% CI [44.80 - 1224.55]. Similarly, the risk of maternal death was multiplied by 8.26 in patients whose gestational age was less than 28 weeks + 6 days compared to those whose pregnancy was at term with P-value = 0.002; OR = 8.26; 95% CI [2.19 - 31.12]. Assogba S.C. [8] found 34.1% for prematurity, 40.6% for hypotrophy, and 28.2% for acute fetal distress. In our study, prematurity appeared as the most frequent fetal complication and can be explained by therapeutic interruption of pregnancy in the face of signs of maternal or fetal severity requiring rapid extraction.

Conclusion

Pre-eclampsia remains a true public health problem, exposing the pregnant woman and her fetus to a high risk of morbidity and mortality. Patients with a

gestational age < 28 weeks + 6 days, those with fewer than three obstetric ultrasounds, referred patients, patients with convulsions, a Glasgow score <= 11, or those admitted to intensive care should be considered at high risk of death. Newborns from mothers who completed fewer than 4 ANC visits or fewer than 3 obstetric ultrasounds, those with low birth weight or an Apgar score < 7 at the 5th minute, have an increased risk of death.

The implementation of rigorous prenatal care, early screening for signs of severity, and rapid and appropriate management of pre-eclampsia constitute the most effective means to reduce its complications and improve maternal-fetal prognosis.

Study limitations

The retrospective nature of the study meant that some records could not be found, the absence of standardization of practices between the four hospitals, the small size of certain groups, particularly few patients who had not undergone any ultrasound (n = 5), making interpretation of results difficult.

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