Obstetric Admissions to the Intensive Care Unit: A 18-Year Review in a Portuguese Tertiary Care Centre

Admissões Obstétricas em Unidade de Cuidados Intensivos: Uma Revisão de 18 Anos num Hospital Terciário Português

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Acta Med Port 2019 Nov;32(11):693–696 ▪ https://doi.org/10.20344/amp.11410

ABSTRACT

Introduction: Maternal mortality and morbidity are important indicators of the quality of health-care services. Obstetric admissions to an intensive care unit may be considered a marker of maternal morbidity. The aim of this study was to determine the incidence, maternal morbidity and mortality of pregnant and postpartum women who required admission to the intensive care unit.

Material and Methods: Retrospective analysis of all the obstetric patients admitted to the intensive care unit between 2000 and 2017.

Results: Ninety-three women required admission to intensive care (0.7 per 1000 deliveries, 0.8% of all adult admissions). Mean age was 30.3 years, mean gestational age was 33.6 weeks, 51 (54.8%) were primiparous, nine (9.7%) were pregnant of twins and five (5.4%) had not been followed during pregnancy. Eighty-four (90.3%) were admitted after immediate delivery. The most common reasons for admission were hypertensive disorders of pregnancy (35.5%) and obstetric haemorrhage (24.7%). Median length of stay was five days. Transfusion of blood products was needed in 23 (57.0%), artificial ventilation in 50 (53.8%) and use of vasopressors in 21 (22.6%). We observed four maternal deaths (4.3%). Most patients (95.7%) successfully recovered and were transferred to other departments. Sequential Organ Failure Assessment score was significantly associated with maternal mortality.

Discussion: Our results are comparable to those obtained in other studies. Maternal mortality was comparable to maternal mortality in developed countries.

Conclusion: The incidence of obstetric admissions to the intensive care unit was 0.8% and 0.7 per 1000 deliveries. Hypertensive disorders of pregnancy were the main causes of admission. Maternal mortality was 4.3%. Studies of maternal morbidity are important and can help to improve the quality of health care services.

Keywords: Intensive Care Units; Maternal Mortality; Pregnancy; Pregnancy Complications

RESUMO

Introdução: Mortalidade e morbilidade maternas são importantes indicadores da qualidade dos cuidados de saúde. As admissões obstétricas numa unidade de cuidados Intensivos podem ser consideradas um marcador de morbilidade materna. O objetivo deste estudo foi determinar a incidência, morbilidade e mortalidade maternas das gestantes e puérperas admitidas na unidade de cuidados intensivos.

Material e Métodos: Estudo retrospetivo de todas as admissões obstétricas na unidade de cuidados intensivos no período de 2000 a 2017.

Resultados: Noventa e três mulheres necessitaram de internamento em Cuidados Intensivos (0,7 por 1000 partos e 0,8% de todas as admissões de adultos). A média de idades foi de 30,3 anos, a idade gestacional média foi 33,6 semanas, 51 (54,8%) eram primíparas, nove (9,7%) eram gravidezes gemelares e cinco (5,4%) não tinham sido vigiadas durante a gravidez. Oitenta e quatro (90,3%) foram admitidas no período pós-parto imediato. Os motivos mais comuns de internamento foram os distúrbios hipertensivos da gravidez (35,5%) e hemorragia obstétrica (24,7%). A mediana do tempo de internamento foi de cinco dias. A transfusão de hemoderivados foi necessária em 53 (57,0%), ventilação artificial em 50 (53,8%) e uso de vasopressores em 21 (22,6%). Observámos quatro óbitos maternos (4,3%). A maioria das doentes (95,7%) recuperaram e foram transferidas para outros serviços. O valor do *Sequential Organ Failure Assessment score* teve associação estaticamente significativa com a mortalidade materna.

Discussão: Os resultados obtidos são comparáveis aos obtidos em outros estudos. A mortalidade materna foi semelhante à mortalidade materna nos países desenvolvidos.

Conclusão: A incidência de admissões obstétricas numa unidade de cuidados intensivos foi de 0,8% e 0,7 por 1000 partos. Os distúrbios hipertensivos da gravidez foram as principais causas de internamento. A mortalidade materna foi de 4,3%. Estudos de morbilidade materna são importantes e podem ajudar a melhorar a qualidade dos serviços de saúde.

Palavras-chave: Complicações na Gravidez; Gravidez; Mortalidade Materna; Unidades de Cuidados Intensivos

INTRODUCTION

Maternal mortality is used globally to assess the quality of health-care services. According to the World Health Organization, maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy.[1] With improved health resources, maternal mortality has declined significantly over the past few decades.[2,3] In Portugal, in 2016, it was 6.9 per 100 000 deliveries.[4] However, the prevalence of severe maternal morbidity remains controversial due to variability in criteria and a lack of data. Admission to an intensive care unit (ICU) may be considered an objective marker of severe maternal morbidity.[2,5] The percentage of

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Recebido: 11 de outubro de 2018 – Aceite: 03 de maio de 2019 |

pregnant or postpartum women who require ICU admission is claimed to be 0.4% to 16.0% of admissions and 0.7 to 13.5 per 1000 deliveries, depending on the studies.[3,5–7] The aim of this study was to determine the incidence, epidemiological characteristics, morbidity and mortality of pregnant and postpartum women who required admission to our ICU.

MATERIAL AND METHODS

This study was conducted in one of the five tertiary care centres in Portugal with a 29-bed ICU and an annual number of about 6000 births. After institutional approval, a retrospective record analysis of all obstetric admissions during 18-year period from January 2000 to December 2017 was made. We included all pregnant women or women admitted within six weeks after delivery admitted to the ICU over this period. Hospital and ICU databases were consulted, and medical records of women included were reviewed. We evaluated demographic data, reason and time of admission, Sequential Organ Failure Assessment (SOFA), Simplified Acute Physiological Score (SAPS II) and Acute Physiology and Chronic Health Evaluation (APACHE II) score in the first 24 hours of the ICU stay, interventions required, length of stay in the ICU, maternal and perinatal mortality.

SPSS 25.0 software was used for all statistical analyses. Normality of numerical variables was accessed with Kolmogorov-Smirnov test. Parametric data were represented as mean and standard deviations, nonparametric data as median and interquartile range (IQR). Absolute and relative frequencies (n (%) were used for categorical variables. In addition to the descriptive statistics, we also analysed the association between severity scores, maternal and pregnancy variables with mortality. Student *t* test or Mann-Whitney U test were used for numerical variables. The chi-square or Fisher exact probability tests were used for categorical data as appropriate. A significance level of 0.05 was considered to be statistically significant.

RESULTS

During the 18-year study period, 93 pregnant women were admitted to ICU. During this period, there was a total of 11 888 admissions in the ICU which means that obstetric admissions corresponded to 0.8% of all adult ICU admissions. Among the 93 women admitted to the ICU during the study period, 73 (78.5%) women delivered in our institution. A total of 107 121 deliveries occurred in our institution during the study period so the incidence of ICU admission was estimated as 0.7 per 1000 deliveries. The epidemiological characteristics are described in Table 1.

The mean age of the patients admitted to ICU was 30.3 ± 6.0 years with a mean gestational age of 33.6 ± 6.6 weeks. Most of them 84 (90.3%) were admitted to ICU in the postpartum period. The causes for antepartum admissions were non-obstetric infections in five cases (2 pneumonias, 2 H1N1 infections and 1 pyelonephritis), trauma in two women victims of car accidents and subarachnoid haemorrhage in the context of ruptured brain aneurysm, and traumatic brain injury in other two women. Out of all women,

Table 1 – Demographic characteristic of the patients admitted at UCI

	Total (n = 93)
Age (years)	30.3 ± 6.0
Weight (kg)	68.9 ± 12.7
Height (m)	1.6 ± 0.6
BMI (kg/m^2)	26.4 ± 4.1
Gestational age (years)	33.6 ± 6.6
Primiparous	51 (54.8%)
Single pregnancy	84 (90.3%)
Antepartum care	88 (94.6%)

51 (54.8%) were primiparous, nine (9.7%) were pregnant of twins and five (5.4%) did not have regular antepartum care. The most common mode of delivery was caesarean section in 67 (81.7%), followed by instrumented delivery in eight (9.8%) and eutocic delivery in seven (8.5%). The most common reasons for ICU admission are described in Table 2. Severe preeclampsia was the main cause (35.5% of the admissions) and was associated with HELLP syndrome in 17 cases and eclampsia in nine. There were 23 cases of obstetric haemorrhage, 22 caused by uterine atony and one uterine rupture. Infections were the third cause (20.4%), pneumonia in seven women, obstetric infections in four, urosepsis in two, two H1N1 infections, one case of varicella and one appendicitis with peritonitis. Non-obstetric diagnoses accounted for trauma, ruptured brain aneurysm, one anaesthetic complication and other clinical conditions like Noonan syndrome and Mirror syndrome. Obstetric complications included perineal laceration during instrumented delivery (3) and laceration of bladder or ureter during caesarean delivery (3).

The median length of ICU stay was 5 days (IQR, 1 – 66 days). Time taken after delivery for transfer to ICU was less than 24 hours in 46.4%, the median was 1 day (IQR, 0 – 17 days). The most common interventions during ICU admission were transfusion of blood products in 53 (57.0%), artificial ventilation in 50 (53.8%) and use of vasopressors in 21 (22.6%) women. The median of days with artificial ventilation was 4 (IQR, 1 – 64 days) (Table 3).

Four women died within 42 days after delivery. The incidence of maternal death was therefore four out of 93 (4.3%) which results in a maternal mortality rate of 3.7 per 100 000 deliveries. Causes of maternal death were haemorrhagic shock due to uterine rupture during childbirth, septic shock (*clostridium sordellii* infection) secondary to a legal

Table 2 – Reasons for admission

Reasons for admission	Frequency (%)
Hypertensive disorders of pregnancy	33 (35.5%)
Obstetric haemorrhage	23 (24.7%)
Sepsis/infection	19 (20.4%)
Non-obstetric diagnoses	12 (13.0%)
Other obstetric complications	6 (6.4%)

Table 3 – Risk scores, treatment and length of stay in UCI

	Total (n = 93)
APACHE II	10.4 ± 7.1
SAPS II	22.8 ± 12.2
SOFA	5.1 ± 3.5
Artificial ventilation	50 (53.8%)
Days with artificial ventilation	4 (1 – 64)
Blood transfusion	53 (57.0%)
Vasopressors	21 (22.6%)
Length of ICU stay	5 (1 – 66)

medical abortion, subarachnoid haemorrhage in the context of ruptured brain aneurysm and acute respiratory distress syndrome (ARDS) associated with H1N1 infection. Upon review of the patient files we verified that two other patients were dead, one 3 months later after ICU stay with an oncologic disease and one patient with Noonan syndrome that died 3 years later due to a massive pulmonary embolism.

The mean weight of the newborns was 2503 ± 970 g, median APGAR at 1 minute was 6 (0 – 10), at 5 minutes was 9 (0 – 10) and at 10 minutes was 10 (0 – 10). There were seven fetal deaths with less than 28 weeks, one was a medical abortion and the other were associated with maternal infections and one car accident. We observed four perinatal deaths. Perinatal mortality was therefore 4.2% (4 out of 95, including 9 twins).

We did not find any association between maternal or pregnancy variables and mortality ($p > 0.05$).

APACHE II and SAPS II scores showed no association with mortality ($p = 0.64$ and $p = 0.12$ respectively). SOFA score had a statistically significant association with maternal mortality ($p < 0.001$) (Table 4).

DISCUSSION

The present study is one of the few studies to investigate obstetric admissions to ICU in Portugal and one of the studies with the longest period of analysis. In our study, obstetric admissions accounted for only 0.8% of total admissions in our intensive care unit and 0.7 per 1000 deliveries. These results are comparable to those obtained in other countries.[5,8,9] The majority of women admitted to ICU were postpartum (90%), which is in accordance with the published literature.[5,8–11] The length of ICU stay in present study, 5 days (IQR, 1 – 66 days), was comparable with most of the published studies.[5] The most common reasons for ICU admission in this study were hypertensive disorders of pregnancy in 35.5% and obstetric haemorrhage in 24.7%, sepsis/infection in 20.4%, non-obstetric diagnoses in 13% and other obstetric complications in 6.4%. In the study by Pollack *et al*, hypertensive disease of pregnancy accounted for 12% – 75.5% of ICU admissions, obstetric haemorrhage 5% – 53%, sepsis/infection 0% – 24%, other obstetric complications 0% – 55%, and non-obstetric diagnoses 0% – 47%.[5] In the study by Wanderer *et al*, hypertensive disorders of pregnancy and haemorrhage account for approximately 30% and 19% of ICU admissions, respectively.[12] Even though haemorrhage and hypertensive diseases of pregnancy are the most common reasons for ICU admission, they are not the most common causes of death in this population as shown in our results and in other studies.[13] Maternal mortality was 4.3%, which is similar to other studies in developed countries with a mean maternal mortality of 3.4%.[5]

Table 4 – Severity scores and association with mortality in ICU

Score	Survival	Mean ± standard deviation	*p*-value
APACHE II	Dead (n = 4) Alive (n = 85)	12.0 ± 1.8 10.3 ± 7.2	0.64
SAPS II	Dead (n = 4) Alive (n = 83)	32.0 ± 5.6 22.3 ± 12.3	0.12
SOFA	Dead (n = 4) Alive (n = 83)	7.8 ± 0.5 5.0 ± 3.5	< 0.001

Several scoring systems are used in general ICU populations to predict the risk of mortality. The most frequently used systems are SOFA, SAPS II and APACHE II. SOFA score at admission might be a useful tool for predicting mortality in the obstetric population, according to some studies.[14–16] However, in obstetrical ICU populations, SAPS II and APACHE II appeared to be unable to accurately predict mortality, especially in ICU admissions for obstetrical diagnoses.[11,17,18] This is explained by the fact that obstetric patients are relatively young and healthy, and that physiological changes in pregnancy already cause higher scores in the absence of any disease. It has, therefore, been reasonably suggested that a new scoring system is required for obstetric ICU patients.[13,19]

Our study has some limitations. The first is the selected population in a tertiary referral centre for high risk situations, so that comparison with other studies and the conclusions should be carried out with caution. The second is the retrospective design that affects the ability to identify cases accurately using existing hospital or ICU databases or medical records. Accordingly, identification of cases is dependent on accurate and consistent reporting of either the pregnant or postpartum status of the woman. Thus, it is possible that the incidence of ICU admission of pregnant and postpartum women has been under-reported.

CONCLUSION

The incidence of obstetric ICU admission was 0.8% and 0.7 per 1000 deliveries. Most admissions occurred after delivery and the main causes were hypertensive disorders of pregnancy and haemorrhagic complications. The maternal mortality was 4.3%.

More studies on severe maternal complications are needed to improve the quality of health care services.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

CONFLICTS OF INTEREST

This work had no financial support.

FUNDING SOURCES

The authors declare they have no conflict of interest.

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