International Journal of Research and Reports in Gynaecology

5(3): 197-211, 2022; Article no.IJRRGY.94349

Severe Obstetric Morbidity and Quality of Maternal Healthcare at a Tertiary Level Health Facility in Southern Nigeria

Justina Omoikhefe Alegbeleye [a*] and Celestine Osita John [a]

[a] Department of Obstetrics and Gynaecology, University of Port Harcourt, Rivers State, Nigeria.

Authors' contributions

This work was carried out in collaboration between both authors. Author JOA conceived the idea of the research, designed the questionnaire and did the literature review, data collection and data analysis. Author COJ reviewed the questionnaire, results and manuscript. Both authors read and approved the final manuscript.

Article Information

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/94349

Original Research Article

Received 01 October 2022
Accepted 03 December 2022
Published 10 December 2022

ABSTRACT

Background: In most women, pregnancy is often uncomplicated and will bring about the delivery of healthy babies at term. However, in some women, severe complications may occur during pregnancy, labour, or the postpartum period, which may be life-threatening for either the mother, baby, or both, thereby necessitating certain interventions to prevent morbidity or mortality.
Aim and Objectives: To evaluate the critical interventions, process indicators, as well as pregnancy outcomes of severe obstetric morbidity at the University of Port Harcourt Teaching Hospital (UPTH).
Materials and Methods: A retrospective cross-sectional study carried out at the department of Obstetrics and Gynaecology of the University of Port Harcourt Teaching Hospital. Stratified sampling method was used to select the folders of 610 women who were managed during pregnancy, labour or postpartum period, abortion and ectopic pregnancy between January 1, 2018, and December 31, 2020. Data collection tool was used to obtain information from folders and SPSS 25 used for analysis. Mean and standard deviation were used to summarize descriptive data, while test for association was done using chi square test and logistic regression.
Results: Blood transfusion was the most common 65 (52.9%) critical intervention. Process indicators were all optimal (100%) except for corticosteroid therapy (60%). Maternal near miss

**Corresponding author: E-mail: justina.alegbeleye@uniport.edu.ng, drefe_2@yahoo.co.uk;*

morbidity was significantly associated with prolonged hospital stay (p=0.001), preterm delivery (p=0.000), perinatal death (p=0.001), low birth weight (p=0.002), Special Care Baby Unit (SCBU) admission (p=0.002) and birth asphyxia (p=0.001).
Conclusion: Transfusion of blood and blood products was the most common critical interventions instituted for maternal near miss. Process indicators were all optimal, except for corticosteroid therapy for preterm births less than 34 weeks. It was also noted that interventional radiology was not performed. Caesarean delivery was the most common mode of delivery. Maternal near miss was associated with preterm birth, perinatal death, low birth weight, admission into SCBU, and severe birth asphyxia.

Keywords: Maternal near miss; maternal morbidity; critical interventions; process indicators; pregnancy outcomes; Port Harcourt; Nigeria.

1. INTRODUCTION

In developing countries like Nigeria, the maternal mortality rate has remained consistently high.

According to some experts, if maternal mortality is unacceptably high in underdeveloped countries, morbidity must be greater. Maternal death is frequently referred to as "only the tip of the iceberg," implying that there is a huge, submerged base of the iceberg- maternal morbidity, that is mostly hidden, undescribed, and unreported [1].

Maternal mortality was previously regarded as the primary indicator for tracking improvements in women's health. Maternal mortality, on the other hand, only gives one half the picture; because for every one of these maternal deaths, there is a huge burden of maternal morbidity, which can lead to long-term disability [2,3]. Severe acute maternal morbidities, also known as maternal near miss are more common than maternal deaths, and they may yield more data because the woman might be a source of information by sharing her own narrative. This makes severe acute maternal morbidity the best measure of the quality of obstetric care, as reviewing these cases will aid in improving clinical practice by identifying health system failures or deficiencies in practice, the quality of intervention, and the provision of alternative strategies, as well as other social and economic factors that lead to a reduction in maternal deaths and improved maternal and neonatal outcomes [4-7].

In 2004, the World Health Organization (WHO) began to emphasize the importance of going beyond simply counting the number of deaths to gaining a better knowledge of why they occur and how they might be avoided [8]. These unfavourable obstetric events that result in maternal deaths can be avoided if timely interventions are carried out to save the woman's life [9]. As a result, women who survive these complications may act as surrogates, providing valuable information for a better understanding of these preventable conditions that lead to maternal death [10]. Furthermore, it is estimated to be 12 times more common than maternal deaths and associated with poor maternal and fetal outcomes, lost productivity, high healthcare costs, and increased financial strain on healthcare systems [11,12].

Maternal Near Miss also known as Severe Acute Maternal Morbidities (SAMM) is defined by WHO (2011) as a woman who nearly died but survived a complication during pregnancy, delivery, or within 42 days of termination of pregnancy [4]. In practice, a woman is considered a near-miss if she survives a potentially fatal condition during pregnancy, childbirth, or abortion, as well as during the postpartum period (WHO, 2011) [4].

According to the World Health Organization (2011), critical interventions are those that are required in the management of life-threatening or potentially life-threatening conditions. These critical interventions include uterine evacuation, the use of blood products, laparotomy (including hysterectomy and other emergency surgical interventions in the abdominal cavity but excluding caesarean section), hysterectomy, and other emergency surgical interventions in the abdominal cavity, but exclude caesarean section, interventional radiology (uterine artery embolization), and ICU admission [4]. The ICU is a unit that can provide 24-hour medical supervision and can provide mechanical ventilation and continuous vasoactive drug support. The use of anticonvulsants such as magnesium sulphate (MgSO4), parenteral antibiotics, corticosteroids for fetal lung maturity in preterm births, and prevention and treatment

of primary postpartum haemorrhage with oxytocin and other uterotonic are process indicators. The WHO (2011) recommends that coverage of critical interventions should be 100%. However, if less than 95%, it should be viewed as an opportunity to improve services and standard of care [4].

Process indicators are those that assess the processes of health care and the use of key interventions for the prevention and management of severe complications. Data on the use of key interventions provide information on the implementation status of evidence-based recommendations. These process indicators include delivery or abortion before arrival in the health facility, delivery within 3 hours of arrival in the health facility, laparotomy for ectopic pregnancy within 3 hours of arrival in the health facility and laparotomy for uterine rupture within 3 hours of arrival in the health facility (WHO 2011) [4].

Severe Acute Maternal morbidities (SAMM) are largely unreported and undocumented so long as the women survived, with no in-depth investigation into the underlying causes. As a result, there is a scarcity of data on the assessment of critical interventions and process indicators in health care facilities. It is in view of this, that the researchers sought to determine the proportion of critical interventions, process indicators, and evaluate the pregnancy outcome of maternal morbidities at the University of Port Harcourt Teaching Hospital from January 1, 2018, to December 31, 2020.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out at the University of Port Harcourt Teaching Hospital (UPTH), which is in Alakahia community in Obio-Akpor Local Government Area (LGA) of Rivers state. The University of Port Harcourt Teaching Hospital is a tertiary health-care facility in Port Harcourt, Rivers State, Nigeria. It has an 884-bed capacity and offers general and specialized services to patients, as well as serving as a referral centre for most peripheral hospitals and health centres.

The Obstetrics and Gynaecology department has 175 beds, accounting for 19.8% of all hospital beds: 30 in the antenatal ward, 40 in the postnatal ward, 40 in the unbooked lying-in ward, 36 in the gynaecological ward, and 8 in the private/semi-private rooms. There are 2 admission rooms, 9 beds in the first stage room for booked patients, 4 beds in the first stage room for unbooked patients, 4 delivery suites and a theatre in the labour ward complex. It has an average annual delivery of 1500.

The hospital offers emergency and intensive care services around the clock, as well as a functional blood bank, neonatal intensive care unit, and intensive care unit. Women with risk factors or obstetric complications are referred to the hospital by clinics and hospitals in the surrounding area, as well as from neighbouring states. The department is divided into five units/firms, each with consultants, resident doctors, and house officers. A unit staffs each clinic day, and the Antenatal, Postnatal, and Gynecology clinics are open Monday through Friday.

2.2 Study Design

This retrospective institution-based cross-sectional study aimed to evaluate the critical interventions, process indicators, as well as pregnancy outcomes of maternal morbidity at the University of Port Harcourt Teaching Hospital (UPTH).

2.3 Study Population

From January 1, 2018, to December 31, 2020, all pregnant women managed at the UPTH during the antenatal period, delivery, or within 42 days of termination of pregnancy constituted the study population. Pregnant women, women who presented in labour, and women who presented with abortion, ectopic pregnancy, or within 42 days of termination of pregnancy met the inclusion criteria. Women with complications unrelated to pregnancy were excluded, as were those with incomplete case records.

2.4 Sample Size Determination

The sample size was calculated using the Cochran formula; $n = \frac{Z^2 pq}{d^2}$

where, n = the minimum sample size

Z = the standard normal deviate set at 1.96, to correspond to 95% confidence level
p = the proportion of the target population with maternal near miss
q = (1 – p)

d = the desired precision set at 5% (0.05). It is the degree of accuracy desired

Therefore: n = $\frac{0.6100307136}{0.0025}$ = 244.01

n = 244.01, approximately 244.

Adjustment for 20% incomplete data rate: Adjustment sample size =

$$\frac{\text{Minimum sample size (n)}}{1 - \text{incomplete data rate}}$$

$$n_s = \frac{}{0.8} = \frac{244}{0.8} = 305$$

Applying the design effect of 2, a sample size of 610 was used.

2.5 Methods

The stratified sampling technique was used to select women who presented with or without complications during pregnancy, delivery, and 42 days after termination of pregnancy for the three-year study, and the sample size was allocated proportionally to each year. A simple random sampling technique with a table of random numbers drawn from 4,598 case records was used to select the assigned sub-samples for each stratum. Following that, data was extracted from the selected case records using the standardized WHO Maternal Near Miss Tool (WHO, 2011), which had been modified to include information on socio-demographic profile and obstetric history.

2.6 Data Collection

From April 1 to May 31, 2021, data was collected for eight weeks. Three house officers were recruited as research assistants and were given a one-day short training in data collection techniques and research protocol, including confidentiality. The folders comprising the selected sub-samples were collected from the hospital's Records department. Information on socio-demographic characteristics, obstetric history, diagnosis, critical interventions, process indicators, and pregnancy outcomes were all reviewed in the records.

Each questionnaire was given a distinct identity to ensure anonymity and simplify identification. Records from wards, labour wards, ICUs, and theatres were used to compile information on critical interventions, process indicators, perinatal outcomes, total deliveries, and total live births during the evaluation period. The accuracy and completeness of the data collection tools were checked daily. Data was entered successively by the researcher and the three research assistants.

2.7 Data Analysis

Data was coded and entered into a Microsoft Excel spreadsheet before being cleaned and analyzed with the IBM Statistical Package for Social Sciences (SPSS) version 25.0 software. Means, medians, percentages, frequencies, ratios, and standard deviation were used to describe the socio-demographic characteristics, pattern of maternal morbidity, critical interventions used, process indicators, and pregnancy outcome. Chi square analysis was used to compare proportions and determine associations. Results are displayed in the form of tables and were considered statistically significant for p values < 0.05.

3. RESULTS

Data on obstetric characteristics were complete in 549 of the 610 women, yielding a data completeness rate of 90%. Perinatal outcomes were inadequate for 21 women who delivered outside of a health facility. The case records, on the other hand, were included in the study because they contained sufficient variables for analysis. Furthermore, 23 women had ectopic pregnancy, and one had a septic incomplete abortion, both conditions are not considered deliveries and were thus excluded from the perinatal outcomes analysis.

Table 1 showed that most 214 (35.1%) of the women were aged 30 - 34 years, with an average age of 31.57 ± 5.0 years. The majority 541 (88.7%) of the women were married, and 335 (54.9%) had tertiary education. Most of the women, 273 (44.8%), worked in partially skilled jobs, while 179 women had never worked or had been unemployed for a long time, accounting for 29.3%.

Only data for 549 (90%) women were available for the number of pregnancies (gravidity), which revealed that most of the women, 264 (48.1%), had 2-3 pregnancies, while 93 (16.9%) had either never been pregnant or had only been pregnant once, with a mean gravidity of 3.07 ± 1.57. The majority of the women, 273 (44.8%), had 2-4 deliveries, with only 11 (1.8%) having five or

more deliveries and a mean parity of 1.44 ± 1.28. Three hundred and eleven women had one to two living children, accounting for the largest proportion, with a mean number of living children of 1.41 ± 1.28. This is shown in Table 2.

Table 3 showed that 123 women with maternal near miss had critical interventions (some women had more than one). These included 65 (52.8%) women who had blood transfusion for obstetric haemorrhages, 36 (29.3%) who had laparotomy either for ruptured ectopic pregnancy, ruptured uterus, or severe primary postpartum haemorrhage. About one-fifth, 24 (19.5%) of the women were admitted into the ICU.

Twenty-three women had ectopic pregnancy, which is not considered as a delivery or an abortion. Hence, the data for the remaining 100 women were analyzed. Table 4 showed that in 22 (22%) of the women, delivery or abortion occurred before arrival at the health facility, while only 14 (17.9%) gave birth within 3 hours of arrival in the hospital. More than three-quarter, 64 (82.1%) of them stayed more than 3 hours until they gave birth. Of the 23 women with ectopic pregnancy, 17 (73.9%) had a laparotomy within 3 hours of presentation and most, 10 (90.9%) of the women with ruptured uterus had laparotomy within 3 hours of arrival at the health facility.

Five hundred and forty-two women were the target population for prevention of primary postpartum haemorrhage. All the eligible women received oxytocin and other uterotonics, which in this case was rectal misoprostol. This is as shown above in Fig. 1.

Table 5 showed that 14 women had severe primary postpartum haemorrhage, and all (100%) received oxytocin, while 13 (92.9%) received misoprostol, indicating that 13 women were managed with both oxytocin and misoprostol. Tranexamic acid was administered to 11 (78.6%) of the women, while 4 (28.6%) had removal of retained products of conception. Of the 11 women with uterine rupture, 6 (42.9%) had undergone hysterectomy. All the women with severe pre-eclampsia and eclampsia received anticonvulsants in form of magnesium sulphate, while one woman received other anticonvulsants in addition to magnesium sulphate as shown in Table 6.

Table 7 showed that 73 women required antibiotics. Of these, all the 62 women who had caesarean section received prophylactic antibiotics, while all the 11 women with sepsis or severe systemic infection received therapeutic antibiotics for treatment.

Only 60% of women with preterm births less than 34 weeks gestation received corticosteroid therapy prior to delivery for fetal lung maturity. The remaining 40% did not receive corticosteroid therapy because the women had to be delivered due to extremely high blood pressures. This is shown in Table 8.

Most of the women, 57 (46.4%) were delivered by emergency caesarean section. Twenty-three (18.7%) of the maternal near miss cases had laparotomies for ectopic pregnancy and 11 (8.9%) had laparotomies for ruptured uterus. However, 5 (4.1%) women were delivered by elective caesarean section. With regards to duration of hospital stay, 63 (51.2%) of the women stayed more than 7 days in hospital, with a mean duration of 9.12 ± 5.17 days. This is shown in Table 9a.

Table 9b showed that there was a statistically significant association between mode of delivery and maternal near miss. The table showed that 93.1% of women with normal pregnancy had vaginal delivery compared with 6.9% for maternal near miss cases. Additionally, 116 (65.2%) women with normal pregnancy had caesarean delivery compared with 62 (34.8%) of women with maternal near miss conditions (p= 0.0001). Concerning the duration of hospital stay, there was a statistically significant relationship between duration of hospital stay and maternal near miss (p = 0.001). A higher proportion of women with maternal near miss (72.4%) had longer hospital stays (> 7 days) compared with those with uncomplicated pregnancies (27.6%).

There were 99 deliveries, of which 53 (53.5%) were preterm births, with a mean gestational age of 35.60 ± 3.43 weeks. There were 19 (19.2%) stillbirths, of which 12 (63.2%) were fresh still births. Only 82 of the 99 babies had their birth weights recorded, with low birth weight observed in 35 (42.7%) of the babies delivered. Apgar scores were analyzed for the 78 babies that were delivered at the health facility. Severe birth asphyxia was observed in the first and fifth minute in 9 (11.5%) and 8 (10.3%) babies respectively. Mild/moderate birth asphyxia occurred in 27 (34.6%) and 17 (21.8%) babies in the first and fifth minutes respectively.

Of the 78 babies delivered, 39 of them were admitted into the SCBU, giving a SCBU

admission rate of 50%. The most common indications for admission into SCBU was preterm low birth weight, accounting for 17 (43.6%). This was followed by moderate birth asphyxia 9 (23.0%) and moderate birth asphyxia with preterm low birth weight 5 (12.8%). Concerning the outcome of SCBU admission, about one-third 14 (35.9%) of the babies had perinatal death. This is shown in Table 10a.

Table 10b illustrates certain perinatal outcomes. The gestational age at birth is used to assess the level of maturity of the newborn and it is classified into three groups, preterm (less than 37 completed weeks), term (37 – 42 weeks) and post term (above 42 completed weeks). The gestational age of the two groups, differed significantly (p=0.000) with a comparably higher preterm delivery among near misses 53 (57.6%) compared to women with normal pregnancies 39 (42.4%).

The baby outcome also differed significantly (p=0.001), with a higher occurrence of stillbirth among maternal near miss 19 (55.9%) compared to 15 (44.1%) in uncomplicated pregnancies. About 53 (10.6%) of maternal near miss cases had good 5-minute Apgar scores compared to 446 (89.4%) uncomplicated pregnancies, while severe birth asphyxia was significantly higher among near misses compared to uncomplicated pregnancies (p=0.001).

The birth weight was categorized into two groups of low birth weight (< 2.5kg) and normal weight (2.5kg- 4kg). There was no record of macrosomia (> 4kg). A significantly higher proportion of maternal near misses had low birth weight babies compared with normal pregnancies (p=0.002). Admission into the SCBU also differed significantly, with a higher proportion of maternal near miss babies requiring admission (p=0.002).

Table 11 showed that there is a statistically significant relationship between admission into the ICU and maternal outcome (p=0.000). The Table showed that 38.5% of those that had ICU admissions died compared to 2% who were not admitted into the ICU. Additionally, it was also observed that women admitted into the ICU were 30.94 times at odds of dying from maternal near miss conditions (OR: 30.94R; 95% CI: 0.00-0.16; p=0.000). However, there was no statistically significant relationship between use of blood products and laparotomy with maternal outcome.

Table 1. Socio-demographic characteristics of the women

Variable	Frequency (n=610)	Percent
Age as at last birthday (years)		
<20	10	1.6
20-24	45	7.4
25-29	147	24.1
30-34	214	35.1
35-39	170	27.9
≥40	24	3.9
Mean Age 31.57 ± 5.0		
Marital status		
Married	541	88.7
Single	69	11.3
Level of education completed		
No formal education	2	0.3
Primary	36	5.9
Secondary	237	38.9
Tertiary	335	54.9
Occupational status		
Professional/higher managerial occupations	42	6.9
Intermediate/lower managerial occupation	114	18.7
Manual skilled occupation	2	0.3
Partly skilled occupation	273	44.8
Unskilled occupation	0	0.0
Never worked/long term unemployed	179	29.3
Religion		
Christianity	584	95.7
Islam	26	4.3

Table 2. Obstetric characteristics of the women

Variable	Frequency (n=610)	Percent
Gravidity (number of pregnancies) (n=549)[γ]		
≤1	93	16.9
2-3	264	48.1
4 or more	192	35.0
Mean 3.07 ± 1.57		
Parity (number of delivery)		
Para 0	184	30.2
Para 1	142	23.2
Para 2-4	273	44.8
Para ≥ 5	11	1.8
Mean 1.44 ± 1.28		
Number of living Children		
None	190	31.1
1-2	311	51.0
3-4	100	16.4
≥ 5	9	1.5
Mean 1.41 ± 1.28		
Booking status		
Booked	371	60.8
Booked elsewhere	101	16.6
Unbooked	138	22.6
Gestational age at booking (n=371)		
Mean 18.49 ± 5.09 weeks		
Patient referred to the facility (n=239)		
Yes	182	76.2
No	57	23.8
Sources of Referral (n=182)		
Primary Health centre	68	37.4
Traditional Birth Attendants / Church	47	25.8
Private clinic / Maternity	43	23.6
Secondary Health centre	24	13.2

γ = number of pregnancies was not stated in some folders

Table 3. Critical interventions used for maternal near miss

Variable	Near Miss	
	Frequency (n=123)	Percent
Use of blood products (includes any blood transfusion)	65	52.8
Laparotomy	36	29.3
Admission into ICU	24	19.5

**ICU: Intensive Care Unit*

Table 12 showed that women who died had 5 times the odd of a delivery or abortion occurring before arrival at the health facility compared to the MNM group (cOR=5.06R, 95% CI; 0.06-0.66, p=0.0002). Also, women with MNM were 45.33 times more likely to have laparotomy (cOR=45.33, 95% CI; 4.55-419.23, p=0.000). There was no statistically significant association between delivery within 3 hours of hospital arrival and maternal outcome (cOR=0.53, 95% CI: 0.14-2.23, p=0.287).

Table 4. Process Indicators for maternal near miss

Variable	Near miss	
	Frequency (n=123)	Percent
Delivery or abortion occurred before arrival at any health facility (n=100)	22	22.0
Delivery within 3 hours of arrival in the health facility (78)	14	17.9
Laparotomy for ectopic pregnancy within 3 hours of hospital arrival (n=23)	17	73.9
Laparotomy for uterine rupture within 3 hours of hospital arrival (n=11)	10	90.9

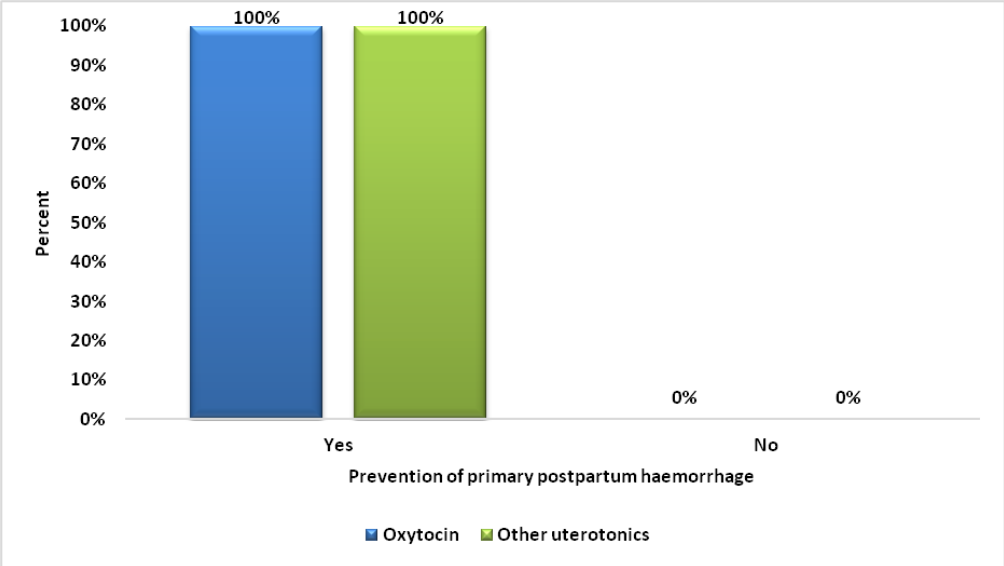

Fig. 1. Prevention of primary postpartum haemorrhage (n=542)

Table 5. Treatment of primary postpartum haemorrhage

Variable	Frequency (n=14)	Percent
Oxytocin	14	100.0
Misoprostol	13	92.9
Tranexamic acid	11	78.6
Removal of retained products	4	28.6
Hysterectomy	6	42.9

Table 6. Use of anticonvulsants for severe pre-eclampsia and eclampsia

Variable	Frequency (n=67)	Percent
Magnesium sulphate	67	100.0
Other anticonvulsants (diazepam)	1	1.5

Table 7. Antibiotics therapy for prevention and treatment of sepsis

Variable	Frequency (n=123)	Percent
Required antibiotics	73	59.4
Prophylactic antibiotics during caesarean section (n=62)	62	100.0
Therapeutic antibiotics for patients with sepsis or severe systemic infection (n=11)	11	100.0

Table 8. Corticosteroid therapy for preterm birth below 34 weeks

Variable	Frequency (n=30)	Percent
Corticosteroids (dexamethasone or betamethasone)		
Yes	18	60.0
No*	12	40.0

**Extremely high blood pressures*

Table 9a. Mode of delivery and duration of hospital stay of maternal near miss cases

Variable	Frequency (n=123)	Percent
Final Mode of delivery/End of pregnancy		
Emergency caesarean section	57	46.4
Vaginal delivery	26	21.1
Laparotomy for ectopic pregnancy	23	18.7
Laparotomy for ruptured uterus	11	8.9
Elective caesarean section	5	4.1
Medical methods for uterine evacuation	1	0.8
Duration of hospital stay		
Normal discharge (≤7 days)	60	48.8
Other (> 7 days)	63	51.2
Mean 9.12 ± 5.17 days		

Table 9b. Comparison of mode of delivery and duration of stay in hospital between maternal near miss and normal pregnancy

Variables	Maternal near miss (Freq %)		Total	(χ2)	P-value
	Yes n=123	No n=470			
Final mode of delivery					
Vaginal delivery	26 (6.9)	352 (93.1)	378 (100.0)		**0.0001µ***
Caesarean section	62 (34.8)	116 (65.2)	178 (100.0)		
Medical methods for uterine evacuation	1 (100.0)	0 (0.0)	1 (100.0)		
Laparotomy	34 (94.4)	2 (5.6)	36 (100.0)		
Duration of hospital stay					
Normal discharge (≤ 7 days)	60 (11.9)	446 (88.1)	506 (100.0)	161.93	**0.001***
Delayed discharge (> 7 days)	63 (72.4)	24 (27.6)	87 (100.0)		

**Statistically significant (p<0.05); µ=Fisher's exact p (recommended for values <5)*

4. DISCUSSION

Maternal morbidity and mortality have remained unacceptably high in resource-poor countries [13,14]. Nigeria continues to struggle with high maternal morbidity despite targeted programmes and interventions. The goal of this study was to evaluate critical interventions, process indicators, as well as pregnancy outcome of maternal morbidity at a tertiary health care facility in South-South Nigeria.

In the current study, there was a large proportion (52.85%) of blood transfusions (five or more units of red cells) and hysterectomy due to severe bleeding caused by ruptured ectopic pregnancy, severe primary postpartum haemorrhage, and ruptured uterus, both of which are life-saving procedures. This was comparable to the reports from Ghana, Ethiopia, and Iraq [5,15,16]. However, it was significantly higher than reports observed in those reported in Ekiti, South Africa, Nepal, and India [17-19]. The cause for this variance could be attributed to the limited sample size employed in these studies.

Table 10a. Perinatal outcome of maternal near miss

Variable	Frequency (n=99)	Percent
Gestational age		
Preterm (<37 weeks)	53	53.5
Term (37- 42 weeks)	46	46.5
Mean 35.60 ± 3.43 weeks		
Baby outcome		
Alive	80	80.8
Dead	19	19.2
Birth weight of baby (n=82) γ		
< 2.5kg	35	42.7
≥ 2.5kg	47	57.3
If baby not alive (n=19)		
Fresh still birth	12	63.2
Macerated still birth	7	36.8
I-minute Apgar score (n=78) γ		
Low (0-3)	9	11.5
Mild/moderate (4-6)	27	34.6
Normal (7-10)	42	53.9
5-minute Apgar score (n=78) γ		
Low Apgar score (0-3)	8	10.3
Mild/moderate Apgar score (4-6)	17	21.8
Normal Apgar score (7-10)	53	67.9
Baby admitted to SCBU (n=78) γ		
Yes	39	50.0
No	39	50.0
Indication for admission (n=39)		
Preterm low birth weight	17	43.6
Moderate birth asphyxia	9	23.0
Moderate birth asphyxia and preterm low birth weight	5	12.8
Severe birth asphyxia and preterm low birth weight	4	10.3
Severe birth asphyxia	4	10.3
Outcome of SCBU admission (n=39)		
Alive	25	64.1
Dead	14	35.9

γ= some missing data for birth weight and Apgar scores

One-fifth of the women had laparotomy for haemorrhages due to ruptured ectopic pregnancy, ruptured uterus and about half of the women with severe primary postpartum haemorrhage due to uterine atony. This also included women who had peripartum hysterectomy when other treatment modalities failed. Similar observations were made by previous researchers [10,20]. However, higher proportions were reported in Iraq and India [5,19].

In this study, one-third of the women with maternal near miss events required admission to the intensive care unit (ICU), with hysterectomy and haemorrhage being the most frequent indications for admission. The ICU admission rate of 19.51% is far below the recommended standard of 70% (WHO, 2011) [4]. The reason for this may be due to the non-availably of a departmental ICU. The hospital has few ICU beds that serves all specialties, which may have limited the number of maternal near miss cases admitted into the ICU. This underscores the importance of reviewing the number of readily available beds, as women with obstetric complications frequently require higher levels of care. Likewise, low ICU admission rates of 20.6%, 20.5%, and 25% were reported in Ethiopia, South Africa, and India [16,17,21]. However, ICU admission was reported as the most frequent critical intervention with higher rates reported in Nepal, Malaysia, and Egypt with 72.5%, 72.3% and 83.3% respectively [18,20,22].

Table 10b. Comparison of perinatal outcome of maternal near miss and normal pregnancy

Variables	Maternal near miss (Freq %)		Total	(χ2)	P-value
	Yes n=123	No n=470			
Gestational Age					
Preterm (< 37 weeks)	53 (57.6)	39 (42.4)	92 (100.0)	123.46	**0.000***
Term (≥ 37weeks)	46 (9.6)	431 (90.4)	477 (100.0)		
Baby outcome					
Alive	80 (15.0)	455 (85.0)	535 (100.0)	144.72	**0.001***
Dead	19 (55.9)	15 (44.1)	34 (100.0)		
Birth weight of baby γ					
< 2.5kg	35 (67.3)	17 (32.7)	52 (100.0)	28.95	**0.002***
≥2.5kg	47 (9.1)	467 (90.9)	514 (100.0)		
Baby admitted to SCBU					
No	39 (8.2)	435 (91.8)	474 (100.0)	5.07	**0.002***
Yes	39 (52.7)	35 (47.3)	74 (100.0)		
I minute Apgar score γ					
Low (0-3)	9 (56.3)	7 (43.7)	16 (100.0)	3.91	**0.001***
Mild/moderate (4-6)	27 (46.5)	31 (53.5)	58 (100.0)		
Good (7-10)	42 (8.9)	432 (91.1)	474 (100.0)		
5 minute Apgar score γ					
Low (0-3)	8 (80.0)	2 (20.0)	10 (100.0)	5.27	**0.001***
Mild/moderate (4-6)	17 (43.6)	22 (56.4)	39 (100.0)		
Good (7-10)	53 (10.6)	446 (89.4)	499 (100.0)		

**Statistically significant (p<0.05); μ=Fisher's exact p (recommended for values <5), γ=Some folders had no record*

Table 11. Relationship between critical Interventions used and maternal outcome

Variable	Maternal near miss (n=123)		Maternal death (n=17)			χ2 (p-value)	OR [95% CI]
	Frequency	Percent (%)	Frequency	Percent (%)	Total		
Use of blood products							
Yes	65	84.4	12	15.6	77 (100.0)	1.886	0.47
No	58	92.1	5	7.9	63 (100.0)	(0.170)	(0.12-1.54)
Laparotomy							
Yes	36	94.7	2	5.3	38 (100.0)	2.297	3.10
No	87	85.3	15	14.7	102 (100.0)	(0.130)	(0.66-29.2)
Admission to intensive care unit							
Yes	24	61.5	15	38.5	39 (100.0)	34.85	30.94R
No	99	98.0	2	2.0	101(100.0)	**(0.000)**	(0.00-0.16)

**Statistically significant (p<0.05)*

According to the WHO (2011), women who present at the hospital with ruptured ectopic pregnancy or uterine rupture should have a laparotomy performed within three hours of their arrival in hospital. Failure to do this reflects sub-optimal care and may imply an intra-hospital delay (type 3 delay) [4]. In our study, majority of the women with these conditions had laparotomy performed within three hours of presentation. This was far higher than reported in South - Sudan, [23] which is among the least developed countries in the world with a weak health system and unacceptably low provisions for health care [24].

Table 12. Relationship between process Indicators and maternal outcome

Variable	Maternal near miss (n=123)		Maternal death (n=17)			χ2 (p-value)	OR [95% CI]
	Frequency	Percent (%)	Frequency	Percent (%)	Total		
Delivery or abortion occurred before arrival							
Yes	22	68.7	10	31.3	32 (100.0)	9.831	5.06R
No	78	91.8	7	8.2	85 (100.0)	**(0.0002)**	(0.06-0.66)
Delivery within 3 hours of hospital arrival							
Yes	14	73.7	5	26.3	19 (100.0)	1.134	0.53
No	64	84.2	12	15.8	76 (100.0)	(0.287)	(0.14-2.23)
Laparotomy							
Yes	17	94.4	1	5.6	18 (100.0)	17.822	45.33
No	6	85.3	16	72.7	22 (100.0)	**(0.000)**	(4.55-419.23)
Admission to intensive care unit							
Yes	10	100.0	0	0.0	10 (100.0)	23.183	∞
No	1	5.6	17	94.4	18 (100.0)	**(0.000)**	(12.006-∞)

**Statistically significant (p<0.05)*

For each condition, the target population was identified and the proportion of the target population that received the recommended intervention was assessed. Higher proportions of women receiving appropriate interventions for each condition indicate better quality of care and vice-versa. In the current study, the use of oxytocin for the prevention and treatment of postpartum haemorrhage, magnesium sulphate for the prevention and treatment of eclampsia, prophylactic antibiotics during caesarean section and parenteral antibiotics for the treatment of sepsis were all 100%, except for the use of corticosteroids in preterm births which was 60% because some women had to be promptly delivered due to excessively high blood pressure.

Coverage of interventions below 95% should be considered as a window of opportunity to improve care.4 As a result, adherence to WHO recommendations indicates that health-care facilities provide high-quality care. Similarly, a high coverage of essential interventions was observed in Malaysia [20]. This similarity may be because both studies were conducted at Teaching hospitals, where women are often managed using evidence-based guidelines and protocols, despite our centre being in a resource-poor country. The challenge is not with the application of these protocols, rather it is delay in provision because of out-of-pocket health expenditure in Nigeria. However, lower coverages were reported by researchers in Ethiopia, Namibia, Kenya, South Sudan, and Iraq [5,16,23,25,26]. These disparities may be because some of these studies were conducted in secondary healthcare institutions, which may not be properly equipped to care for these maternal near miss events, particularly in Africa.

Nearly half of the pregnancies in the current study were terminated by emergency caesarean section, highlighting the women's critical condition when they arrived at the health facility and the urgency of the maternal near miss conditions. Other researchers have identified caesarean delivery as the most common method of delivery [10,20,27] The caesarean section (CS) rate in this study was 34.83%, which was higher than the WHO-recommended 10-15% but close to the 34.9% reported at a district hospital in rural Rwanda [28] Local studies in Enugu and Calabar, however, revealed higher rates of 42.4% and 69.4%, respectively [10,27]. Similarly, higher rates of 46.1% were observed in Ghana [15]. This high rate might be because this was the most common mode of delivery in women with maternal near miss. However, 42.5% of the

maternal near miss cases in Nepal had vaginal delivery [18]. This disparity may be attributable to the women's earlier presentation to the healthcare facility in Nepal.

The study observed that maternal near miss was significantly correlated with caesarean delivery (0.0001) and prolonged hospital stay (0.001) compared to women without complications. This is consistent with studies conducted at referral hospitals in Ethiopia and Brazil [29-31]. The need for interventions to manage severely ill patients could explain the longer period of hospitalization.

With regards to perinatal outcome, near misses were found to be significantly linked to adverse perinatal outcomes. MNM was significantly associated with preterm birth (0.000), still birth (0.001), low birth weight (0.002), SCBU admission (0.002), and severe birth asphyxia (0.001). Preterm birth was the leading cause of neonatal deaths. Previous research in Nigeria, Ethiopia, and Brazil found similar results [10,27,31,32,33]. This could be attributed to the severity of the maternal near miss conditions and the need to terminate the pregnancy earlier. In contrast, researchers in Ile-Ife found stillbirth and post-maturity to be substantially linked with maternal near miss [32].

5. CONCLUSION

Transfusion of blood and blood products was the most common critical interventions instituted for maternal near miss, followed by laparotomy for ruptured ectopic pregnancy and ruptured uterus. Process indicators were all optimal, except for corticosteroid therapy for preterm births less than 34 weeks, as delivery was expedited in some women with extremely high blood pressure. It was also noted that interventional radiology was not performed.

Caesarean delivery was the most common mode of delivery among women with MNM and they had a longer duration of hospital day compared to women with normal pregnancy. Also, maternal near miss was associated with preterm birth, perinatal death, low birth weight, admission into SCBU, and severe birth asphyxia. This finding further laid credence to the available research evidence that maternal near miss is associated with adverse pregnancy outcome.

6. RECOMMENDATIONS

The following recommendations are made based on the findings of this study.

To the Government and policy makers:

- Scale up the peripheral health facilities to be able to provide comprehensive emergency obstetric care, with regular and progressive assessment.
- Strengthen the health systems at all levels and ensure health workers promptly refer complicated cases by establishing linkages between peripheral health care facilities and the referral hospitals, to minimize delays.

To Health care Institutions:

- Implementation of community-based interventions to educate women and families on the importance of antenatal care, follow up, birth preparedness, and institutional delivery. This will facilitate prompt decision making about seeking care. This can be done during religious gatherings like churches and mosque, market days, and electronic media.
- Tertiary care facilities must have fully functional ICUs with enough beds. Furthermore, institutions should aim toward the establishment of departmental ICUs to alleviate the chronic shortage of ICU beds for critically ill women.
- Concerted efforts should be made to overcome in-hospital (Type 3) delays. This can be done by making provision for blood and blood products, and anaesthetic drugs for emergency cases.
- Instituting a Maternal Near Miss Review at the study centre as an integral part of processes and practices. This can be done at intervals, to evaluate, monitor, and improve the quality of obstetric care, generate a more comprehensive data on magnitude and associated factors of maternal near miss. This should also include interviewing the women that survived a maternal near miss event, so they can relate their own narrative, thereby highlighting the causes of type 1 and type two delays.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Ethical approval was obtained from the Research and Ethics committee of the hospital before

commencement of the study. The data collection tools were labeled with unique identifiers and did not include hospital numbers. There was no direct interaction with the women and the study simply analyzed their case records, hence informed consent from the women was not necessary.

ACKNOWLEDGEMENT

We would like to acknowledge all the staff of the department of obstetrics and gynaecology, the medical record departments, the nurses, and the research assistants for making available this data for our review.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kalhan M, Singh S, Punia A, Prakash J. Maternal near-miss audit: lessons to be learnt. Int J Appl Basic Med Res. 2017; 7(2):85-87.
2. Pacagnella RC, Cecatti JG, Camargo RP, Silveira C, Zanardi DT, Souza JP, Haddad SM. Rationale for a long-term evaluation of the consequences of potentially life-threatening maternal conditions and maternal near-miss incidents using a multi-dimensional approach. J Obstet Gynecol Can. 2010;32:730-738.
3. Storeng KT, Drabo S, Ganaba R, Sundby J, Calvert C, Filippi V. Mortality after near-miss obstetric complications in Burkina Faso Medical, social, and health-care factors. Bull World Health Organ 2012; 90;418-425.
4. World Health Organization. Evaluating the quality of care for severe pregnancy complications -The WHO near- miss approach for maternal health. Geneva: World Health Organization Document Production Services. WHO; 2011.
5. Jabir M, Abdul-Salam I, Suheil DM, Al-Hilli W, Abul-Hassan S, Al-Zuheiri A, Souza JP. Maternal near miss and quality of maternal health care in Baghdad, Iraq. BMC Pregnancy Childbirth 2013;13(11):1-9.
6. Berhan Y, Berhan A. Commentary: Reasons for persistently high maternal and perinatal mortalities in Ethiopia: part III–perspective of the “three delays” model. Ethiop J Health Sci 2014;24:137–148.
7. Abate T, Dile M, & Syoum T. Proportion of maternal near misses and associated factors in referral hospitals of Amhara regional state, Northwest Ethiopia: institution based cross sectional study. Gynecol Obstet. 2015;5(8):1-8.
8. Abdollahpour S, Miri HH, Khadivzadeh T. The maternal near miss incidence ratio with WHO Approach in Iran: A systematic review and Meta-analysis. Iranian J Nurs Midwifery Res. 2019a; 24(3):159-166.
9. Sarma HKD, Sarma HK, & Kalita AK A prospective study of maternal near-miss and maternal mortality cases in FAAMCH, Barpeta; with special reference to its aetiology and management: First 4 months report. J Obstet Gynaecol Barpeta 2014; 1(2):100-106.
10. Aduloju OP, Aduloju T, Ipinnimo OM. Profile of maternal near miss and determinant factors in a teaching hospital, Southwestern Nigeria. Int J Obstet Gynaecol, Res 2018;5(1):598-617.
11. Storeng KT, Murray SF, Akoum MS, Ouattara F, Filippi V. Beyond body counts: a qualitative study of lives and loss in Burkina Faso after 'near-miss' obstetric complications. Soc Sci Med 2010;71 (10):1749-1756.
12. Gebrehiwot Y, Tewolde BT. Improving maternity care in Ethiopia through facility-based review of maternal deaths and near misses. Int J Gynaecol Obstet. 2014; 127;29-34.
13. World Health Organization. Maternal mortality fact sheet no. 348. World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the World Bank Group, the United Nations Population Fund (UNFPA). Trends in maternal mortality: 1990 to 2015. World Health Organization; 2015; WHO /RHR/15.23.
14. Geleto A, Chojenta C, Taddele T, Loxton D. Incidence of maternal near miss among women in labour admitted to hospitals in Ethiopia. Midwifery. 20202;82:102597. Doi:https://doi.org/10.1016/j.midw.2019.10 2597
15. Tuncalp Ö, Hindin MJ, Adu-Bonsaffoh K, Adanu RM. Assessment of maternal near-miss and quality of care in a hospital-based study in Accra, Ghana. Int J Gynaecol Obstet. 2013;123(1): 58-63.
16. Wakgar N, Dulla D, & Daka D. Maternal Near misses and Death in Southern Ethipia: A Retrospective study. Ethiopian J Reprod Health. 2019;11(2):17-25.

17. Iwuh IA, Fawcus S, Schoeman I. Maternal near-miss audit in the Metro West maternity service, Cape Town, South Africa: A retrospective observational study. S Afr Med J. 2018;108(3):171-175.
18. Shrestha J, Shrestha R, Tuladhar R, Sangeeta Gurung S, Shrestha A. Maternal Near Miss in a Tertiary Care Teaching Hospital. Am J Public Health Res. 2015;3(5A):17-22.
19. Manjunatha S, Harsha TN, Damayanthi HR. A study of maternal near miss at a district Teaching hospital: a retrospective observational study. Int J Reprod Contracept Obstet Gynecol 2018;7(4): 1421-1426.
20. Norhayati MN, Nik Hazlina N, Sulaiman H, Azman MY. Severe maternal morbidity and near misses in tertiary hospitals, Kelantan, Malaysia: a cross-sectional study. BMC Public Health 2016;16:229-241.
21. Samant PY, Dhanawat J. Maternal near miss: an Indian tertiary care centre audit. Int J Reprod Contracept Obstet Gynecol. 2019;8(5):1874-1879.
22. Abdel‐Raheem SS, Al‐Attar GST, Mahrana DG, Qayed MH, Ali ZH, Othman ERA. Delays associated with maternal near‐miss cases admitted in Women's Health Hospital, Assiut University, Egypt. J Curr Med Res Pract. 2017;2(1):1-9.
23. Alemu FM, Fuchs MC, Vitale TM, Salih MAM. Severe maternal morbidity (near-miss) and its correlates in the world's newest nation: South Sudan. Int J Women's Health 2019;11:177-190.
24. Downie R. A report of the CSIS global health policy centre, The state of Public Health in South Sudan. 2012;1-25.
25. Heemelaar S, Josef M, Diener Z, Chipeio M, Stekelenburg J, van den Akker T, Mackenzie S. Maternal near-miss surveillance, Namibia. Bull World Health Organ 2020;98(8):548-557.
26. Owolabi O, Riley T, Juma K, Mutua M, Pleasure ZH, Amo‐Adjei J, Bangha M. Incidence of maternal near‐miss in Kenya in 2018: findings from a nationally representative cross‐sectional study in 54 referral hospitals. Sci Rep 2020;10: 15181.
Doi: https://doi.org/10.1038/s41598-020-72144-x
27. Akpan BU, Asibong U, Omoronyia E, Arogundade K, Agan T, Ekott M. Severe Life- Threatening Pregnancy Complications, "Near Miss" and Maternal Mortality in a Tertiary Hospital in Southern Nigeria: A Retrospective Study. Obstet Gynecol Int 2020;3697637:7.
Doi: https://doi.org/10.1155/2020/3697637
28. Kalisa R, Rulisa S, van den Akker T, van Roosmalen J. Maternal Near Miss and Quality of care in a rural Rwandan Hospital. BMC Pregnancy Childbirth. 2016;16:324.
29. Asaye MM. Proportion of Maternal Near-Miss and Its Determinants among Northwest Ethiopian Women: A Cross-Sectional Study. Int J Reprod Med 2020;5257431.
Available:https://doi.org/10.1155/2020/5257431
30. Fenta SL, Nigussie AA, Bante AS, Asres EM, Goedert MH. Obstetric Near Miss in Northwest Ethiopia, Has a Pregnant Woman Still 'One Foot in the Grave'? Clin Mother Child Health 2020; 17:353.
Doi: 10. 35248/2090-7214.20.17.353
31. Madeiro AP, Rufino AC, Lacerda EZG, Brasil LG. Incidence and determinants of severe maternal morbidity: a transversal study in a referral hospital in Teresina, Piaui, Brazil. BMC Pregnancy Childbirth 2015;15:210-218.
32. Adeoye IA, Onayade AA & Fatusi AO. Incidence, determinants, and perinatal outcomes of near miss maternal morbidity in Ile-Ife Nigeria: A prospective case-control study. BMC Pregnancy Childbirth. 2013;13(1):93-103.
33. Liyew EF, Yalew AW, Afework MF, Essén B. Distant and proximate factors associated with maternal near-miss: a nested case-control study in selected public hospitals of Addis Ababa, Ethiopia. BMC Women's Health. 2018;18(1):28.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/94349