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Obstetric patients in intensive care unit: Perspective from a teaching hospital in Pakistan

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Abstract

Objective: Review of obstetric cases admitted to the intensive care unit.
Design: Ten year retrospective review of individual patients' medical records.
Participants: Records of obstetric patients admitted from 2005–2014.
Setting: Aga Khan University Hospital Karachi
Main Outcome measures: Diagnosis at the time of admission, associated risk factors, and intervention required aspects of management and rate of mortality.
Findings: A total of 194 obstetric patients were admitted out of which 86.2% of patients had ventilator support. Mortality was not seen to be significantly associated with parity and antenatal/postnatal status. The median age of patients was 34 years, minimum length of stay was 24 hours and maximum stay was 53 days. Sixty one percent of patients were admitted to with organ system failure. The overall mortality rate was 21.64% (42/194). The mortality rate was five times more likely in patients who had gastrointestinal complication {Odds Ratio=4.87; 95%CI: 1.65-14.36}. The largest group of patients {28.4%} presented with hematological diagnosis.
Conclusion: When the intensive care unit admission became essential, primary diagnosis included: postpartum hemorrhage, hypertensive disorders, sepsis and infectious diseases. An increased vigilance of high-risk pregnant women and a stabilization of their condition before intervention is administered, improves the outcome of these women.

Keywords

pregnancy, critical care, obstetrics

Background

Critically ill obstetric patients admitted in the intensive care unit present a case for the attending intensive care unit team and obstetrician.[1] In the majority of women, pregnancy and labour progress without any event as patients are usually young and healthy with minimum or no co-morbidity. The physiological burden of pregnancy places the pregnant patient population at a greater risk of contracting and developing emerging infections, thromboembolic accidents, sepsis and other diseases.

In the intensive care unit, pregnant patients may present with diseases and conditions that are specific to pregnancy. Such conditions are required to be observed against variances in physiology between gravid and non-gravid patients, as well as gravid patients and their foetus.[1] The critically ill obstetric patients can be categorised into three groups. The first group is of patients who present with illnesses specific to the pregnant patient: for example, pre-eclampsia/eclampsia, thromboembolic disorders, peripartum/postpartum haemorrhage and puerperal sepsis. The second group comprises patients who present with the existing illnesses resulting from medical conditions aggravated due to pregnancy: for example, hypertension, rheumatic heart disease and diabetes. Complications in pregnancy resulting from chronic and acute medical disorders are developing as a significant cause of morbidity and mortality.[2]

The third group includes patients with pre-existing medical conditions, that may not be as critical in a non-gravid state, but that directly correlate with high mortality rates in pregnant women. An example of such a condition is hepatitis E in pregnancy. That has a mortality rate of 20% in pregnant women and 1% in non-pregnant women.[3] Hepatitis E is also associated with perinatal mortality and high rates of preterm labour.[4]

In Pakistan, each year, over five million women become pregnant and it is projected that about 500 maternal deaths occur per 100,000 live births each year due to pregnancy-related causes. In reality, it may be higher because of registration of deaths in women where the cause of death is unknown.[5] The management of such patients requires a multidisciplinary approach that engages obstetrician, intensivist and anesthesiologists.

This paper will give an overview of the critical illnesses affecting the obstetric population: it will focus

on the potential obstetrics and gynecology-related risk factors leading to admission in the intensive care unit, the treatment provided and the outcomes and monetary cost of the admission.

Materials and methods

Patients

A retrospective study was undertaken of all the obstetric patients admitted to the intensive care unit in Aga Khan University Hospital between January 2005 and December 2014. Aga Khan University Hospital is a 577-bedded tertiary care hospital with 55 critical-care beds available in the intensive care unit, cardiac care unit and neonatal intensive care unit. Aga Khan University Hospital accepts referrals nationally and regionally. Aga Khan University Hospital has the region's lowest average length of stay of 3.3 days.[6]

The admission criteria for the intensive care unit include the patient's need for respiratory support or intensive therapy. The decision to admit the patient to the intensive care unit is made by both the intensive care team and the primary attending physician. Furthermore, patients who require haemodynamic monitoring and vasopressor support, invasive or non-invasive ventilator support and/or patients with major organ dysfunction are also admitted to the intensive care unit.

The intensive care unit is a 10-bed adult and 4-bed pediatric intensive care unit. The facility is approved by Joint Commission International Accreditation[7] for standards of patient safety and care. The unit is open and staffed 24 h a day, seven days a week and equipped with ventilators, invasive haemodynamic monitoring systems and haemodialysis and patients receive 1:1 nursing care.

The nursing staff consist of registered nurses (nurse manager, clinical nurse specialist, head nurse, clinical nurse instructor and staff nurse), enrolled nurses, patient care assistants and healthcare attendants. They work 8 h rotational shifts. All registered nurses are Advanced Cardiac Life support certified and they undergo re-certification every two years.[6] All consultants and associate consultants managing intensive care unit patients are credentialed. Performance indicators and their audits are used to assess and improve important functions and processes of patient care. Inpatient feedback data acquired through patient satisfaction surveys also help healthcare professionals to meet patient needs and expectations.

For the purpose of this study, only those cases have been reviewed in which patients were admitted for 24 h or above. Cases coded between '630' and '67914' according to ICD-9 codes (International Classification of Diseases, 9th revision) system and for whom there were sufficient retrievable demographic and laboratory data at the time of admission to the hospital and to the intensive care unit were included in this study. 'Obstetric cases' were defined as patients who were either pregnant at admission or those who had delivered in the six weeks prior to admission.

A detailed review of the medical record for each case was conducted; this included a review of indications, management and outcome. Patient data collected included basic demographic characteristics, obstetric/medical history, diagnosis at admission, the intensive care unit course, length of stay, treatment administered and outcome. Laboratory data collected included haemoglobin, white blood cell and platelet counts, serum creatinine levels and the prothrombin international normalised ratio. The disease identified to be responsible for the patient's critical illness was referred to as the primary diagnosis, and patients were categorised according to related complications and outcomes of the disease.

The overall mortality rate was calculated and the cause of death was determined by the intensive care unit charts. The presence of sepsis was defined either bacteriologically by positive cultures of blood, urine or pelvic tissue (taken at the time of hospital admission), or by histopathological examination.

Statistical methods

This study was approved by the Ethics Committee of the Aga Khan University Hospital. The software Microsoft Excel was used to organise relevant patient data obtained for the study. Data were analysed after importation into a statistical package for Social Sciences Software version 19. Continuous variables were reported as median and interquartile range while categorical variables were reported as number and percentage. Chi-square test was used to identify associated risk factors at univariate level and logistic regression for multivariate analysis. Odds ratio and 95% confidence interval were also computed. A two-sided p value of ≤ 0.05 is considered statistically significant.

Results

A total of 194 obstetric patients were admitted to the intensive care unit during January 2005 to December 2014. The median age of obstetric patients was 34 years (range: 20–49) and 86.2% of patients required ventilator support. Table 1 summarises

Table 1. Outcomes of patients admitted to the intensive care unit with regards to their gravidity, pregnancy status and source of admission.

Variables	Total $n = 194$	Survived $n = 152$	Expired $n = 42$	Odds ratio [95% confidence interval]
Gravidity				
Primigravida	67	54 (80.6%)	13 (19.4%)	0.81 [0.39–0.169]
Multigravida	127	98 (77.2%)	29 (22.8%)	
Pregnancy status				
Antenatal	72	57 (79.2%)	16 (22.2%)	1.03 [0.51–2.07]
Postnatal	121	95 (78.5%)	26 (21.5%)	
Source of admission				
Emergency department	74	52 (70.3%)	22 (29.7%)	2.11 [1.06–4.23]
Obstetrics and gynecology department	120	100 (83.3%)	20 (16.7%)	

Results are presented as *n* (%).

the outcomes in the pregnant patients admitted to the intensive care unit in relation to their gravidity, pregnancy status and source of admission. Mortality was not statistically associated with parity and antenatal/postnatal admission; however, the mortality rate was observed to be two times higher in women admitted to the intensive care unit through the emergency department (odds ratio = 2.11; 95% confidence interval: 1.06–4.23).

The minimum length of stay in the intensive care unit was 24 h and maximum length of stay was 53 days. The case with maximum duration of intensive care unit presented on fifth postnatal day with respiratory failure due to H1N1 pneumonia and acute respiratory distress syndrome. She was placed on ventilatory support for 24 days and eventually died. The mean cost of receiving treatment in the intensive care unit was $3300. This expenditure does not include additional treatment after the patient was discharged from the intensive care unit.

The overall mortality rate of patients admitted to intensive care unit was 21.64% (42/194). Sixty-one per cent of patients were admitted to the intensive care unit with multiorgan failure and, among them, the following diseases were classified: 32% cardiovascular, 31% were respiratory, 39% renal, 23% liver/gastrointestinal, 20% haematological and 36% neurological abnormalities; 56% of patients presented septic shock, 51% haemorrhage and 12% with cardiogenic shock. Only 4.2% of patients were admitted to the intensive care unit due to anesthetic complications. At the time of admission to the hospital, the majority of patients had an imbalance in their serum creatinine levels, haemoglobin and white blood cell counts. The demographic of the patients and laboratory findings of the study are summarised in Table 2.

Table 2. Demographics and laboratory findings (*n*: 194).

Variables	Median(IQR)
Age (years)	34.5 (29–37)
Intensive care unit stay (days)	27 (18–32)
Haemoglobin (11.1–14.5 g/dL)	9 (7–10)
WBC (4.5–10.0 $\times 10^9$/L	14 (9.6–16.4)
Platelets (150–400 $\times 10^9$ L	220 (148–259)
Creatinine (0.6 to 1.1 mg/dL)	4.3 (3–5)
INR	10.4 (7.2–12.2)

IQR: interquartile range; INR: international normalised ratio.

Mortality rates for patients who had cardiovascular, respiratory, renal, endocrine or haematological complications were not statistically different. Mortality rate was five times higher in patients who had gastrointestinal complications (odds ratio = 4.87; 95% confidence interval: 1.65–14.36). The largest number of patients admitted presented with haematological diagnoses (28.4%). The majority of this group of patients was diagnosed with obstetrical

haemorrhage (41%). The main causes of obstetric haemorrhages were placenta accrete (33%) followed by uterine atony (27%), placenta previa (19%), placental abruption and retained products of conception (13%), cervical trauma and uterine rupture (11%) and pelvic trauma (2.8%). Pre-eclampsia was the main cause of admission for patients with cardiovascular diagnoses (24.23%), respiratory diagnoses (12.37%) and pulmonary edema (62%). Of the patients who presented with sepsis (20.1%), the majority had puerperal sepsis (62%), with fewer patients presenting with endometritis (14%), chorioamnionitis (5.9%) and mastitis (2.9%). Seventy per cent of infections were of bacteriological origin. A comparison of co-morbidities in survival and expired patients is summarised in Table 3.

Table 3. Comparison of co-morbidities in survived and expired patients (*n*: 194).

Obstetric Complications	Total *n* = 194	Survived *n* = 152	Expired *n* = 42	Odds ratio [95% confidence interval]
CVS	48 (24.7%)	40 (26.3%)	8 (19%)	0.66 [0.28–1.54]
A. Peripartum cardiomyopathy	14 (7.2%)	10 (6.6%)	4 (9.5%)	
B. Hypertensive disease of pregnancy	34 (17.5%)	30 (19.7%)	4 (9.5%)	
I. Pre-eclampsia	27 (13.9%)	24 (15.8%)	3 (7.1%)	
II. Gestational HTN	3 (1.5%)	3 (2%)	–	
III. Superimposed pre-eclampsia	4 (2.1%)	3 (2%)	1 (2.4%)	
Respiratory	25 (12.9%)	20 (13.2%)	5 (11.9%)	0.89 [0.31–2.54]
A. Amniotic fluid embolus	1 (0.5%)	0 (0%)	1 (2.4%)	
B. Pulmonary edema	15 (7.7%)	12 (7.9%)	3 (7.1%)	
C. ARDS	4 (2.1%)	3 (2%)	1 (2.4%)	
Others	5 (2.6%)	5 (3.3%)	–	
GI	15 (7.7%)	7 (4.6%)	8 (19%)	4.87 [1.65–14.36]
A. HELLP	4 (2.1%)	3 (2%)	1 (2.4%)	
B. Acute fatty liver	2 (1%)	2 (1.3%)	–	
C. Hepatitis E	9 (4.6%)	2 (1.3%)	7 (16.7%)	
Renal	15 (7.7%)	12 (7.9%)	3 (7.2%)	0.89 [0.24–3.34]
Proteinuria	7 (3.6%)	6 (3.9%)	1 (2.4%)	
Others	8 (4.1%)	6 (3.9%)	2 (4.8%)	
Endocrine—GDM	7 (3.6%)	5 (3.3%)	2 (4.8%)	1.47 [0.27–7.86]
Haematological	55 (28.4%)	39 (25.7%)	16 (38.1%)	1.78 [0.86–3.66]
Sepsis	39 (20.1%)	31 (20.4%)	8 (19%)	0.92 [0.82–2.18]
A. Pelvic sepsis	36 (18.6%)	28 (18.4%)	8 (19%)	
B. Mastitis	3 (1.5%)	3 (2%)	–	

Data are expressed as *n* (%).
CVS: cardiovascular system; GI: gastrointestinal; GDM: gestational diabetes mellitus; ARDS: acute respiratory distress syndrome; HTN: Hypertension; HELLP: haemolysis, elevated liver enzyme levels, low platelet levels.

Discussion

The number of patients reviewed in this article does not represent a sample of all obstetric women requiring intensive care unit care in the area or the city. Access to and quality of healthcare in Karachi vary drastically. Not all patients have access to intensive care units, and many cases are managed by smaller hospitals with limited resources, tertiary centers or out of hospital. Considering the high maternal mortality rate of 200 to 513 per 100,000 live births[8] coupled with the high birth rate for Pakistan, these numbers probably do not reflect the true intensive care unit need for obstetrical patients.

International epidemiology findings over numerous years[9–11] had consistently presented that obstetric patients are often admitted to intensive care unit due to obstetric haemorrhage or hypertensive diseases of pregnancy. The other reasons for the high mortality in women of low- and middle-income countries include: infections, unsafe abortion and obstructed labour. In Pakistan, maternal death was found to be directly caused by postpartum haemorrhage (21.0%), hypertension (18.6%), sepsis (13.3%), abortions (11.0%), obstructed labour (8.7%) and other causes (27.4%).[12] The findings of this study also corroborate the major diagnoses in obstetrics cases leading to life-threatening emergencies: haemorrhage (28.4%), hypertension (17.5%) and sepsis (20.1%). In comparison to earlier reports from Aga Khan University Hospital, this review reveals that sepsis was the commonest cause and accounted for 25% of 81 maternal deaths.[13] The other causes were hypertension and haemorrhage, 7.4% and 12%, respectively, infectious disease in 17%, malignancy in 5% and hepatic failure in 21% of patients.

High rates of repeat caesarean section may possibly lead to obstetric intensive care unit referrals, eventually requiring peripartum hysterectomy due to an augmented risk of haemorrhage.[14] Globally, the rate of caesarean section has increased; however, this rate varies from 1.6% in the city of Haiti to 59% in Chilean hospitals.[15] Placenta increta/percreta is a common cause of haemorrhage in cases where the patient has had three to four caesarean sections in the past. In a population-based cross-sectional study in Madras, India,[16] the caesarean section rate for the total population was 32.6% with a primary caesarean section rate of 25%. This trend of increasing caesarean section rates observed in other developing countries is directly correlated with a higher pregnancy incidence of placenta increta.

This study reported a mortality of 21.64%. Mortality was five times more likely in patients who had gastrointestinal diseases with hepatitis as the main cause of death. It is unfortunate that in countries where young women are burdened by obstetrical risks, they are also prone to develop infectious diseases such as hepatitis. In pregnant women, the illness is predominantly severe and carries a high case fatality rate (15%–25%).[17] Hepatitis may be the admitting diagnosis in up to 6.2% of patients presenting to the intensive care unit.[18] In Pakistan, hepatitis A virus is accountable for more than 19% of all new infections and ranks second to hepatitis C virus. Hepatitis E virus ranks third and causes 12% of all newly diagnosed/acute cases of viral hepatitis.[19] In a retrospective study of 62 pregnant women in New Delhi, India, who presented in the third trimester with jaundice, hepatitis E infection was detected in 45% of the women. In this group, 82% of the women had fulminant hepatic failure and mortality rate was 26.9%.[4]

Although Pakistan has all the precursors for the spread of these two kinds of hepatitis, the healthcare sector has been unsuccessful at better protecting the population.[20] Consequently, a large sector of our population remains susceptible to acute hepatitis E virus infection. Certain cohorts such as women of childbearing age can be protected through hepatitis E virus vaccine.[21] Spreading an awareness of hepatitis E virus and hepatitis A virus as primary health challenges is the first step towards developing effective hepatitis control strategies. Other ways to control both diseases are to ensure provision of clean water, improved sanitation and promoting vaccination.

Other studies suggest a high rate of deaths around the time of childbirth.[22–24] The majority of maternal deaths taking place in the community are caused by a lack of access to skilled care providers, lack of antenatal, intrapartum and postnatal care and underutilisation of healthcare facilities. An average of 89% (77.1% urban and 94.1% rural) of deliveries takes place at home, where a traditional birth attendant or *dai* is the main healthcare provider.[25] During labour and deliveries, women develop complications and only 1 out of 20 is transported to a health facility with access to emergency obstetric care.[26] Lack of access to emergency obstetric care, unsafe deliveries by traditional birth attendants, high fertility rates, a lack of knowledge and an ineffective referral system are the main factors related with maternal deaths in Pakistan.[25,26] In order to reduce the problem encountered during pregnancy and delivery, it is important to strengthen the referral process and primary healthcare infrastructure. Skilled birth attendants and trained health personnel play a vital role in the community during antenatal care, at the time of delivery and in the assessment of patient for referrals.

There has been a collective effort of the medical community to encourage women to deliver in health clinics or in hospitals.[27] Admission to intensive care

unit services is determined by socio-economic factors, health infrastructure and policy. The insufficient allocation of funds for healthcare has reduced the availability of intensive care units in many countries[28–30] as there is a disparity in the overall incidence and prevalence of intensive care unit admission between developed and developing countries. In developed countries, such as the United States, only 0.2%–0.9% of the obstetric patients are admitted in critical-care units.[31] The small number of obstetric intensive care unit admissions is made possible by increasing access to specialised centres for quality obstetric services, evidence-based practice, providing well-equipped labour rooms and financial adequacy. In this study, 1.34% of obstetrics patients were transferred to the general intensive care unit. This finding corresponds to the 1.34% and 1.4%, statistics quoted by reports on obstetric patients admitted to intensive care units in developing countries.[32]

Many countries still do not have an integrated, well-functioning healthcare system that caters to the needs of patients at risk, this leads to the poor statistical reports cited.[33,34] Studies focused on developing countries reported a maternal death to near miss ratio of 1:5 and 1:7, respectively.[35–37] Studies conducted in developed countries reported a ratio of 1:117–223.[35] The numbers of intensive care unit beds also varies considerably between developed and developing countries; intensive care unit beds number 2/100,000 population in developing countries compared with 30.5/100,000 in the US.[38,39] This proportion is indicative of the standard of care provided to critically ill patients.

The data for this study were collected retrospectively. An analysis of intensive care unit admissions provides an understanding of the scope and the extent of the factors that contribute to maternal morbidity. Pregnancy is a condition which can present with preventable morbidity even where there is optimum care and well-developed maternal services.[40] In developing countries, delay in care seeking and substandard care at health facilities influences outcomes. Strategies for educating pregnant women and their families about the importance of presenting at the healthcare facility as a first response to the onset of symptoms related to complications can improve outcomes. Increased vigilance and improved training at healthcare facilities would make a significant contribution.

Conclusion

The need for admission to the intensive care unit remains unchanged over the recent years; it is often unavoidable and unforeseeable. Primary diagnoses at the time of admission are postpartum haemorrhage, hypertensive disorders, sepsis and infectious diseases. The proportion, severity and access to critical care may vary in different health jurisdictions. Effective management of the peripartum patient entails an understanding of the normal physiological variations that accompany pregnancy. If the at-risk patient receives timely and adequate medical attention and is started on the appropriate course of treatment, this may decrease the severity of a developing event. In order to achieve this, a multidisciplinary team is of utmost importance.

Accessibility to good obstetric care is the basis for decreasing maternal mortality. Considering the high number of women who deliver at home or in basic health units in developing countries, there is a need for a regional referral center to respond to emergency situations. Access to the intensive care unit is not the only measure of the quality of obstetric care delivered but it is an important aspect of care. In proportion, small numbers will require intensive care unit care, but for these patients provision of this care is a matter of life and death. An early referral to the intensive care unit and, therefore, optimal care of circulation, blood pressure and ventilation may reduce the occurrence of multiorgan failure in at-risk patients. The information discussed in this study is beneficial for counseling purposes and in the distribution of departmental and hospital resources. This study also concludes that a close monitoring of high-risk pregnant women and an optimum stabilisation of their situation before intervention improves the outcome for these women.

Declarations

Competing interests: None declared

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Ethical approval: This is a retrospective chart review of cases and hence no consent form is required. The ethical review committee gave written permission to review the medical files.

Guarantor: RQ

Contributorship: RQ conceived, designed, final approval of manuscript and also takes the responsibility for all aspects of the research in ensuring that questions related to accuracy of the data are resolved and available for any future correspondence; SIA data collection, monitoring quality of data collection, designed statistical analysis, manuscript writing and final editing; AR did statistical analysis; AK data collection, manuscript writing; UC manuscript writing.

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