Pediatric Anesthesia and Critical Care Journal 2026;14(1):22-28
doi:10.14587/paccj.2026.4

PACCJ

Reducing maternal and fetal mortality related to eclampsia in intensive care through the management of traditional risk factors: prospects in Kinshasa

JJ. Kalombo[1], A. Makembi Bunkete[2], K. Anga Muamba[1], W. Mbombo[1], R. Mbala[1], D. Tonduangu[1], M. Bulabula[1], B. Barhayiga[1]

[1]Department of Anesthesia-Resuscitation, University Clinics of Kinshasa, Kinshasa, Democratic Republic of Congo
[2]Department of Internal Medicine, University Clinics of Kinshasa, Kinshasa, Democratic Republic of Congo

Corresponding author: Arriel Makembi Bunkete, Department of Internal Medicine, University Clinics of Kinshasa, University of Kinshasa, Kinshasa, Democratic Republic of Congo. Email: docteur.makarriel2017@gmail.com.

Keypoints

Resource-limited settings, with a focus on Kinshasa (Democratic Republic of Congo), illustrate the impact of overburdened health services, limited access to essential medicines and intensive care units, and delays in referral on maternal-fetal prognosis.

Abstract

Eclampsia remains one of the leading causes of maternal and perinatal mortality, particularly in low- and middle-income countries. Despite the availability of effective treatments, deaths persist, especially among patients admitted to intensive care. This review summarizes current knowledge on the pathophysiology of preeclampsia and eclampsia, highlighting the cascade of events involving defective placentation, angiogenic imbalance, and systemic endothelial dysfunction, which cause multiorgan and neurological complications. It also analyzes the traditional risk factors associated with increased mortality : insufficient or absent prenatal care, late recognition of signs of severity, uncontrolled comorbidities, and structural limitations of health systems. Resource-limited settings, with a focus on Kinshasa (Democratic Republic of Congo), illustrate the impact of overburdened health services, limited access to essential medicines and intensive care units, and delays in referral on maternal-fetal prognosis. The article proposes concrete ways to improve care and reduce mortality, including strengthening prenatal monitoring, standardizing clinical protocols for blood pressure control and magnesium sulfate administration, providing continuing education for health professionals, and developing effective referral pathways between peripheral facilities and centers with obstetric resuscitation capabilities. These pragmatic interventions, adapted to the local context, can transform the management of eclampsia and contribute to a sustainable reduction in maternal and fetal mortality.

Keywords

eclampsia, Kinshasa, maternal mortality, resource-limited countries, preeclampsia, obstetric resuscitation

Introduction

Hypertensive disorders of pregnancy are one of the main determinants of maternal and perinatal mortality worldwide, with a disproportionate burden borne by low- and middle-income countries. Among these disorders, eclampsia is the most serious complication, reflecting the failure of early detection and optimal management of preeclampsia. It remains responsible for a significant proportion of preventable maternal deaths, despite the

existence of effective and well-established therapeutic strategies [1].

Eclampsia is characterized by the onset of generalized seizures against a background of systemic endothelial dysfunction, associated with potentially fatal multiorgan damage. While its incidence has declined significantly in high-income countries thanks to improved prenatal care, standardized protocols, and rapid access to intensive care, it remains common and often fatal in resource-limited settings [2]. This disparity signifies not a biological distinction but a significant deficiency in the structuring of care, prevention, and response to obstetric emergencies. The current understanding of the pathophysiology of preeclampsia and eclampsia highlights a cascade of events initiated in the first trimester of pregnancy, involving defective placentation, angiogenic imbalance, and systemic endothelial dysfunction [3]. Brain damage, which is at the heart of eclampsia, results from a breakdown in cerebral vascular autoregulation, exacerbated by acute hypertensive episodes, explaining the occurrence of cerebral edema, ischemic lesions, and intracranial hemorrhages [4]. These mechanisms highlight the central role of blood pressure control and seizure prevention in reducing maternal mortality. However, beyond biological mechanisms, the occurrence of severe eclampsia requiring admission to intensive care is strongly influenced by so-called "traditional" risk factors : delayed or absent prenatal care, late recognition of serious signs, uncontrolled comorbidities, and systemic failures in healthcare structures [5]. These factors, which are well identified in the literature, remain particularly prevalent in large African cities, where rapid population growth is putting increased pressure on already fragile health systems. In Kinshasa, the capital of the Democratic Republic of Congo, eclampsia remains a major cause of admission to obstetric intensive care and maternal deaths. Structural constraints, limited access to specialized intensive care, and heterogeneous clinical practices contribute to an often unfavorable prognosis for both the mother and the fetus [6]. In this context, critical analysis of the management of traditional risk factors appears to be an essential lever for reducing maternal and fetal mortality. This Perspective review aims to synthesize current data on the pathophysiology, risk factors, and management of severe eclampsia in intensive care, while highlighting the specificities of resource-limited settings. Drawing on international and regional data, it offers a targeted reflection on the prospects for improvement applicable to Kinshasa, with a view to achieving a sustainable reduction in maternal and perinatal mortality.

Pathophysiology of preeclampsia and eclampsia

Preeclampsia is a placental disorder with multiple causes, and the most widely accepted pathophysiological model is based on two successive phases [3]. The first phase is characterized by insufficient trophoblastic invasion of the spiral arteries, leading to inadequate and unstable placental perfusion. This hypoperfusion causes chronic placental oxidative stress, which is responsible for the release of antiangiogenic factors into the maternal circulation [3]. The second phase corresponds to the systemic maternal response, marked by diffuse endothelial dysfunction affecting the cerebral, renal, hepatic, and placental vascular beds [3]. This damage explains the multisystemic nature of preeclampsia and the occurrence of severe complications. Eclampsia represents the extreme neurological expression of this pathophysiological cascade. Severe hypertension compromises cerebral autoregulation, exposing the parenchyma to sudden hyperperfusion and increased blood-brain barrier permeability [4]. This results in vasogenic cerebral edema, often associated with posterior reversible encephalopathy syndrome (PRES), as well as ischemic or hemorrhagic lesions contributing to maternal mortality [4]. These mechanisms are exacerbated by factors frequently encountered in resource-limited countries, such as anemia, intercurrent infections, and delays in treatment, which increase the severity of neurological damage [2,5].

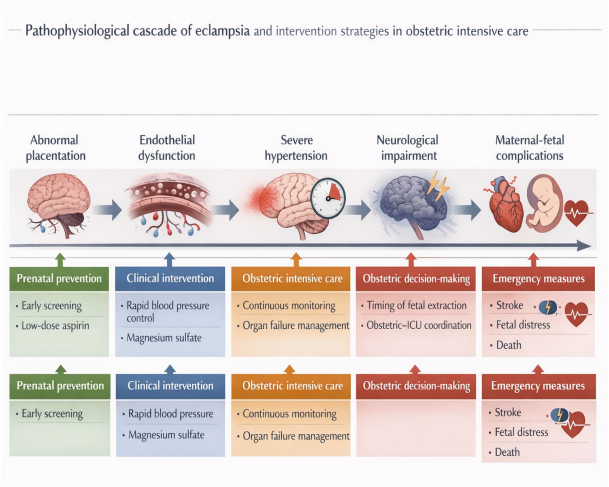

Figure 1. Pathophysiological cascade of eclampsia and levers for intervention in obstetric resuscitation

Traditional risk factors associated with maternal and fetal mortality

Traditional risk factors play a central role in the progression to severe forms of eclampsia. At the individual level, primiparity, extreme maternal age, chronic hypertension, and a history of preeclampsia are associated with an increased risk of maternal and perinatal complications [5]. The absence or inadequacy of prenatal care is one of the most powerful determinants of eclampsia-related mortality, contributing to late recognition of signs of severity and delaying the implementation of preventive measures [2,5]. Many patients have prodromal symptoms—headaches, visual disturbances, epigastric pain—that are not identified or treated in time [7].

Systemic factors, including inadequate intensive care infrastructure, a shortage of qualified personnel, and the absence of standardized protocols, contribute to transforming a potentially controllable condition into a life-threatening emergency [2]. Overcrowded healthcare facilities and referral delays in Kinshasa exacerbate these shortcomings [6].

Area	HICs	LMICs	**Impact on mortality**
Prenatal screening	Systematic screening, structured follow-up	Late or absent follow-up	Late diagnosis, severe forms
Recognition of signs of severity	Early, protocolized	Often late	Progression to eclampsia
Access to magnesium sulfate	Widely available	Unreliable availability	Uncontrolled seizures
Blood pressure control	Rapid and standardized	Frequent delays	Maternal strokes
Obstetric resuscitation	Dedicated units, continuous monitoring	Limited capacity	Multivisceral complications
Referral system	Functional pathways	Late transfers	Preventable deaths
Neonatal intensive care	Widely available	Often limited	High perinatal mortality

Table 1. Clinical, systemic, and organizational factors influencing mortality related to eclampsia according to the healthcare context. HIC: High-income countries; LMIC: Low- and middle-income countries.

Eclampsia and obstetric resuscitation: major clinical challenges

Low- and middle-income countries (LMICs) account for the majority of maternal deaths related to eclampsia worldwide, illustrating a persistent paradox between the availability of effective treatments and their insufficient implementation [2]. Unlike in high-income countries, where eclampsia has become rare, its occurrence in LMICs often reflects a series of failures throughout the

continuum of care, from prenatal monitoring to emergency management [8].

In these contexts, preeclampsia is frequently diagnosed late, sometimes only at the stage of neurological or multivisceral complications. Delays in accessing care, insufficient prenatal consultations, and poor health service coverage contribute to the silent progression of the disease [2]. Data from large multicenter analyses show that maternal mortality associated with eclampsia is several orders of magnitude higher in LMICs than in high-income countries [8].

Beyond diagnostic delays, the severity of eclampsia in LMICs is amplified by major structural constraints. Limited access to magnesium sulfate, injectable antihypertensive drugs, and continuous monitoring compromises the effectiveness of care [9]. In addition, obstetric intensive care units are often inadequate or nonexistent, making it difficult to manage the neurological, respiratory, and renal complications associated with severe eclampsia [2].

Nevertheless, several experiments conducted in constrained settings have shown that the implementation of simple, standardized protocols adapted to available resources can significantly reduce maternal morbidity and mortality [9]. These data suggest that, in LMICs, improving prognosis depends less on the introduction of advanced technologies than on the optimization of existing clinical and organizational practices.

Data from low- and middle-income countries

Low- and middle-income countries (LMICs) account for the majority of maternal deaths related to eclampsia worldwide, highlighting a marked imbalance in the distribution of maternal and fetal mortality risks [2,8]. In these settings, maternal mortality associated with eclampsia can be 5 to 10 times higher than in high-income countries, while perinatal mortality also remains significantly higher [6,8]. The main causes of death include stroke, acute renal failure, pulmonary edema, hemorrhagic complications, and nosocomial infections, all of which are exacerbated by delays in admission and inadequate monitoring [2,6].

Several structural factors explain this excess mortality. First, prenatal care is often limited, irregular, or absent, delaying the detection of severe forms of preeclampsia and delaying the early initiation of prophylactic treatments such as magnesium sulfate [2,5]. Second, intensive care facilities are often inadequate : a lack of dedicated beds, a shortage of trained staff, and a lack of continuous monitoring make the management of multiorgan complications particularly difficult [9]. Finally, access to essential medicines and emergency interventions is uneven, resulting in suboptimal or even incomplete care [2].

Despite these constraints, experiences in various LMICs show that the implementation of standardized protocols adapted to available resources can significantly improve prognosis. For instance, the use of simple rules for controlling blood pressure, the regular use of magnesium sulfate, and the prioritization of transfers to units that can handle serious complications have all helped lower maternal mortality and severe morbidity [9]. These observations suggest that improving the quality of care, even without advanced technologies, is a major lever for reducing mortality gaps between high-income countries and LMICs.

Data from LMICs highlight a persistent paradox : while effective treatments exist, their actual availability and systematic application remain insufficient. In this context, any strategy aimed at reducing maternal and fetal mortality must combine primary prevention, strengthened prenatal care, training of health personnel, and effective organization of referral systems to translate scientific knowledge into tangible clinical benefits [2, 6, 8, 9].

Specific perspectives for Kinshasa

In Kinshasa, eclampsia remains a major cause of maternal mortality, reflecting both the high burden of hypertensive disorders of pregnancy and the structural limitations of the urban health system [6]. Rapid population growth, combined with unevenly distributed healthcare provision, puts considerable pressure on referral facilities, particularly obstetric intensive care units.

Primary prevention is a priority. Strengthening prenatal care, with early identification of high-risk women, is essential to halt the progression to severe forms [6]. In this context, the targeted use of low-dose aspirin in high-risk patients is a preventive strategy based on solid evidence and applicable in the Kinshasa context [10].

At the organizational level, standardizing protocols for the management of severe hypertension and eclampsia appears to be a high-impact intervention. Continuing education for healthcare professionals in recognizing signs of severity, administering magnesium sulfate, and monitoring blood pressure is key to reducing treatment delays [11]. These measures are all the more crucial given that delays in referral remain common and contribute to late admission to intensive care [6].

Finally, the development of functional referral networks, linking peripheral facilities to centers with obstetric intensive care capabilities, is a strategic priority. Such an organization would improve continuity of care and reduce the loss of opportunity associated with late or inappropriate transfers [6,11,12].

Clinical and public health implications

A sustainable reduction in maternal and fetal mortality related to eclampsia requires close coordination between clinical interventions and public health strategies. Clinically, the systematic implementation of standardized protocols for the management of severe hypertension has been shown to significantly reduce serious complications, including eclampsia and stroke [9].

At the population level, improving access to and quality of prenatal care is a top priority. Health education for pregnant women, aimed at early recognition of the warning signs of preeclampsia, encourages earlier consultation and reduces delays in treatment [2]. These interventions are particularly relevant in high-density urban settings such as Kinshasa, where inequalities in access to care persist [6,12,13].

Furthermore, preeclampsia and eclampsia should be considered early markers of long-term cardiovascular risk. Recent data highlight a significant increase in the risk of cardiovascular disease in women who have experienced these complications, justifying the inclusion of extended postpartum follow-up in maternal health policies [14,15]. This approach would transform the management of eclampsia into an opportunity for long-term prevention.

Conclusion

Eclampsia remains a major but largely preventable cause of maternal and fetal mortality, particularly in low- and middle-income countries. Current data show that the severity of this condition is less related to the lack of therapeutic solutions than to persistent failures in prevention, early diagnosis, and the organization of care.

In Kinshasa, a significant reduction in eclampsia-related mortality is achievable through pragmatic interventions tailored to the local context. Strengthening prenatal care, standardizing clinical protocols, providing ongoing training for professionals, and improving referral systems are priority levers.

In the future, research and public health efforts should focus on evaluating the real impact of these integrated strategies in real-world settings to guide maternal health policies. Integrating the management of eclampsia into a comprehensive vision of women's health, including long-term follow-up, is essential for sustainably reducing maternal mortality and improving perinatal outcomes.

Funding

This work did not receive any specific funding from public, commercial, or non-profit organizations.

Conflicts of interest

The authors declare that they have no conflicts of *interest.*

Author contributions

JJK and AMB conceptualized and designed the article. KAM, WM, RM, DT, MB, and BB participated in the bibliographic research, critical analysis of the literature, and interpretation of the data. JJK and AMB wrote the first draft of the manuscript. All authors contributed to

the critical revision, approved the final version, and assume responsibility for its content.

Acknowledgments

The authors would like to thank the staff of the University Clinics of Kinshasa for their support and all the *authors whose work contributed to this synthesis.*

Consent to publish

Not applicable.

Availability of data and materials

The reference list cites all data used in this article from published studies. Additional information can be obtained from the corresponding author upon reasonable request.

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