

Clinical characteristics and survival of obstetric patients with cerebrovascular disease in a tertiary referral center

Características clínicas y sobrevida de la paciente obstétrica con enfermedad vascular cerebral en un centro de referencia de tercer nivel

Alejandra Dávila-Córdova¹, Tania Colin-Martínez^{2*}, Karla R. Butanda-Cruz¹, Guadalupe Vargas-Ortega³, Laura Romero-Gutiérrez¹, and Luis A. Sánchez-Hurtado⁴

¹Intensive Care Unit; ²Quality Division Head. Hospital de Especialidades; ³Management, High-Specialty Medical Unit; ⁴Head of the Critical Areas Division, Hospital de Especialidades. Centro Médico Nacional Siglo XXI, Instituto Mexicano del Seguro Social. Mexico City, Mexico

Abstract

Background: Cerebrovascular disease (CVD) during pregnancy and the puerperium represents a condition with high maternal and fetal morbidity and mortality, associated with physiological changes inherent to pregnancy and hypertensive disorders of pregnancy. **Objective:** The objective of the study is to describe the clinical-therapeutic characteristics and survival of obstetric patients diagnosed with CVD admitted to a tertiary care intensive care unit (ICU). **Material and methods:** This is an analytical, longitudinal, and retrospective study that included obstetric patients during pregnancy or the postpartum period diagnosed with stroke, admitted to the ICU of the Centro Médico Nacional Siglo XXI between 2023 and 2025. This study was approved by the local research committee. Demographic, clinical, therapeutic, and outcome variables were collected. Descriptive and inferential analyses were performed, as well as survival analysis using Kaplan-Meier curves. **Results:** Eighteen patients were included, with a predominance of hemorrhagic events and a high frequency of hypertensive disorders of pregnancy. High scores on the Acute Physiology and Chronic Health Evaluation II and SOFA scales were associated with increased mortality. In-hospital survival was high in patients who received timely intervention and multidisciplinary management. **Conclusion:** Stroke in obstetric patients constitutes a critical emergency that requires early diagnosis and specialized ICU management. Severity scales retain prognostic utility, and protocolized care can positively impact survival.

Keywords: Cerebrovascular event. Pregnancy. Postpartum. Intensive care unit. Extreme maternal morbidity.

Resumen

Antecedentes: La enfermedad vascular cerebral (EVC) durante el embarazo y el puerperio representa una condición de alta morbilidad materna y fetal, asociada a cambios fisiológicos propios de la gestación y a enfermedades hipertensivas del embarazo. **Objetivo:** Describir las características clínico-terapéuticas y la sobrevida de pacientes obstétricas con diagnóstico de EVC ingresadas a una unidad de cuidados intensivos de tercer nivel. **Material y métodos:** Estudio analítico, longitudinal y retrospectivo que incluyó a pacientes obstétricas durante el embarazo o el posparto diagnosticadas con accidente cerebrovascular, ingresadas en la Unidad de Cuidados Intensivos del Centro Médico Nacional Siglo XXI entre 2023 y 2025. Aprobado por el comité de investigación local. Se recopilaron variables demográficas, clínicas, terapéuticas y

*Correspondence:

Tania Colin-Martínez
E-mail: tania.colin2a@gmail.com

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de resultados. Se realizaron análisis descriptivos e inferenciales, así como análisis de supervivencia mediante curvas de Kaplan-Meier. **Resultados:** Se incluyeron 18 pacientes, con predominio de eventos hemorrágicos y alta frecuencia de enfermedad hipertensiva del embarazo. Los puntajes elevados en las escalas APACHE II y SOFA se asociaron con mayor mortalidad. La sobrevida intrahospitalaria fue elevada en pacientes con intervención oportuna y manejo multidisciplinario. **Conclusiones:** La EVC en pacientes obstétricas constituye una emergencia crítica que requiere diagnóstico temprano y manejo especializado en UCI. Las escalas de gravedad conservan utilidad pronóstica y la atención protocolizada puede impactar favorablemente en la sobrevida.

Palabras clave: Evento cerebrovascular. Embarazo. Puerperio. Unidad de cuidados intensivos. Morbilidad materna extrema.

Introduction

During pregnancy and the puerperium, the maternal organism undergoes a series of complex physiological adaptations that affect multiple systems, with the goal of sustaining fetal development and preparing the mother for childbirth and lactation. These changes, although indispensable for reproductive success, also predispose the pregnant woman to various medical complications and pathologies.^{1,2}

Among the principal modifications are cardiovascular changes, characterized by increased plasma volume, elevated cardiac output, and decreased peripheral vascular resistance, as well as hematological alterations that include a hypercoagulable state. This physiological environment, designed to prevent hemorrhage during and after delivery, simultaneously increases the risk of thromboembolic and vascular events, such as deep venous thrombosis, cerebral venous sinus thrombosis, and stroke (cerebrovascular disease [CVD]).¹

CVD during pregnancy and the puerperium, although infrequent, represents one of the most serious neurological complications, associated with high maternal morbidity and mortality and significant neurological sequelae. Its incidence is particularly elevated in patients with hypertensive disorders of pregnancy, such as pre-eclampsia and eclampsia, as well as in those with high-risk obstetric comorbidities.³⁻⁵ Timely recognition of stroke in this population is especially complex, as its clinical manifestations may be confused with symptoms inherent to pregnancy or other obstetric emergencies.^{3,6}

In Mexico, the management of obstetric emergencies has been strengthened through the implementation of the Código Mater, an institutional system aimed at the early detection and immediate management of conditions that threaten maternal and fetal life.⁷ Despite these advances, CVD continues to represent a diagnostic and therapeutic challenge, particularly in critical scenarios requiring admission to intensive care units (ICUs).

In this context, the concept of extreme maternal morbidity or near miss becomes relevant as an indicator of quality in obstetric care and as a tool for identifying potentially fatal events that do not culminate in death.⁸

In recent years, the number of CVD cases in women has shown an increasing trend in Mexico, and particularly in Mexico City, a finding that contrasts with the progressive reduction in maternal mortality observed during the same period.⁷⁻¹¹ Although epidemiological records do not directly link CVD as a specific cause of maternal death, the coexistence of both problems underscores the need to strengthen epidemiological surveillance and the comprehensive management of these patients, especially in women of reproductive age.

Despite the standardization of neurological management through the Código Cerebro protocol and the use of prognostic scales in ICUs, the available evidence regarding the clinical-therapeutic characteristics, clinical course, and factors associated with survival in obstetric patients with CVD remains limited.⁹⁻¹¹

It is therefore essential to systematically characterize this patient population in order to identify clinical patterns, optimize care protocols, and contribute to the development of preventive strategies that positively impact maternal morbidity and mortality – the motivation for conducting this study.

Material and methods

This was an observational, analytical, longitudinal, retrospective study conducted with authorization from the local research committee.

The medical records of all obstetric patients who were pregnant or within 11 months postpartum, admitted to the ICU of the Hospital de Especialidades of the Centro Médico Nacional Siglo XXI with a diagnosis of cerebrovascular event, admitted between January 2023 and September 2025, and who had been evaluated using the SOFA and Acute Physiology and Chronic Health Evaluation II (APACHE II) scales to assess mortality risk, were included.

Table 1. Baseline demographic and clinical characteristics in the ICU

n %	All	Alive	Deceased	p
Age	31 ± 7.8	31 ± 7.5	30 ± 11.1	0.7 25
Weight	66.06 ± 9.73	65.4 ± 9.4	70.5 ± 14.8	-
Treating service				
Neurosurgery	13 (68.4)	10 (62.5)	3 (100)	0.44
Neurology	5 (26.3)	5 (31.3)	0	
Rheumatology	1 (5.3)	1 (6.3)	0	
Obstetric status				
Pregnancy	6 (31.6)	5 (31.3)	1 (33.3)	0.69
Immediate puerperium	4 (21.1)	3 (18.8)	1 (33.3)	
Mediate puerperium	4 (21.1)	3 (18.8)	1 (33.3)	
Late puerperium	5 (26.3)	5 (31.3)	0 (0)	
Fetal status				
Alive	16 (84.2)	14 (93.3)	2 (66.7)	0.067
Stillbirth	1 (5.3)	1	0	
Anembryonic	1 (5.3)	0	1	
Comorbidities				
Systemic arterial hypertension	3 (15.8)	2 (12.5)	1 (33.3)	0.36
Diabetes mellitus	1 (5.3)	1 (100)	0	0.65
Hypothyroidism	2 (10.5)	1 (50)	1 (50)	0.161
Obesity	4 (21.1)	-	-	-
Epilepsy	1 (5.3)	1 (100)	0	0.65
Rheumatic disease	1 (5.3)	1 (100)	0	0.65
Smoking	5 (26.3)	4 (25)	1 (33)	0.764
Acute disease severity				
APACHE II	8 (2-20.5)	5 (2-14)	20 (20-21)	0.027
SOFA	3 (2-9.5)	2.5 (2-6.7)	10	0.023
GLASGOW at admission	13 (3-15)	15 (13-15)	3	0.017

ICU: intensive care unit; APACHE II: Acute Physiology and Chronic Health Evaluation II; n: number; Data with percentiles (25-75): Mann-Whitney U test; Mean and standard deviation: Student's t-test; Categorical: Chi².

The following variables were analyzed: age, sex, treating service, health status, admission diagnosis, assessment status, and discharge status; data on the interventions and therapeutic measures used (use of vasopressors, use of invasive mechanical ventilation, requirement for deep sedation, etc.), as well as complications during the hospital stay (infections, length of hospitalization, and presence of brain death), as well as laboratory data including: complete blood count and arterial blood gas analysis at admission.

Descriptive statistics were used, and the Chi-square or Fisher's exact test for qualitative variables and Student's t-test for quantitative variables with a normal distribution were used; the nonparametric Mann-Whitney U test was used for distribution-free comparisons to detect differences between groups.

Kaplan-Meier survival curves were used to evaluate potential indicators of a Código Mater patient in a critical state, and the proportional hazards model was

used to identify factors associated with complications among obstetric patients with a CVD diagnosis.

The Statistical Package for the Social Sciences software version 29 was used.

Results

Nineteen Código Mater patients with a diagnosis of cerebrovascular event were evaluated. Of these, 32% presented with cerebral venous thrombosis, 32% with subarachnoid hemorrhage, 26% with intraparenchymal hemorrhage, and 10% with arteriovenous malformation (Table 1).

On initial neurological assessment, a Glasgow score of 15 points was recorded in 10 of the 19 patients, 13 points in 2 patients, 12 points in 1 patient, and 3 points in 5 patients.

Regarding obstetric history, 13 of the 19 patients had a hypertensive disorder of pregnancy, distributed as follows: 46% had eclampsia, 23% had pre-eclampsia,

Table 2. Physiological and paraclinical characteristics at admission

Variable	All	Alive	Deceased	p
Temperature	36.3 ± 0.38	36.3 ± 0.40	36.3 ± 0.2	0.91
Systolic blood pressure, Median (IQR)	122 (108-129)	120 (101-129)	125 (113-125)	0.48
Diastolic blood pressure	70 (65.5-78.5)	70 (65.5-79.2)	66 (62-66)	0.87
Heart rate	75.8 ± 14.5	76 ± 15.4	73.3 ± 11	0.75
Lactate (mmol/dL)	1.1 (0.8-1.3)	1 (0.8-1.2)	6.8 (2.1-6.8)	0.004
SaO ₂ %	96 (94.5-98)	96.5 (95-98)	92	0.35
PaO ₂ /FiO ₂	241.7 ± 108.4	240.1 ± 100	253 ± 216	0.88
PaCO ₂ (mmHg)	32.7 ± 7.4	33.5 ± 7.2	28.6 ± 8.6	0.30
PaO ₂ (mmHg)	83.5 ± 40.5	77.8 ± 29.6	114 ± 80.6	0.15
Arterial pH	7.3 ± 0.07	7.3 ± 0.06	7.3 ± 0.1	0.63
Hb (g/dL)	11.6 ± 2.0	11.8 ± 1.6	10.5 ± 3.8	0.30
Hematocrit (%)	35.3 ± 6.0	35.8 ± 4.8	32.7 ± 11.9	0.43
Leukocytes (10 ³ /μL)	12.7 (9.5-18.4)	10.1 (8.9-17.9)	25.3 (13.3-25.3)	0.03
Neutrophils	10.4 (6.8-13.6)	7.5 (6.1-12.2)	82.2 (10.4-82.8)	0.068
Platelets (10 ³ /μL)	217.3 ± 106.3	244.9 ± 90.7	70 ± 36.5	0.005
HCO ₃ (mmol/L)	20.3 ± 4.1	21 ± 3.2	16.5 ± 6.7	0.08
Glucose (mg/dL)	103 (89-156)	102.5 (89.2-154.2)	135 (81-135)	0.95

IQR: interquartile range; PaO₂: arterial oxygen partial pressure; PaCO₂: arterial carbon dioxide partial pressure; SaO₂: oxygen saturation; Hb: hemoglobin; Data with percentiles (25-75): Mann-Whitney U test; Mean and standard deviation: Student's t-test; Categorical: Chi².

16% had HELLP syndrome, and 15% had gestational hypertension.

Among baseline demographic and clinical characteristics, a median age of 31 ± 7.8 years was observed. Regarding obstetric status at the time of the event, 13 patients were in some stage of the puerperium, of whom 4 were in the immediate puerperium, 4 in the mediate puerperium, and 5 in the late puerperium. The fetal status was reported as alive on 16 occasions.

The comorbidities identified were arterial hypertension (3 patients), diabetes mellitus (1 patient), hypothyroidism (2 patients), obesity (4 patients), and smoking (5 patients).

The APACHE II and SOFA scales were used for severity and prognostic assessment. On the APACHE II scale, surviving patients had a median of 5 points (2-14), while deceased patients had a median of 20 points (20-21). On the SOFA scale, surviving patients obtained a median of 2.5 points (2-6.7) and deceased patients a median of 10 points.

Regarding physiological and paraclinical characteristics at admission, vital signs, arterial blood gas

analysis, and complete blood count were recorded. With respect to lactate, surviving patients had a mean of 1 mmol/dL (0.8-1.3), while deceased patients had a mean of 6.8 mmol/dL (2.1-6.8) (Table 2).

On complete blood count, the leukocyte count showed a mean of 10.1 (8.9-17.9) in surviving patients and 25.3 (13.3-25.3) in deceased patients. The neutrophil count had a mean of 7.5 (6.1-12.2) in surviving patients and 82.2 (10.4-82.8) in deceased patients. Regarding platelet count, surviving patients had a mean of 244.9 ± 90.7, while deceased patients had a mean of 70 ± 36.5.

Regarding the therapeutic approach, vasopressor use was documented in 42% of patients, while 53% required sedation and mechanical ventilation.

Finally, 16 patients showed clinical improvement, while 3 patients died during their hospital stay.

Discussion

The present study describes the clinical characteristics, associated factors, and prognostic variables in

obstetric patients with cerebrovascular events treated in a tertiary care ICU. Although the sample size is limited, the findings allow for the identification of relevant clinical trends, particularly regarding the high proportion of hemorrhagic events, the elevated frequency of hypertensive disorders of pregnancy, as well as the utility of prognostic scales and certain paraclinical parameters to differentiate clinical outcomes between surviving and deceased patients. These results should be interpreted with caution and do not allow for the establishment of causal relationships, but they provide useful information for the generation of new hypotheses and future studies.

Among the 19 patients evaluated, with a median age of 31 ± 7.8 years, 13 were in some stage of the puerperium. Of these, 58% presented with a hemorrhagic cerebrovascular event: (32%) subarachnoid and (27%) intraparenchymal. These findings are consistent with those reported by Cuero and Varelas., who describe that the type of CVD with the greatest prevalence in the obstetric population is hemorrhagic, with an incidence of 6/100,000 and an increased risk during pregnancy with an RR of 2.5 (95% CI 1.0-6.4), reaching its highest peak in the 3rd trimester and immediate puerperium with an RR of 28.5 (95% CI 13.0-61.4), a situation similar to that observed in more than 50% of our studied population.

Of the 19 patients included, 13 (68.4%) presented with some hypertensive disorder of pregnancy. Miller and Leffert report that the probability of developing a cerebrovascular event is up to 6 times higher in patients with pre-eclampsia or other hypertensive disorders. In our analysis, when comparing the group of surviving patients and the deceased patients who, in addition to the CVD diagnosis, had a history of hypertensive disorder of pregnancy, a statistical significance of 0.013 was found, reinforcing the relationship between this condition and an unfavorable outcome.⁴

At admission, patients were evaluated using the APACHE II and SOFA scales. When comparing scores between surviving and deceased patients, significantly higher values were observed in the deceased group, with a statistically significant difference for both scales (APACHE II: $p = 0.027$; SOFA: $p = 0.023$). These findings suggest that severity scales widely used in the general population retained adequate discriminative capacity for stratifying the severity and mortality risk in obstetric patients with severe neurological pathology, despite the physiological changes inherent to pregnancy that could overestimate maternal obstetric mortality, as mentioned by Silva et al.⁵

Regarding physiological and paraclinical characteristics at admission, high statistical significance was observed in three parameters: hyperlactatemia ($p = 0.004$), leukocytosis ($p = 0.03$), and thrombocytopenia ($p = 0.005$), between surviving and deceased patients. The elevation of lactate and inflammatory markers observed in patients with fatal outcomes is consistent with what has been reported in non-obstetric and obstetric critical populations, where these parameters are associated with higher mortality.^{3,6}

Finally, despite the high requirement for multi-organ support, patients treated in the tertiary care ICU presented a survival rate of 84.2%, corresponding to 16 of the 19 patients who evolved favorably, while 3 died. This finding suggests that timely and multidisciplinary management at a referral center may be associated with favorable clinical outcomes in this type of population.^{12,13}

Limitations

The present study has some limitations that should be considered when interpreting the results. This is a study conducted in a non-obstetric tertiary-level hospital, which may influence the clinical profile of the patients treated, as it predominantly involves cases of high complexity and severity, which could limit the extrapolation of findings to obstetric units of lower complexity.

Furthermore, the sample size is limited, which reduces the statistical power to detect associations and does not allow for the establishment of causal relationships – only the identification of clinical trends.

As a local, non-multicenter study, the results reflect the experience of a single hospital unit, which could restrict their generalizability to other populations or care settings.

Finally, the retrospective nature of the study implies dependence on the quality and completeness of clinical records, which may introduce information biases.

Conclusion

In this study of obstetric patients with cerebrovascular events treated in a tertiary care ICU, hemorrhagic CVD predominated along with a high frequency of hypertensive disorders of pregnancy. Patients with unfavorable outcomes had higher scores on the APACHE II and SOFA scales, as well as significant alterations in paraclinical parameters, particularly lactate, leukocytes, and platelets. Despite the clinical complexity, the survival rate was 84.2%. These findings suggest that prognostic

scales and certain clinical markers may be useful for early risk stratification in this population, although studies with larger sample sizes and multicenter designs are required to validate these findings.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely collected and anonymized clinical data; therefore, individual informed consent was not required. Relevant ethical recommendations have been followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial

intelligence was used in the writing or creation of the content of this manuscript.

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