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Clinical Profile and Treatment Outcomes of Women and their Neonates admitted in The Obstetric Intensive Care Unit, Muhimbili National Hospital, Tanzania

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Abstract

Background

Critical illness during pregnancy and puerperium may result from -associated complications, non-obstetric medical illness, or preexisting conditions. The best outcome for both maternal and neonates depends on the multidisciplinary approach, from the involvement of obstetricians, neonatologists, physicians or surgeons and critical care physicians. Muhimbili national hospital's obstetric critical care unit is still in the early stage, therefore there is a need to study the clinical profiles and treatment outcomes of critically ill obstetric patients for further improvement of maternal health care.

Methods

A cross-sectional facility-based study was conducted using 257 case files of women who were admitted to the obstetric intensive care unit during pregnancy or puerperium from November 2017 to December 2018 at Muhimbili National Hospital. The socio-demographic characteristics, indications for admission, interventions given, and maternal and fetal outcomes were retrieved from the case files and charts using a checklist. Statistical software version 23 was used and the descriptive statistics were presented in frequency and summarized in tables.

Results

Over a fourteen-month study period, 10,112 women were delivered at Muhimbili National Hospital, and 0.25% were admitted to the Obstetric intensive care unit with a mean age of 28±6.6 SD. Most patients were multiparous and admitted during the postpartum period. Obstetric hemorrhage (33.1%) and pregnancy-related hypertension with its complications (45.5%) were the leading causes of admissions. The most common interventions done were blood transfusion (53.3%), anticonvulsants (31.1%) and mechanical ventilation (28.8%). Overall, the fatality rate among women admitted to Intensive care unit was 20%.

Conclusion

Critically ill obstetric patients were relatively young in our study population, mostly admitted due to obstetric hemorrhage and pregnancy-related hypertension. Morbidity and Mortality associated with these conditions are preventable by emphasizing on early detection and involvement of a multidisciplinary team with increased access to a dedicated intensive care unit and high dependency unit.

Keywords*: Critical care, Obstetrics, Maternal mortality.*

Background

Critical care during pregnancy and postpartum is a complex and crucial aspect of maternal health care. Pregnancy introduces profound cardiovascular, respiratory, and hematological changes which create a dynamic physiological state (1–4). A critically ill patient is defined as a patient with impending, developing or established significant organ dysfunction, which may lead to a long-term morbidity or death (5) .The admission of pregnant and postpartum patients to the Intensive Care Unit (ICU) ranges from 0.7 to 13.5 per 1000 deliveries (6–8). This represents less than 2% of the patients, however, both maternal and fetal mortality is high when ICU care is required (6,9–14).

The commonest disorders among patients admitted to the ICU during pregnancy or the postpartum period are the hypertensive disorders, such as preeclampsia and eclampsia, and they are significant contributors to maternal morbidity and mortality (6,15–17). Patients with pre-eclampsia are at increased risk of life-threatening conditions such as cerebrovascular hemorrhage, pulmonary edema, liver rupture, and acute kidney injury (15). The delicate balance required to manage hypertension without compromising fetal perfusion underscores the complexity of critical care in pregnancy. Close monitoring, antihypertensive medications, and, in severe cases, timely delivery may be necessary to mitigate risks.

Hemorrhagic complications, including postpartum hemorrhage, demand rapid and coordinated interventions (18,19). Hemostasis must be achieved promptly to prevent maternal exsanguination, requiring a thorough understanding of the causes and effective management strategies. Transfusion support, uterine artery embolization, or surgical interventions may be vital components of critical care in these situations (18,19).

Infections represent another challenge during pregnancy and the postpartum period. Maternal immunological adaptations make pregnant women susceptible to certain infections, and prompt identification and treatment are essential to prevent complications (20,21). Antibiotic therapy, close monitoring, and sometimes surgical interventions may be necessary to address infectious threats (20,21).

Cardiac complications, though rare, can have severe consequences for both mother and baby (22–24). Conditions such as peripartum cardiomyopathy or pre-existing cardiac conditions require specialized critical care. Balancing the needs of the mother's cardiovascular system while ensuring adequate fetal oxygenation presents a delicate challenge that demands the expertise of a multidisciplinary team (24–26).

Timely and appropriate critical care during pregnancy and the postpartum period involves collaboration among obstetricians, intensivists, neonatologists, and other specialists (27). Effective communication and a shared understanding of the unique considerations in

managing critically ill pregnant patients are paramount. As medical knowledge advances, refining strategies for critical care in pregnancy becomes essential to improve outcomes and ensure the health and safety of both mothers and their newborns.

Methods

Study aim, design, and setting

The study aimed to describe the clinical profiles and the treatment outcomes of women admitted to the Obstetric ICU at Muhimbili National Hospital (MNH), Tanzania. It was across-sectional descriptive study conducted at a tertiary-university affiliated hospital which receive patients from various health facilities. The obstetric ICU at MNH was fully established in 2017. The ICU team comprises 2 critical care physicians, certified critical care nurses working in shifts, resident doctors, and obstetrician specialists. A clear standard operating procedure (SOP) is available in the Unit containing admission and discharge criteria, management protocols for patients in the ICU, and infection control protocols. The maternity ICU is located close to the preeclampsia/eclampsia ward, and labor ward, and the obstetric operating theatre is nearby.

The obstetric critical care unit is divided into two areas, 4-bed Intermediary care (Step down) with an oxygen pipeline mounted on the bedside head wall and a multi-parameter monitor, with a nurse-to-patient ratio of 1:2. The main area is the 5 bedded ICU, with a central nursing station with direct visual contact to all patients. Major equipment in the ICU includes noninvasive blood pressure, a defibrillator, a suction machine, an oxygen pipeline, and a portable oxygen cylinder. Respiratory support equipment available includes one CPAP machine and a standard ventilator for each bed and the nurse-to-patient ratio is 1:1. All admissions are recorded in the ICU register book, then the information is transferred into the electronic database of the hospital. The 9-bed obstetric ICU receives on average 40 patients per month. The study included all pregnant and postpartum (< 6 weeks) women admitted at MNH obstetric ICU from November 2017 to December 2018.

Data collection and analysis

Eligible patients who were admitted to the obstetric ICU at MNH from November 2017 to December 2018 were identified from ICU registry books and then their files were retrieved from medical records. The sampled files were checked to confirm all the information required in the study were available. Data was collected from the patient's file by the principal investigator using the checklist which was in English language. The data collected included information on patients' demographics, significant antenatal, past medical and surgical history,

delivery, indications for ICU transfer, complications, ICU interventions, ICU length of stay, and treatment outcomes. Data was coded and entered in SPSS software version 23, then frequency distribution tables were used to present the clinical profiles and treatment outcomes of the patients.

Results

During the study period of 14 months, there were 257 admissions to the obstetric ICU. The total number of women who delivered at MNH were 10,112 and among them 25 were admitted to the obstetric ICU. Therefore, ICU utilization rate at MNH was 2.5 per 1000 deliveries.

As shown in Table 1, the majority of women (67.7%) were in the age group of 20-34 years (mean age=28±6.6) and were married (76%). Almost half of them had a parity of 2 to 5 and over half were in the postpartum period. Remarkably, 96% of women admitted to obstetric ICU tested negative for HIV, and with regards to the mode of delivery, almost half were delivered by spontaneous vaginal delivery and by cesarean section.

Table 1: Socio-demographic and obstetrics characteristics of women admitted to obstetric ICU at MNH (N=257)

Variable	Frequency (n)	Percentage (%)
Age (years)	Mean age (28±6.6)	
< 20	?	9.34
20-34	174	67.7
≥ 35	59	22.96
Marital status		
Single/divorced	62	24.1
Married/cohabiting	195	75.9
Parity at admission		
Nulliparous	43	16.7
1	74	28.8
2-5	119	46.3
> 5	21	8.2
Gestational age at admission		
< 28 weeks	11	4.28
Early preterm (28-32 weeks)	32	12.45
Late preterm (33-36^{+6} weeks)	40	15.56
Term	25	9.73
Postpartum	149	57.98
HIV status		

Positive	11	4.3
Negative	246	95.7
Mode of delivery		
Spontaneous vaginal delivery	112	43.58
Vacuum delivery	9	3.5
Caesarean section	116	45.14
Assisted breech delivery	2	0.78
Abortion	7	3.11
Not Applicable*	11	3.89

**Deceased while still pregnant (n=6) / discharge while still pregnant (n=5)*

Table 2 depicts the clinical profile of women admitted to ICU. The majority of women (90%) admitted to obstetric ICU were referred from other health facilities. A quarter of women were not fully conscious at the time of admission. The main reasons for admissions were obstetric complications; severe anemia (59%), hypertensive disorders of pregnancy (45.5%), and obstetric hemorrhage (33.1%). The most common non-obstetric indications for admission were preexisting heart disease exacerbation (8.9%) and infectious diseases (6.2%).

Table 2: Clinical profile of women admitted to obstetric ICU at MNH (N=257)

Variables	Frequency (n)	Percentage (%)
Mode of Admission		
From referral hospital	232	90.3
From Postnatal/ labor ward	11	4.3
From theatre	14	5.4
Mental Status at Admission		
Conscious	187	72.8
Semi-conscious	47	18.3
Unconscious	23	8.9
Diagnosis/Indications at Admission (Multiple responses)		
Obstetric		
Hypertensive disorders of pregnancy		
Eclampsia	64	24.9
Severe preeclampsia/HELLP	53	20.6
Obstetric Hemorrhage		
Postpartum hemorrhage	75	29.2
APH and complications	10	3.9

Puerperal sepsis/Septicaemia	47	18.3
Peripartum cardiomyopathy	35	13.6
Pulmonary Embolism	4	1.6
Severe anemia	152	59.1
Non-obstetric		
Pre-existing Heart diseases	23	8.9
Status epilepticus/seizure disorders	6	2.3
Infectious diseases*	16	6.2
Sickle cell crisis in pregnancy	4	1.6
DKA	2	0.8
Asthmatic attack	5	1.9
Anaesthetic and Surgical complications		
High spine block	5	1.9
Bladder and Ureteric injury	4	1.6
Comorbidities		
Sickle cell disease	4	1.6
Asthma	8	3.1
Diabetes	2	1.2
Epilepsy	3	0.8

***Infectious diseases: Malaria (9), Tuberculosis in pregnancy (5), Meningitis (2); DKA diabetes ketoacidosis, APH Antepartum hemorrhage*

As shown in Table 3, Almost a third of women admitted to obstetric ICU required mechanical ventilation, and a quarter required surgical interventions (laparotomy +/- hysterectomy). The commonest medications used during admissions were; antihypertensive (54%), and anticonvulsants (31.1%), and over half of women required blood products (53.3%). Only 18% of patients stayed for more than 8 days in ICU. Among women admitted to obstetric ICU, 20% died and 6% recovered with short/long-term morbidities. Almost half of women had live births, 35% were stillbirths and 5% of pregnancies were terminated before 28 weeks.

Table 3: Interventions provided, length of stay, and treatment outcome of women admitted to obstetric ICU at MNH

Variables	Frequency (n)	Percentage (%)
Interventions (Multiple responses)		
Mechanical ventilation	74	28.8
CPAP/BiPAP	31	12.1
Dialysis	14	5.4
Surgery*	65	25.3
Medications/ treatment (multiple response)		
Inotropes	50	19.5
Antihypertensives	140	54.5
Anticonvulsants	80	31.1
Nebulization	29	11.3
Antimalarial drugs	9	3.5
Blood products	137	53.3
Sedation	63	24.5
Length of stay in ICU(days)		
0 -3	138	53.7
4 -7	71	27.6
8 -14	31	12.1
15 -21	11	4.3
22 and above	6	2.3
Treatment outcomes		
Death	53	20.6
Recovery	188	73.2
Morbidity	16	6.2
Fetal outcomes		
Live birth***	51	47.2
Stillbirth	38	35.2
Abortion	6	5.6
END	2	1.8
Discharge in utero**	11	10.2

**Surgery: Laparotomy, Hysterectomy, ** Discharge before delivery, ***one live birth was before 28 weeks. END Early Neonatal Death, CPAP/BiPAP Continuous Positive Airway Pressure/Bilevel Positive Airway Pressure*

Discussion

In this study, the overall admission rate to the maternity ICU was 2.5 per 1000 deliveries. Obstetric causes were responsible for the majority of admissions specifically hypertensive disorders of pregnancy (45.5%), obstetric hemorrhage (33.1%), and sepsis of pelvic origin (18.3%). The most frequent interventions/treatments were transfusion of blood derivatives, anticonvulsants, mechanical ventilation, and the use of inotropes. In addition, a shorter length of stay was noted in the majority of patients (53.2%).

The rate of ICU admission for obstetric patients who delivered at MNH was found to be similar to other sub-Saharan African countries where the number of obstetric patients admitted in ICU falls in a range of 0.24–0.97% (28,29).The rate at MNH might have been higher given the limited capacity of our ICUs representing only around 0.4% of hospital beds while the ideal number should be more than 10% as is the case in high-income countries. This scarcity of ICU beds is shared with other sub-Saharan African countries.

Consistent with international reports over several decades, obstetric patients were commonly admitted to ICU because of hypertensive disorders of pregnancy or in the context of Obstetric hemorrhage (6,16,17). The current study supports this evidence, as we found out that obstetric hemorrhage and pregnancy-related hypertensive disorders were the most common reasons for admission. This was also in agreement with previous reports done in Tanzania (30,31). Despite advanced strategies and available guidelines, these conditions are quite common. This might be due to the inadequate availability and readiness of lower-level facilities to provide comprehensive emergency obstetric care and the lack of prompt referral to higher facilities.

Regarding interventions, the most frequent were mechanical ventilation, anticonvulsants, transfusion of blood derivatives, and the use of vasoactive drugs. These findings are in agreement with data already published (32,33). The need for a greater number of interventions and procedures in these women reflects attempts to maintain body homeostasis in the most severe cases.

In the present study, although the mean length of stay in ICU was 5.2 days, the duration of ICU stay was 3 days or shorter in 53.2% of our patients. This result fits with studies done in various regions (14,34) and reflects the transitory nature of the majority of obstetric pathologies, fixed by the delivery and placental expulsion. The shorter duration of stay in the ICU further highlights that the majority of maternal mortality cases can be prevented through the timely management of emergent conditions and by the involvement of a multidisciplinary team.

The case fatality rate among critically ill obstetric patients in our setting was 20.6% similar to other African countries like Nigeria (29,35) and Ethiopia (36) but lower than in Rwanda (37) where the rates had reached 53.4%. According to the systematic review involving 40 studies, there was a significantly higher maternal mortality rate in developing countries than the developed countries (6). In resources-limited countries, patients tend to have higher illness severity scores suggesting delayed admission to ICU. Moreover, in countries with low mortality rates, early assessment and interventions with a team approach are the best predictors for the better outcome of women admitted to obstetric ICU.

Fetal mortality is found to be high when critical care is required for pregnant women. In this study, there was 35% fetal loss, 5.6% abortions, and 1.8% early neonatal deaths. Similar higher rates of fetal loss have been reported in other studies (6,37–39) whereby most of the deaths have been associated with the severity of maternal illness and early gestational ages at admission to the ICU. A multidisciplinary approach with the early involvement of neonatologists in the management of obstetrics patients in the ICU is required to reduce fetal loss.

Study limitations and mitigation

The study was done at a tertiary facility and it encircled a small population, thus the results may not be generalizable to all health facilities in the country. Our study was retrospective using administrative data and some files had some few missing information like referral facility name, however this had no effect on results and was minimized by extracting data from round books and electronic hospital data.

Strength of the study

It is the first study that focused on critically ill obstetric patients admitted to a tertiary hospital-maternity ICU in Tanzania. The study indicates the need to increase awareness of the need for obstetric ICU beds in the region and to improve the inter-hospital transfer system and staff training on EmONC at peripheral hospitals as most causes of ICU mortality were preventable. Furthermore, knowledge of the clinical profile of such patients will be helpful with the identification of priorities and resources required for a stepwise improvement of obstetric care in middle-income countries like Tanzania.

Conclusion

Critically ill obstetric patients were relatively young in our study population, mostly admitted due to obstetric hemorrhage and pregnancy-related hypertension. Morbidity and Mortality

associated with these conditions are preventable by emphasizing early detection and involvement of a multidisciplinary team in a dedicated ICU and HDU.

Recommendation

There is a need for a regular provision of in-service refresher training to emphasize the practice and compliance of per-protocol case management through a team approach to reduce the burden of maternal and neonatal mortality and morbidity. Further studies are encouraged to explore obstetric patients' health-related quality of life (HRQoL) before and after critical care. The study also recommends a follow up study on how to improve survival of mothers at the primary level of care.

Abbreviations

CPAP	Continuous Positive Airway Pressure
EMOnC	Emergency Obstetric and Neonatal Care
HDU	High dependency Unit
ICU	Intensive Care Unit
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
SOP	Standard Operating Procedure

Declarations

Ethical considerations

The ethical clearance with Ref.No.DA.287/298/01A/ for the study was obtained from Muhimbili University of Health and Allied Science (MUHAS) research and publication committee. A waiver was provided by MNH to use patient's information from hospital data, and confidentiality was observed.

Availability of data and materials

Data used to support the findings of this study are available from the corresponding author upon request.

Competing interests

The authors hereby declare that there are no competing interests.

Authors' contributions

RY Principal investigator, study design, data collection, data analysis and manuscript preparation; ZHY Participated in study design, data analysis, preparation and critical review of manuscript. FAA Participated in study design, data analysis and critical review of manuscript.

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