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CLINICAL ARTICLE

Epidemiologic profile, survival, and maternal prognosis factors among women at an obstetric intensive care unit

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ABSTRACT

Objective: To identify the epidemiologic profile, maternal survival, and prognosis factors that might affect survival rates in the obstetric intensive care unit (ICU). *Methods:* A prospective cohort study was conducted between January 2007 and February 2009 in a tertiary referral ICU, Belo Horizonte, Brazil. Critical patients during pregnancy and puerperium were followed from admission until discharge or death. Maternal survival was assessed in association with the cause of ICU admission, grouped into direct or indirect obstetric causes, by Kaplan–Meier curves and log-rank tests. *Results:* Among 298 patients admitted to the ICU during the study period, mortality was 4.7% (n = 14). Hypertensive disorders (46.0%), hemorrhage (15.9%), sepsis (14.2%), and heart disease (5.7%) were the main causes of admission. Half of the patients who died were admitted for direct obstetric reasons (n = 7). Survival was statistically linked to the cause of admission: most survivors were admitted for a direct obstetric cause (75.5%; $P = 0.044$). Maternal survival rates of patients admitted for indirect obstetric causes were lower than those admitted for direct obstetric causes (27.8 and 19.6 days, respectively; $P = 0.019$). *Conclusion:* The main cause of admission was a decisive factor for maternal survival in the obstetric ICU. Direct obstetric complications had a better prognosis.

1. Introduction

The admission of an obstetric patient to the intensive care unit (ICU) is a challenge for the health team. The mortality of such patients is variable, ranging from 0% to 40% [1]. This value has been used as an important indicator of the health system's performance and is indirectly related to the population's sanitary conditions. Analyzing obstetric admission, survival, and death rates aids managers, health services, and professional staff in improving access to health services and providing quality healthcare locally and nationwide [2]. Nevertheless, there is considerable disparity in these rates among low- and high-income countries [3–5].

In 2007, the maternal mortality rate in Brazil was 77 cases per 100 000 live births [6]. This rate reflects social and economic conditions in addition to government spending on health, and includes numerous avoidable cases despite considerable progress in improving maternal and child health conditions regarding sanitation in Brazil, particularly in recent decades [2,7].

Besides the mortality rate, it is also important to study the near-miss cases because their epidemiologic characteristics are almost unknown in low-resource countries such as those in South America [5,8]. Additional efforts are fundamental to improve the identification of risk factors leading to poor maternal outcomes, particularly in countries where poor outcomes are at unsatisfactory high levels. The aim of the present study was to identify the epidemiologic profile, maternal survival, and prognostic factors that affect the survival rate of women admitted to the obstetric ICU.

2. Materials and methods

The present descriptive population-based survey on severe maternal morbidity was carried out in a tertiary referral ICU for treating critical patients during pregnancy and puerperium in Belo Horizonte, Brazil. Between January 1, 2007, and February 28, 2009, a prospective cohort study was recruited and followed from admission until discharge or death. The survey was approved by the health institution's Ethics and Research Commission. Signed informed consent forms were obtained from each patient.

Clinical data were collected by doctors. The study ICU does not have electronic health records, and a specific electronic spreadsheet was used to record the study database (MS Office Excel 2007; Microsoft, Redmond, WA, USA).

Information was collected on both the diagnosis for admission to the ICU and the maternal development of the patient. Admission in postpartum period was classified as such if it occurred immediately after

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delivery, with complete placental separation and immediate care at the obstetric ICU, up until 42 days after childbirth.

Data were collected on patient age; number of days at the hospital; existence of diseases prior to pregnancy; city and hospital of origin; parity; stage of pregnancy on admission; primary cause of hospitalization; Acute Physiology and Chronic Health Evaluation II (APACHE II) score, either as an absolute value or ranked as low (0–4 points), middle (4–7 points), or high (≥8 points); clinical complications such as the need for antibiotics, mechanical ventilation, or hemodialysis; and maternal survival until discharge from the ICU or death.

The primary cause of admission to the ICU was classified as direct or indirect obstetric, or non-obstetric. WHO criteria were used to classify maternal death [9]. Admissions were categorized by the following clinical disorders: hypertensive disorders (HPDs) [10], hemorrhagic disorders, infectious diseases, and other disorders. A history of previous systemic diseases up to the present pregnancy was taken into consideration on the basis of patient information, prenatal data, or medical reports.

To evaluate the importance of predictors in immediate maternal prognosis, survivors and non-survivors were compared via χ^2 test or Fisher exact test to link categoric variables. To compare numerical variables between the groups, the *t* test of averages or Mann–Whitney test was used in accordance with a parametric or non-parametric distribution, respectively. Where an association was demonstrated, co-variables were analyzed for their impact on maternal survival using the log-rank test in Kaplan–Meier curves.

In the overall survival analysis, the maternal survival time was assessed via a Kaplan–Meier curve. Admission to the obstetric ICU was taken as the study's starting date. Survival time until discharge or death was counted in days. The event of interest, or censuring, was the occurrence of death during hospitalization at the ICU.

Statistical analyses were performed via Minitab version 14.13 (Minitab, State College, PA). A *P* value of less than 0.05 was considered to be statistically significant.

3. Results

During the study period, 299 women were admitted to the ICU. After the exclusion of 1 case for a non-obstetric cause (traumatic brain injury), data were analyzed from 298 women who received intensive care for obstetric causes.

Maternal age ranged from 14 to 46 years (median 27.5 years) among the study patients (Table 1). Forty-three (14.4%) women were under 20 years, and 70 (23.4%) were over 35 years. Most patients (232 women, 76.1%) were from the same city as the ICU, but were referred from other hospitals. In total, 157 women (51.9%) had been admitted to the referral maternity hospital itself, where there were 12 342 births during the study period and an estimated 12.7 admissions to the ICU per 1000 deliveries. Most of the admissions of the cohort study occurred during the postpartum period (217 women, 73.0%), and 40.5% were primigravidas. Five women (1.7%) were transferred from other intensive care services at the request of relatives.

Regarding the general cause of ICU admission, 162 women (46.0%) had HPDs, 56 women (15.9%) had bleeding disorders, and 50 women (14.2%) were admitted chiefly for infectious complications. For 17 women (5.7%), heart disease before pregnancy was the general cause of admission.

In addition, HPDs were the main cause of ICU admission: among 222 women who were admitted for direct obstetric causes, 127 (57.2%) had HPDs. Among these 127 women, the categories of the HPDs were eclampsia (21 women, 16.5%) and HELLP (hemolysis, elevated liver enzymes, low platelet count) syndrome (84 women, 66.1%). Among the 76 patients admitted for indirect obstetric causes, 16 (21.1%) had heart disease and 3 (3.9%) had acquired immunodeficiency syndrome.

The clinical and obstetric characteristics of the study women were grouped into direct and indirect obstetric causes (Table 1). Between the 2 groups, gestational age ($P = 0.051$), clinical severity evaluated by APACHE II score ($P = 0.480$), and mean arterial pressure ($P = 0.246$) were similar. The patient's place of origin did not significantly affect the outcome ($P = 0.431$ for women from the same city; $P = 0.907$ for women from other cities). The age range ($P = 0.034$) and the existence of previous diseases ($P<0.001$) were higher among women admitted for indirect obstetric causes (Table 1).

During the study period, the maternal mortality rate at the ICU was 14/298 (4.7%). Among the 222 women admitted for direct obstetric causes, there were 7 deaths (3.2%). There were also 7 deaths (9.2%) among the 76 women admitted for indirect obstetric causes. Among the women who died, 8 had HPDs, resulting in a mortality rate of 6.3% among the 127 women with hypertension complications. Among the 50 women admitted because of an infectious complication, 2 died (4.0%). In addition, 1 women died (1.8%) among the 56 women who had a hemorrhagic disorder on admission. Three women died from other causes: acquired immunodeficiency syndrome (1 patient), sickle cell anemia (1 patient), and cardiopathy (1 patient).

Survival rates at the obstetric ICU were associated with the cause of admission to the unit: most of the women who survived were admitted for direct obstetric causes (75.7%; $P = 0.044$) (Table 2). The use of antibiotics during the ICU stay ($P = 0.003$), the need for mechanical ventilation ($P < 0.001$), and renal replacement therapy ($P < 0.001$) were associated with lower maternal survival rates. Other factors, including APACHE II score ($P = 0.189$), showed no association with survival prognosis during hospitalization at the obstetric ICU (Table 2).

When evaluated in Kaplan–Meier curves, treatment with antibiotics, use of mechanical ventilation, and need for renal replacement therapy did not significantly affect survival probabilities throughout the hospitalization time in the ICU (25.4 versus 4.9 days, $P = 0.440$; 25.3 versus 20.8 days, $P = 0.131$; and 23.8 versus 20.0 days, $P = 0.181$, with or without the factors respectively; log-rank test).

The length of hospitalization varied from a few hours (0 days) to 53 days (mean 5.0 ± 6.7 days; median 3 days). Kaplan–Meier survival curves showed that the survival time in ICU was longer for women admitted for direct obstetric causes than for those admitted for indirect obstetric causes (27.8 and 19.6 days respectively; $P = 0.019$) (Fig. 1).

Table 1
Admission characteristics of obstetric patients admitted to the ICU by causal group.[a]

Characteristics	No. of women (n = 298)	Direct obstetric cause (n = 222)	Indirect obstetric cause (n = 76)	*P* value	Overall (n = 298)
Maternal age, y	298	27 (15–46)	30 (14–40)	0.034[b]	27.5 (14–46)
Gestational age, wk	271	32.0 (5–42)	34.0 (10–41)	0.051[b]	33.0 (5–42)
Mean arterial pressure, mm Hg	298	98.0 (0–167.7)	93.5 (0–140.7)	0.246[b]	97.2 (0–167.7)
Previous history of systemic disease	298	22 (9.9)	64 (84.2)	<0.001[c]	86 (28.7)
APACHE II score	258	9 (0–28)	10 (0–22)	0.480[b]	10.0 (0–28)
Originating from the study maternity hospital	298	114 (51.4)	43 (56.6)	0.431[c]	157 (52.7)
Originating from other hospitals	298	57 (25.7)	19 (25.0)	0.907[c]	76 (25.5)

Abbreviations: APACHE, Acute Physiology and Chronic Health Evaluation; ICU, intensive care unit.
[a] Values are given as median (range) or number (percentage) unless stated otherwise.
[b] By Mann–Whitney test.
[c] By χ^2 test.