

Clinical characteristics and outcomes of critically ill obstetric patients: a ten-year review

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BACKGROUND AND OBJECTIVES: Pregnancy and delivery can involve complications that necessitate admission to critical care facilities. The objective of our study was to assess the incidence, indications, and outcomes of obstetric patients requiring admission to an intensive care unit (ICU) in a tertiary care hospital, in Saudi Arabia.

DESIGN AND SETTING: Retrospective cohort study of consecutive obstetric admissions to the ICU at the King Abdulaziz Medical City over a 10-year period.

PATIENTS AND METHODS: We collected baseline demographic data and acute physiology and chronic health evaluation II (APACHE II) scores. ICU mortality was the primary outcome.

RESULTS: Over 10 years, 75 obstetric patients were admitted to the ICU, and 59 of these patients (78.6%) were admitted during the antepartum period. The main obstetric indication for ICU admission was pregnancy-induced hypertension (21 patients, 28%) and the leading non-obstetric indication was sepsis (12 patients, 16%). The APACHE II score was 19.59 (15.05). The predicted mortality rate based on the APACHE II score was 21.97%; however, there were only six maternal deaths (8%) among the obstetric patients admitted to the ICU.

CONCLUSION: The overall mortality was low. A team approach facilitated the application of optimal care to these patients. Obstetric patients had better outcomes than those predicted by the APACHE II scores. Appropriate antenatal care is important for preventing obstetric complications.

Pregnancy and delivery can involve complications that necessitate admission to critical care facilities.¹ Critically ill obstetric patients are usually young and initially healthy.² The management of critically ill obstetric patients is complex due to the physiological changes and pregnancy-specific diseases that require collaboration between intensivists and obstetricians.^{1,3} Usually, critically ill obstetric patients are cared for in the general intensive care unit (ICU); an obstetric ICU is only available in a small number of medical centers in developed countries.⁴ Critically ill obstetric patients account for a small proportion of ICU admissions, and the proportion varies from country to country.⁵ A number of studies have reported the characteristics and outcomes of critical ill obstetric patients in developed countries, but there is scant literature on this subject in developing countries.³ Although maternal mortality ranges from only six to twenty per 100 000

deliveries in developed countries, it is higher in developing countries. Critically ill obstetric patients account for as much as 7% of the ICU admissions in developing countries, while they account for a smaller proportion in developed countries.^{2,6} In recent times, two studies from Saudi Arabia have reported that the incidence of obstetric admission and mortality is low compared to that in developed countries.^{7,8} The primary objective of our study was to assess the incidence, indications, and outcomes of obstetric patients requiring ICU admission in a tertiary care hospital in Saudi Arabia.

PATIENTS AND METHODS

This retrospective cohort study was conducted in a 21-bed medical and surgical ICU in an 800-bed, tertiary care teaching hospital in Riyadh, Saudi Arabia. The ICU is a closed unit staffed by in-house, full-time, board-certified intensivists who attend to more than 1100 ad-

missions per year. The study population comprised of all obstetric admissions to the ICU at the King Abdulaziz Medical City over a 10-year period (December 1999 to December 2009). We used data collected prospectively from an ICU database of obstetric patients who were admitted to the ICU. We also collected the following data: baseline demographics, including age, body mass index (BMI), Glasgow coma score (GCS), lactate level, and the type of admission determined by using pre-specified admission diagnoses. Acute physiology and chronic health evaluation II (APACHE II) scores were determined.⁹ The length of stay (LOS) in the ICU and hospital were both calculated in terms of the number of calendar days. The use of vasopressors and mechanical ventilation (MV) was recorded. The patients were followed up until discharge from the hospital or until death, whichever occurred first. The ICU mortality was the primary outcome. The secondary outcomes were the incidence and indications for obstetric admission to the ICU.

Continuous data were expressed as the mean and standard deviation (SD) and were compared using the *t* test. Categorical data were expressed as percentages and compared using the chi-square test. A univariate analysis was performed to examine the association with ICU mortality. The normality of the distribution was tested using the Kolmogorov-Smirnov test. The statistical significance was defined as a *P* value of less than .05. The statistical analysis was performed using Minitab for Windows (version 13.1, State College, PA, USA).

RESULTS

Seventy-five obstetric patients were admitted to the ICU over the 10-year period. This represents 0.75% of all ICU admissions and 0.15% of the total deliveries. The majority of patients (59, 78.6%) were admitted during the antepartum period. The main obstetric indications for ICU admission were pregnancy-induced hypertension (21 patients, 28%) and postpartum hemorrhage (16 patients, 21%). The leading non-obstetric indication was sepsis (12 patients, 16%) that had typically occurred secondary to pneumonia (eight patients, 66%). Four patients sustained injuries from motor vehicle collisions (MVC) (Table 1). Twelve (16%) patients had pre-existing medical illnesses, including bronchial asthma (seven patients), hypothyroidism (two patients), and diabetes mellitus (two patients). Patients admitted due to obstetric-related causes were significantly older (33 vs. 27, *P*<.05). The median ICU length-of-stay (LOS) was two days (interquartile range, Q1-Q3:2-3), and the median hospital LOS was 10 days (Q1-Q3:7-21). Thirty-four patients (45%) required mechanical ventilation (MV) (Table 2). The

APACHE II score was 19.59 (15.05). The predicted mortality based on the APACHE II score was 21.97% (Table 3). Shock developed in 15 patients (20%) and the majority of these shock cases were caused by sepsis (80%). The mortality in this subgroup was 26%, and all these patients required MV (Table 4).

There were six maternal deaths (8%) among the obstetric patients admitted to the ICU. Three patients died from intracerebral hemorrhage (ICH) due to severe eclampsia, one from massive bleeding secondary to postpartum hemorrhage, one from a cerebral vascular accident, and one from septic shock. A standardized mortality ratio calculated for all patients was 0.36 (95% confidence interval, 0.13-0.76) (Table 3).

DISCUSSION

Our study highlights the unique characteristics of critically ill obstetric patients. These patients represent a small proportion of admissions (0.75%) to our ICU

Table 1. Indications for admission to the intensive care unit in the 75 obstetric patients.

Diagnosis	No. of patients (%)
Obstetric	42
Pregnancy-induced hypertension	21 (28)
Postpartum hemorrhage	16 (21)
HELLP syndrome	1 (1.3)
Peripartum cardiomyopathy	1 (1.3)
Antepartum hemorrhage	1 (1.3)
Other	2 (2.6)
Non-Obstetric	33
Sepsis	12 (36)
Pneumonia	8 (10.4)
Urinary tract infection	4 (5.2)
Chronic rheumatic heart disease	1 (1.3)
Central nervous system	
Meningitis	4 (5.2)
Intracranial hemorrhage	3 (3.9)
Motor vehicle collisions	4 (5.2)
Bronchial asthma	3 (3.9)
Pulmonary embolism	2 (2.6)
Brain tumor	2 (2.6)
ARDS	2 (2.6)

HELLP: hemolysis, elevated liver enzymes, and low platelet count; ARDS: adult respiratory distress syndrome

Table 2. Patient characteristics.

Variable	All patients (75)	Obstetric patients n=42 (56%)	Non-obstetric patients n=33 (44%)	P
Age	30.6 (7.4)	33 (7.26)	27 (7.5)	.009
Hospital LOS	10 (7-21)	9 (7-16)	11 (8-25)	.08
ICU LOS	2 (2-3)	2 (1-126)	3 (1.5-6.5)	.77
BMI	31.12 (8.37)	32.03 (7.15)	30.35 (9.34)	.31
Bilirubin	8 (7-21)	8 (7-22.5)	9 (7-22)	.85
GCS	15 (11-15)	15 (12-15)	15 (9.5-15)	.5
Creatinine	54.5 (37-78.3)	63 (42-89)	45 (29.5-72)	.07
Lactic acid	1.4 (1-3.1)	1.5 (0.97-3.45)	1.4 (1-2.9)	.6
INR	1 (0.9-1.3)	1 (1-1.3)	1 (0.9-1.2)	.33
MV	34 (45%)	19 (45%)	15 (45%)	.98
Use of inotropes	15 (20%)	3 (7%)	12 (36%)	.002

Values are mean (SD) or median (interquartile range). LOS: length of stay, BMI: body mass index, GCS: Glasgow coma score, INR: international normalized ratio, MV: mechanical ventilation

Table 3. Predictors and outcomes of critically ill obstetric patients.

Variable	All patients n=75	Obstetric patients n=42 (56%)	Non-obstetric patients n=33 (44%)	P
Mean APACHE II (SD)	19.59 (15.05)	15 (8.13)	24.5 (19.2)	.07
ICU mortality ^a	6 (8) (2.9-16.6)	1 (2) (0.1-12.6)	5 (15) (5-32)	.03
Predicted mortality based on APACHE II	22.0 (19.6)	15.56 (8.7)	27.7 (24.6)	.06
SMR ^a	0.36 (0.13-0.76)	0.13 (0.01-0.81)	0.54 (0.18-1.55)	

^aNumber (%), (Confidence interval); APACHE II: Acute physiology and chronic health evaluation II, SMR: standardized mortality ratio

Table 4. Comparison of obstetric and non-obstetric patients with shock.

Variable	All patients with shock n=15	Obstetric patients with shock n=3 (20%)	Non-obstetric patients with shock n=12 (80%)	P
MV	15	3 (20)	12 (80)	.99
Cause of shock				
Septic	12	0	12 (100)	.002
Hemorrhagic	3	3 (100)	0	.002
Mortality	4 (26)	1 (33)	3 (25)	.99

All values expressed as number (%), MV: mechanical ventilation

and deliveries (0.15%) in the hospital. The mortality rate of critically ill obstetric patients was 8%. The incidence of obstetric ICU admission in our cohort study was 0.15% of the total deliveries in the hospital. This result was similar to reports from developed countries, although the incidence could reach as high as 10% in developing countries.^{5,10} The 8% mortality rate for critically ill obstetric patients was in agreement with reports of maternal mortality in eastern Saudi Arabia (9.4%)⁷ and was comparable to the mortality rates in North America and Europe.^{6,11-13} In China, the maternal mortality rate reached 20%;² in developing countries, the rate could be as high as 30%.¹⁴

Only two previous studies have been conducted on this group of patients in Saudi Arabia. Suleiman and colleagues conducted a retrospective cohort study over a 12-year period in eastern Saudi Arabia. They identified 64 obstetric patients admitted to the ICU, representing 0.22% of all deliveries, and found that the most common indication for ICU admission was postpartum obstetric hemorrhage; maternal mortality occurred in 9.4% of these obstetric admissions.⁷ Another cohort study conducted in Riyadh over a six-year period identified 99 critically ill obstetric patients who represented 0.2% of all deliveries. In that study, postpartum hemorrhage was the most common indication for ICU admission, and only one critically ill obstetric patient died.⁸ A nationwide, population-based cohort study conducted in the Netherlands found that obstetric ICU admissions represented 0.24% of all deliveries, which was comparable with our finding; however, the mortality rate (3.4%) was lower than the rate detected in our study.¹

Pregnancy-induced hypertension (PIH) was the most common obstetric indication for ICU admission in our study, followed by obstetric hemorrhage. This result is in agreement with the findings of other studies.^{13,15-18} Some studies have reported that PIH is the second most common obstetric indication for ICU admission, a finding that can be explained by the management of PIH in the labor wards of those studies.²

Sepsis was the most common non-obstetric indication for admission to the ICU. Community-acquired pneumonia and urinary tract infection were the most common underlying diseases in the sepsis cases. This result was comparable to the findings of studies in developed countries and different from those in developing countries, where malaria and viral hepatitis prevailed.^{5,6} Pelvic sepsis was not observed in our study, but was common in other studies.⁵

Thirty-four critically ill obstetric patients (45%) required MV during their stay in the ICU, a rate similar to that reported elsewhere (19%-60%).^{2,19,20} The most

common indications for MV were acute respiratory failure and hemodynamic instability. Twenty percent of the patients in our study had shock, and the majority of these cases were septic shock. Patients with shock were usually more ill and all of them required MV. The mortality of this subgroup was 26%, slightly lower than that reported in the general population.^{5,21} Reversible causes of shock might explain this finding.

Four obstetric patients sustained an MVC and required ICU admission; MVC is becoming a major public health issue in Saudi Arabia.²² MVC victims occupy one-fifth of all the beds and account for 80% of the deaths in the Ministry of Health hospitals.²³

The predicted mortality rate based on the APACHE II score was higher than the actual mortality rate, confirming the results reported in many previous studies.^{5,13,24} Many reasons can account for this observation: first, normal physiological changes occur in pregnancy; second, the APACHE II test has not been validated for use in obstetric patients as a subgroup of ICU admissions; and finally, the treatable nature of the conditions that originally lead to ICU admission can decrease the APACHE II score.⁵

In our study, maternal mortality was 8%, an acceptable outcome and comparable to findings in developed countries. This low rate may have occurred because board-certified critical care physicians were available 24 hours a day and an obstetric team was also available 24 hours a day, seven days a week.²⁵ The main cause of death was ICH (50%), and this can be explained by the higher relative risk (5.6) for ICH during pregnancy than in non-pregnant patients.^{5,26} ICH is a well-known risk factor for mortality in this group of patients, but can be prevented or carefully managed by controlling hypertension.⁵

Understanding the physiological changes of pregnancy, the pharmacokinetics of the drugs administered during pregnancy, and the course of the diseases that commonly complicate pregnancy is essential to provide high-

quality care. These elements must be coupled with the early involvement of a multidisciplinary team consisting of intensivists, obstetricians, and clinical pharmacists, to deliver comprehensive care and to ultimately achieve improved maternal and fetal outcomes.⁷ The Saudi Arabian healthcare system follows the World Health Organization's (WHO) recommendations to ensure that women have access to care and use it when needed. According to estimates from the WHO, maternal mortality in the WHO European Region ranges from five to 210 deaths per 100 000 live births; in Saudi Arabia, maternal mortality is 23 deaths per 100 000 live births.

The main strengths of this study were that our data were collected prospectively and a large cohort of patients was assessed over a long period. Furthermore, the ICU operated under a closed system that was mainly staffed by board-certified critical care intensivists, thus increasing the homogeneity of clinical management and the controlling of unknown variables. Our study had several limitations. Due to the fact that the data was obtained from an ICU database, information about the gestational age and outcome was not recorded. The study had a retrospective, observational cohort design, a method that has inherent biases; however, the data were prospectively collected. The other limitations of our study were that it was conducted in a single center and the sample size was small.

Pregnancy-induced hypertension and postpartum hemorrhage were the most common indications for admission to the ICU. Overall mortality was low. A team approach facilitated the administration of optimal care for these patients. Obstetric patients had better outcomes than those predicted by the APACHE II scores. Appropriate antenatal care is important for preventing obstetric complications.

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