

Clinico-Epidemiological Profile of Obstetric Admissions to Intensive Care Unit and High Dependency Unit of a Tertiary Care Hospital

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Abstract

Background: Obstetric critical illness can happen in the antenatal, intrapartum and/or postpartum period and may require intensive monitoring and organ-supportive care. High Dependency Units (HDUs) and Intensive Care Units (ICUs) are important in the care of women with severe obstetric and medical complications. **Material and Methods:** This is a prospective observational study conducted in the Department of Obstetrics and Gynaecology, Government Medical College, Kota from 1st October 2023 to 31st December 2024. All eligible obstetric patients admitted to the HDU and/or to the ICU (direct admission or transfer from wards or other departments) were included. Maternal characteristics, indications for critical-care admission, interventions, length of stay, maternal outcomes, causes of death and neonatal/perinatal outcomes were evaluated. All data was analysed using SPSS and presented as frequencies, percentages and mean $\pm$ SD. **Results:** Of 11,880 labour-room admissions, 1,208 (10.16%) needed HDU/ICU care. Most women were aged 21–30 years (53.31%), from rural areas (75.74%), and were referred cases (75.74%). 56.62% of admissions were for postpartum complications. The most common indications were hypertensive disorders of pregnancy (34.25%), antepartum haemorrhage (16.19%) and anaemia (14.73%). Blood and blood-product transfusion was the commonest intervention (45.76%) followed by administration of magnesium sulphate (32.64%). The average length of critical care stay was 2.92 days. The overall recovery rate was 91.39%, near-miss morbidity rate was 3.90% and mortality was 1.57%. The major cause of maternal death was haemorrhagic shock (36.84%). Of 1072 neonates, 79.47% survived till day 7 and 63.72% of livebirths were admitted to the NICU. **Conclusion:** There was a significant critical care burden associated with obstetric HDU/ICU admissions, with hypertensive disorders of pregnancy, obstetric haemorrhage and anaemia all playing a significant role. The high referral and rural population emphasizes the need for prompt recognition, timely referral and prompt multidisciplinary management. Enhancing obstetric HDU/ICU services could have a positive impact on maternal and perinatal outcomes.

Keywords: Obstetric critical care, Intensive Care Unit, High Dependency Unit, Maternal morbidity, Maternal mortality.

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INTRODUCTION

Pregnancy and childbirth are physiological processes, but a proportion of women will develop severe obstetric or medical complications that can quickly escalate to organ dysfunction and need intensive monitoring and life-support measures.^[1] Obstetric critical illness can happen in the antenatal, intrapartum or postpartum period, and is important contributors to maternal morbidity and mortality are hypertensive disorders of pregnancy, obstetric haemorrhage, sepsis, thromboembolic events and associated medical disorders.^[2,3] It is therefore imperative that early recognition of the problem and prompt escalation of care leads to better maternal and perinatal outcomes.^[4]

Intensive Care Units (ICUs) support patients who are very ill and need full organ support, while High Dependency Units (HDUs) are for women who require more than is available in a normal obstetric ward, but not intensive care.^[5,6] In tertiary-care obstetric units, where patients with severe complications are often referred from peripheral hospitals, and may present with advanced disease, the availability and appropriate use of

HDU and ICU facilities are of particular importance.^[7]

Factors affecting the burden of obstetric critical-care admission include the spectrum and severity of obstetric complications, accessibility of antenatal care, timely referral, socioeconomic factors and access to specialized emergency obstetric services.^[8] Analysing indications for HDU/ICU admission, interventions required, length of critical-care stay, maternal and neonatal outcomes, can help identify the major contributors to severe maternal morbidity and mortality. This information can also help to strengthen referral systems, optimize critical-care resources and enhance obstetric emergency care.^[9,10]

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Thus, the present study was conducted to estimate the rate and burden of admission, to study the indications for admission, interventions required and outcome in women admitted for obstetric critical care and to determine the proportion of individual causative factors contributing to admission to HDU/ICU.

MATERIALS AND METHODS

The present study was a prospective observational study done in the Department of Obstetrics and Gynaecology, Government Medical College, Kota. The study was carried out for a period of time between 1 October 2023 and 31 December 2024. All obstetric patients admitted to the High Dependency Unit (HDU) or Intensive Care Unit (ICU) (either directly or transferred from ward or other departments) during the study period were included.

High risk obstetric cases in the HDU/ICU were included, which included referred, transferred, booked and unbooked cases. Antenatal, intrapartum and postpartum women were eligible for inclusion. Obstetric complications like severe preeclampsia, eclampsia, postpartum haemorrhage, disseminated intravascular coagulation, antepartum haemorrhage, and haemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome were included. Pregnant women with underlying medical conditions such as jaundice, cardiac disease, renal disease, and diabetes were also included. The women who were admitted for poisoning, road traffic accidents or medicolegal cases were not included.

Each patient who was admitted to the HDU or the ICU during the study period was assessed in terms of clinical and outcome-related data and information. Patients who were admitted directly to critical care and those who were transferred from other hospital departments were included in the study. Maternal characteristics, obstetric indications for critical-care admission, interventions, length of HDU/ICU stay, maternal outcome, causes of mortality and neonatal/perinatal outcomes were evaluated.

Data was analysed using a computer software called Statistical Package for the Social Sciences (SPSS) for Windows. The continuous variables were presented as mean $\pm$ standard deviation (SD) and the categorical variables were presented as frequencies and percentages. The findings were then descriptively reported based on the objectives of the study.

RESULTS

A total of 11,880 women were admitted in the labour room during the study period, out of which 1,208 (10.16%) women required admission in the HDU/ICU for obstetric critical care. The majority of women requiring critical care were aged 21–30 years (644, 53.31%), followed by those aged >30 years (341, 28.22%) and <20 years (223, 18.46%). Most women belonged to the low socioeconomic group (544, 45.03%), were Hindu (1059, 87.66%), and resided in rural areas (915, 75.74%). As far as admission status is concerned 915 (75.74%) were referred cases, 202 (16.72%) were unbooked and 91 (7.53%) were booked admissions. [Table 1]

Table 1: Sociodemographic and Admission Characteristics of Women Requiring Obstetric Critical Care (N=1208)

Characteristic	N (%)
Age group	
<20 years	223 (18.46%)
21–30 years	644 (53.31%)
>30 years	341 (28.22%)
Socioeconomic status	
Low	544 (45.03%)
Middle	522 (43.21%)
High	142 (11.75%)
Religion	
Hindu	1059 (87.66%)
Muslim	138 (11.42%)
Others	11 (0.90%)
Locality	
Rural	915 (75.74%)
Urban	293 (24.25%)
Booking/admission status	
Booked	91 (7.53%)
Unbooked	202 (16.72%)
Referred	915 (75.74%)

The most common timing/reason for admission in women admitted to the HDU/ICU was postpartum complications (684, 56.62%), followed by antepartum complications (376, 31.12%), ectopic pregnancy (67, 5.54%), abortion (41, 3.39%) and molar pregnancy (40, 3.31%). Among the antepartum cases, primigravidas constituted the largest group (158, 42.08%), followed by second gravidas (104, 27.72%),

third gravidas (75, 19.90%), and women with gravida ≥ 4 (39, 10.30%). Among the 524 antepartum/early pregnancy cases assessed according to gestational age, 256 (48.85%) were >37 weeks, 96 (18.32%) were at 28–37 weeks, 24 (4.50%) were at 20–28 weeks, and 148 (28.24%) were <20 weeks. [Table 2]

Table 2: Obstetric Characteristics of Women Admitted to HDU/ICU

Characteristic	N (%)
Timing/reason for critical-care admission	
Postpartum complications	684 (56.62%)

Antepartum complications	376 (31.12%)
Ectopic pregnancy	67 (5.54%)
Abortion	41 (3.39%)
Molar pregnancy	40 (3.31%)
Obstetric score among antepartum cases (n=376)	
G1	158 (42.08%)
G2	104 (27.72%)
G3	75 (19.90%)
≥G4	39 (10.30%)
Gestational age among antepartum/early pregnancy cases (n=524)	
>37 weeks	256 (48.85%)
28–37 weeks	96 (18.32%)
20–28 weeks	24 (4.50%)
<20 weeks	148 (28.24%)

Hypertensive disorders of pregnancy (493, 34.25%) was the most common indication for admission in the HDU/ICU followed by antepartum haemorrhage (233, 16.19%) and anaemia (212, 14.73%). Other important indications included postpartum haemorrhage (112, 7.78%), HELLP syndrome (96, 6.67%), psychiatric illness (53, 3.68%), epilepsy (41, 2.84%), septicaemia (40, 2.77%), gestational diabetes

mellitus (38, 2.64%), thrombocytopenia (31, 2.15%), and cardiac disease (28, 1.94%). Smaller proportions were represented by acute kidney injury, haemorrhagic shock, septic shock, respiratory distress and neurological complications. As individual women could have more than one indication, the total number of indications exceeded the number of women enrolled. [Table 3]

Table 3: Indications for Admission to HDU/ICU

Indication	N (%)
Hypertensive disorders of pregnancy	493 (34.25%)
Antepartum haemorrhage	233 (16.19%)
Anaemia	212 (14.73%)
Postpartum haemorrhage	112 (7.78%)
HELLP syndrome	96 (6.67%)
Psychiatric illness	53 (3.68%)
Epilepsy	41 (2.84%)
Septicaemia	40 (2.77%)
Gestational diabetes mellitus	38 (2.64%)
Thrombocytopenia	31 (2.15%)
Cardiac disease	28 (1.94%)
Acute kidney injury	18 (1.25%)
Haemorrhagic shock	14 (0.97%)
Septic shock	12 (0.83%)
Respiratory distress	9 (0.62%)
Neurological complications	9 (0.62%)
Total indications	1439 (100%)

The most common intervention required was blood and blood product transfusion (45.76%) (600 women), followed by magnesium sulphate administration (32.64%) (428 women). 93 (7.09%) women received anticonvulsants and 84 (6.40%) women needed other interventions. Fifty one

(3.89%), 31 (2.36%) and 24 (1.83%) women required oxygen, inotropic and ventilatory support, respectively. The total number of interventions was greater than the number of women as some patients had more than one intervention during their HDU/ICU stay. [Table 4]

Table 4: Interventions and Management Provided During HDU/ICU Admission

Intervention	N (%)
Blood and blood product transfusion	600 (45.76%)
Magnesium sulphate administration	428 (32.64%)
Anticonvulsant administration	93 (7.09%)
Other interventions	84 (6.40%)
Oxygen support	51 (3.89%)
Inotrope administration	31 (2.36%)
Ventilator support	24 (1.83%)
Total interventions	1311 (100%)

Of the 1208 women, 451 (37.33%) had vaginal delivery prior to admission to HDU/ICU and 229 (18.95%) had caesarean section prior to admission to HDU/ICU. After admission in HDU/ICU, 145 (12.00%) women gave birth vaginally, while 210 (17.38%) had cesarean section. Other procedures

included evacuation in 75 (6.20%), laparotomy in 67 (5.54%), instrumental delivery in 11 (0.91%), hysterotomy in 6 (0.49%), and relaparotomy in 4 (0.33%). There were 10 women (0.82%) who were not delivered. [Table 5]

Table 5: Mode of Delivery and Obstetric Procedures

Mode/procedure	N (%)
Vaginal delivery before HDU/ICU admission	451 (37.33%)
Caesarean section before HDU/ICU admission	229 (18.95%)
Vaginal delivery after HDU/ICU admission	145 (12.00%)
Caesarean section after HDU/ICU admission	210 (17.38%)
Evacuation	75 (6.20%)
Laparotomy	67 (5.54%)
Instrumental delivery	11 (0.91%)
Undelivered	10 (0.82%)
Hysterotomy	6 (0.49%)
Relaparotomy	4 (0.33%)
Total	1208 (100%)

Of the 1,208 women requiring obstetric critical care, 727 (60.18%) were admitted to the HDU and 481 (39.81%) to the ICU. The duration of stay was 1–2 days in 540 (44.70%) women and 2–4 days in 395 (32.69%). A further 173

(14.32%) women stayed for 4–7 days, while 25 (2.06%) stayed for <1 day and 69 (5.71%) required >7 days of critical care. The average hospital stay in the HDU/ICU was 2.92 days. [Table 6]

Table 6: HDU/ICU Utilization and Duration of Stay

Parameter	N (%)
Location of admission	
HDU	727 (60.18%)
ICU	481 (39.81%)
Duration of stay	
<1 day	25 (2.06%)
1–2 days	540 (44.70%)
2–4 days	395 (32.69%)
4–7 days	173 (14.32%)
>7 days	69 (5.71%)
Total	1208 (100%)
Mean duration of stay	2.92 days

Of the 1148 women admitted to HDU/ICU, 1104 (91.39%) survived and 44 (3.90%) were maternal near-miss. 41 (3.39%) women were referred to another department/hospital and 19 (1.57%) women died. Therefore, most of the women

admitted for obstetric critical care had a good maternal outcome, but there was a small number of near-miss or deaths. [Table 7]

Table 7: Maternal Outcome Following HDU/ICU Admission

Maternal outcome	N (%)
Recovered	1104 (91.39%)
Near-miss	44 (3.90%)
Referred to another department/hospital	41 (3.39%)
Expired	19 (1.57%)
Total	1208 (100%)

The most common reasons for women to be referred to other departments or hospitals were sepsis and infection (12 [29.26%]) (referred to Medicine) and acute kidney injury requiring Nephrology referral (11 [26.82%]). Seven (17.07%) women were referred to Neurology for intracranial

haemorrhage, 5 (12.19%) to Cardiology for cardiac disease and 5 (12.19%) to Surgery for exploratory laparotomy. One woman (2.43%) was referred to another hospital for treatment of retinal detachment. [Table 8]

Table 8: Reasons for Referral to Other Departments/Hospitals

Reason for referral	Referred to	N (%)
Sepsis and infections	Medicine	12 (29.26%)
Acute kidney injury	Nephrology	11 (26.82%)
Intracranial haemorrhage	Neurology	7 (17.07%)
Cardiac diseases	Cardiology	5 (12.19%)
Exploratory laparotomy	Surgery	5 (12.19%)
Retinal detachment	Other hospital	1 (2.43%)
Total		41 (100%)

Of the 19 maternal deaths, haemorrhagic shock was the most common cause with 7 (36.84%) deaths, followed by

pulmonary thromboembolism with 4 (21.05%) deaths and multiple organ dysfunction syndrome with 3 (15.79%)

deaths. Two deaths (10.53%) were due to intracranial haemorrhage, one due to septic shock, one due to aspiration

pneumonitis and one due to myocardial infarction (5.26% each). [Table 9]

Table 9: Causes of Maternal Mortality

Cause of mortality	N (%)
Haemorrhagic shock	7 (36.84%)
Pulmonary thromboembolism	4 (21.05%)
Multiple organ dysfunction syndrome	3 (15.79%)
Intracranial haemorrhage	2 (10.53%)
Septic shock	1 (5.26%)
Aspiration pneumonitis	1 (5.26%)
Myocardial infarction	1 (5.26%)
Total	19 (100%)

Among the 1,072 neonates, 852 (79.47%) were alive at day 7, while 120 (11.19%) were reported as intrauterine fetal deaths, 61 (5.69%) died within 7 days of birth, and 39 (3.63%) were stillborn. Regarding birth weight, 289 (26.95%) weighed >2.5 kg, 268 (25.00%) weighed 2000–2499 g, 204 (19.02%) weighed 1000–1499 g, 196 (18.13%)

weighed <1 kg, and 115 (10.72%) weighed 1500–1999 g. Among 913 live births with available APGAR data, 478 (52.45%) had an APGAR score ≤7 and 435 (47.54%) had a score >7. Of the live births, 581 (63.72%) were admitted to NICU. [Table 10]

Table 10: Neonatal and Perinatal Outcomes Among Deliveries Following HDU/ICU Admission

Parameter	Category	N (%)
Neonatal outcome	Alive at day 7	852 (79.47%)
	Intrauterine fetal death	120 (11.19%)
	Neonatal death within 7 days	61 (5.69%)
	Stillbirth	39 (3.63%)
Birth weight	<1 kg	196 (18.13%)
	1000–1499 g	204 (19.02%)
	1500–1999 g	115 (10.72%)
	2000–2499 g	268 (25.00%)
	>2.5 kg	289 (26.95%)
APGAR score among live births (n=913)	≤7	478 (52.45%)
	>7	435 (47.54%)
NICU admission among live births (n=913)	Yes	581 (63.72%)
	No	332 (36.28%)

Anaemia (212, 30.15%), obesity (108, 15.36%) and hypothyroidism (102, 14.50%) were the most common medical comorbidities among the 703 women reported. Psychiatric illness was present in 53 (7.53%) women, while epilepsy, liver disease, diabetes mellitus, asthma, chronic

hypertension, and cardiac disease were reported in 41 (5.83%), 39 (5.54%), 38 (5.40%), 33 (4.69%), 31 (4.40%), and 28 (3.98%) women, respectively. Four (0.56%) women were reported to have HIV and 14 (1.99%) women had TB. [Table 11]

Table 11: Associated Maternal Medical Comorbidities

Comorbidity	N (%)
Anaemia	212 (30.15%)
Obesity	108 (15.36%)
Hypothyroidism	102 (14.50%)
Psychiatric illness	53 (7.53%)
Epilepsy	41 (5.83%)
Liver disease	39 (5.54%)
Diabetes mellitus	38 (5.40%)
Asthma	33 (4.69%)
Chronic hypertension	31 (4.40%)
Cardiac disease	28 (3.98%)
Tuberculosis	14 (1.99%)
HIV	4 (0.56%)
Total	703 (100%)

DISCUSSION

Majority of women who required obstetric HDU/ICU care in the present study were young with 53.31% in the 21–30 year age group, which is similar to that reported by Garg and Tripathi with 54.87% in the 21–25 year age group and

Bhadade et al. with 82.7% in the 21–30 year age group.^[9,11] There was a significant female predominance from rural areas (75.74%) and low socioeconomic status (45.03%). The same rural predominance has been observed by Mahajan et al. (70% of patients admitted to the ICU were from rural areas), and Jain and

Guleria et al. (41.10% rural).^[12,13] The present study also showed a high percentage of referred patients (75.74%) which was similar to 80.2% reported by Rathod and Malini and 74% reported by Dasgupta et al.^[14,15] The findings reveal that delayed referral, poor access to emergency obstetric services and poor antenatal care all make a significant contribution to the burden of obstetric critical illness.

In the present study, the highest number of admissions to the HDU/ICU were due to postpartum complications (56.62%) followed by antepartum complications (31.12%). This is similar to the findings of previous studies where postpartum admissions accounted for 64% in a study by Pranavi and Rao,^[16] and 59% in a study by Qureshi and Shaheena.^[17] But Mahajan et al. found a much higher postpartum percentage of 92.12%.^[12] The most common indication for critical-care admission in the present study was the hypertensive disorders of pregnancy (34.25%), followed by antepartum haemorrhage (16.19%), anaemia (14.73%), postpartum haemorrhage (7.78%) and HELLP syndrome (6.67%). However, other tertiary-care centres studies have often found obstetric haemorrhage to be the main indication. The high prevalence of hypertension in the current cohort would thus suggest a significant role for pregnancy-specific hypertension in severe maternal morbidity in this context. Blood and blood-product transfusion was the most common intervention required in the present study (45.76%) followed by magnesium sulphate (32.64%) and anticonvulsants (7.09%) whereas ventilatory support was required in only 1.83% and inotropic support in 2.36% of patients. This is in contrast to studies with a higher proportion of patients at the ICU level who had more invasive modes of organ support. Mahajan et al reported that 83.5% received transfusion of blood and blood products, 50.39% received inotropic support, and 38.58% received mechanical ventilation.^[12] The relatively lower requirement for invasive support in the present study may be due to the fact that both HDU and ICU patients were included, with 60.18% of the patients managed in HDU and 39.81% in the ICU. The mean stay in critical care was 2.92 days, with 44.70% of patients staying for 1–2 days and 32.69% staying for 2–4 days, which is broadly similar to the median stay of 2.5 days reported by Jain and Guleria et al.^[13]

Maternal recovery was seen in 91.39% of women, 3.90% had near-miss morbidity, 3.39% required referral and maternal mortality was 1.57%. This mortality was less than in some previous studies done in the ICU such as 4.5% by Bhadade and 8% by De' Souza et al.^[9] in a North Indian obstetric ICU. The most common cause of maternal death in the present study was haemorrhagic shock (36.84%), followed by pulmonary thromboembolism (21.05%) and multiple organ dysfunction syndrome (15.79%). Pranavi and Rao found MODS to be the most common cause of maternal mortality.^[17] Neonatal outcomes too were a reflection of the severity of the maternal illness with 79.47% of neonates being alive at day 7, IUFD in 11.19%, stillbirth in 3.63% and neonatal death in 5.69%. The neonatal death rate was lower than that reported by Dasgupta et al. (8.3%) but higher than that reported by Chantry et al (3.4%).^[17,18] There was a significant neonatal morbidity associated with severe

maternal illness with a high proportion of live born neonates requiring NICU admission (63.72%) and 52.45% with an APGAR score ≤ 7 .

CONCLUSION

The obstetric HDU/ICU admissions were a significant proportion of critical maternal care in this tertiary-care hospital, with postpartum complications and hypertensive disorders of pregnancy making up the majority. Timely referral and appropriate antenatal care were important, as a large proportion of the patients came from peripheral centres and were from rural and low socioeconomic background. Although maternal near-miss and maternal deaths still happened, most women made it through critical-care management with haemorrhagic shock as the most common cause of death. The significant need for blood transfusion, magnesium sulphate and other supportive measures and the high percentage of neonates requiring admission to NICU highlights the importance of timely identification, multi-disciplinary management and well-equipped obstetric HDU/ICU services.

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Conflicts of interest

There are no conflicts of interest.

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