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THE HIGH DEPENDENCY UNIT –A PARADIGM FOR IMPROVED OUTCOME

Dr. Safora Shafaq[1], Dr. Mehnaz Rashid[2*]

[1]Department of Obstetrics and Gynaecology
[2*]Bhagwan Mahaveer Jain Hospital, Bengaluru, Karnataka, India

***Corresponding Author: Dr. Mehnaz Rashid**
*Department of Obstetrics and Gynaecology, Bhagwan Mahaveer Jain Hospital, Bengaluru, Karnataka, India

ABSTRACT

Objective: To evaluate indications for obstetric HDU admission, clinical profile, investigations and interventions, length of stay, ICU transfer, and maternal–perinatal outcomes, thereby appraising the utility of HDU care.

Materials and Methods: In a prospective observational study, all booked or referred obstetric patients (including up to 6 weeks postpartum) admitted to the obstetric HDU from August 2018 to July 2019 were enrolled. A pretested proforma captured demographics, obstetric/medical history, indications for HDU admission, interventions, and outcomes. Records of antenatal and puerperal patients were reviewed; obstetric versus medical complications and maternal–fetal outcomes were tabulated and analyzed.

Results: Women with coexisting medical disorders required HDU admission or delivery at earlier gestations than those with obstetric complications alone and presented with greater hemodynamic instability. They needed more aggressive resuscitation, more invasive monitoring, and had longer mean and more frequently prolonged HDU stays. Referred patients also arrived in poorer condition and required more intensive interventions than booked patients, although not all between-group differences reached statistical significance. Overall ICU transfer was low, and maternal mortality was near-negligible.

Conclusion: The clinical severity at presentation, the need for advanced monitoring and interventions, and the observed outcomes indicate that these patients could not be safely managed in a general ward. An obstetric HDU provides effective, intermediate-level care that reduces pressure on the ICU without compromising maternal or fetal outcomes. Where NICU admission is unnecessary, HDU care also supports mother–infant rooming-in, facilitating early breastfeeding and bonding while minimizing separation-related distress.

Keywords: Obstetric High Dependency Unit, Maternal Morbidity, Hypertensive Disorders of Pregnancy, Intensive Care Utilization, Perinatal Outcomes.

INTRODUCTION

Any pregnant woman can develop life threatening complications with little or no advance warning. Critically ill pregnant women present a unique challenge in obstetrics as it involves care of two patients at once and also because of its high unpredictability[1,2]. The complications of pregnancy and labor can be broadly divided into two types- obstetric Complications like postpartum Hemorrhage

(PPH), preeclampsia/eclampsia (PE/E) and HELLP syndrome (Hemolysis elevated liver enzymes and low platelet count), which require intensive obstetric care by specially trained providers, and medical complications include any medical condition complicating the pregnancy which requires extensive monitoring and multidisciplinary care and cannot be managed in general ward[1,2]. Traditionally such patients were managed in the ICU, Maternal fetal medicine combines tailored care by obstetricians for timely diagnosis and management of life-threatening obstetric complications, with ease of multidisciplinary care and provision of one to one care. Thus, only women who have progressed to a clinical condition with multiorgan involvement/failure or need advanced respiratory support, can be shifted to ICU (intensive care unit) care[3]. High Dependency Unit may be a more appropriate measure of resource utilization for these patients allowing better triage to ICU or cutting short the ICU stay, hence saving the resources which can be utilized for other patients. This necessitates the need for setting up specialized units for appropriate and timely care[1,2].

High Dependency Unit (HDU) care has been defined as a level of care which is in between general ward and an intensive care unit (ICU)[1,4,5]. It typically involves the patients with single organ failure and patients who are at a high risk of developing life-threatening complications, for each maternal death, approximately 118 life threatening events of 'near miss mortality' or 'severe acute maternal morbidity' (SAMM) happen[4]. Global prevalence of SAMM, varies from 0.015 to 8.23%[6]. High dependency unit (HDU) interference is required in these cases mainly and can mean the difference between life and death[1].

AIMS AND OBJECTIVES

Aim: To assess the role of the Obstetric HDU in managing high-risk pregnancies and its impact on maternal and perinatal outcomes.

Objectives: Identify common indications for HDU admission; describe clinical profiles, investigations, and interventions; compare outcomes by complication type (obstetric-only vs medical-obstetric) and booking status (booked vs referred); determine HDU length of stay and ICU transfer rates; evaluate perinatal outcomes (gestational age, birth weight, NICU need, ventilation, sepsis, mortality).

MATERIALS AND METHODS

This prospective observational study was carried out on booked and referred obstetric patients from all over South India who got admitted to obstetric HDU, Bhagwan Mahaveer Jain Hospital, Bengaluru from one year with effect from August 2018 to July 2019.

SAMPLE SIZE[4]: 150 The proportion of HDU admission indicators among pregnant mothers such as HTN, septicemia and PPH were reported as 21%, 35% and 29% respectively. With 8% absolute precision and 95% confidence interval the required sample size is derived for all three proportions. The estimated sample sizes were 100, 137 and 124 respectively. Hence the final sample size for this study was assumed to be 150. The following formula was used to derive the required sample size $n = Z(1-\alpha/2)^2 * p(1-p) / d^2$

INCLUSION CRITERIA

1. All pregnant patients (singleton/multiple gestation) or patients within 6 weeks of delivery booked/referred getting admitted to Obstetric HDU at BMJH.
2. Women willing to participate in the study

Admission Criteria

- Patients needing support for a single organ system but excluding advanced respiratory support/ mechanical ventilation.
- Patients who can benefit from more detailed observation than can be provided on the general ward.

- Patients no longer needing intensive care but who are not yet well enough to be returned to a general ward.
- Post-operative patients who need close monitoring for longer than a few hours

EXCLUSION CRITERIA

1. Women who are not willing to participate in the study.
2. Patients requiring mechanical ventilation.
3. Patients requiring hemodynamic monitoring with pulmonary artery/ intra-arterial catheterization or invasive intra-arterial pressure monitoring.
4. Patients with multi system failure.

METHODOLOGY

Cases included all patients meeting the inclusion criteria who were either booked or referred to Bhagwan Mahaveer Jain Hospital, Bengaluru. Written informed consent was obtained prior to enrollment. Demographic details age, relevant obstetric history, any underlying medical disorder, the indication for obstetric HDU admission, the types of interventions undertaken, and pregnancy outcomes were recorded on a pretested, validated study proforma. For each antenatal and puerperal patient, records were reviewed and all complications, whether obstetric or medical in origin, were noted. Obstetric complications were defined as morbidities directly related to pregnancy or its management during the antepartum, intrapartum, or postpartum period (up to 42 days after delivery), whereas medical morbidity referred to complications arising from pre-existing medical conditions. All patients received individualized care; investigations and interventions, both invasive and non-invasive, were performed as per protocol when required, and all pertinent information regarding obstetric events, indications for HDU admission or transfer, interventions rendered, length of stay, and eventual outcomes was collected, reviewed, tabulated, and analyzed. Antenatal mothers underwent clinical monitoring along with cardiotocography, biophysical profile assessment, and Doppler studies. Management was individualized throughout, with invasive or non-invasive measures applied as needed. Definitions of obstetric events followed Williams's Obstetrics, 25th edition[7], and Creasy and Resnik's Maternal-Fetal Medicine[8]. Patients were followed in the maternal–fetal unit until delivery and into the immediate postpartum period, with discharged women reviewed regularly for at least six weeks. Finally, gestational age at termination of pregnancy, the indication for termination, and maternal and perinatal outcomes were recorded.

Adverse maternal outcome was defined as per references[9,10] to include HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count); eclampsia, meaning preeclampsia complicated by generalized tonic–clonic convulsions; hepatic dysfunction, characterized by an INR >1.2 in the absence of disseminated intravascular coagulation (DIC) or warfarin therapy; DIC; central nervous system complications, including posterior reversible encephalopathy syndrome (PRES); renal complications; and other entities with definitions retained verbatim from the thesis.

Method of Statistical Analysis: The data has been summarised by descriptive statistics such as mean and SD in case of continuous parameters and count with percentage for categorical variables. All continuous parameters are compared between booked/unbooked and medical and obstetric / obstetric only groups by independent t-test. Similarly, the chi-square test was used for categorical parameters. p-value <0.05 was assumed to be statistical significance.

RESULTS

The study included 150 booked/referred cases including pregnant patients (singleton/multiple gestation) and patients within 6 weeks of delivery admitted to the obstetric HDU were included in this study [Table 1]. Demography of our study population showed mean age of patients with only obstetric morbidity and cases with prior medical disease at 31±5.0 and 31.8±5.5 years respectively; mean gestational age at the time of admission of patients with only obstetric morbidity and cases with prior medical disease was 26.68±11.62 and 33.11±4.41 weeks respectively [Table 1]. Forty-

seven primigravidae (31.33%) and 103 multiparas (68.67 %) were observed to have required HDU admission [Table 1]. Mode of delivery was either LSCS, vaginal, ectopic-laparoscopy, abortion/ hysterotomy/ mid-trimester expulsion as per obstetric indication and a majority of 102 patients (69.39%) underwent LSCS, 18 (12.24%) patients had a vaginal delivery, 16 (10.88%) patients needed a laparoscopic removal for ruptured ectopic pregnancy [Table 4]. On examination, anemia was 78 patients with 23(15.33%) patients having severe anemia; hypotension, tachycardia and fever were observed in 34 (22.67%), 98 (65.33%) and 13 (8.67%) women respectively [Table 1]. Hypertension was present in 72 women which included 63 cases with severe preeclampsia, 11 cases had eclampsia [Tables 1–2].

Interventions required during HDU stay were antibiotics (150), blood/blood products (108), steroiding (84), central venous monitoring (70), MgSO4 therapy (66), additional anticonvulsants (14), anticoagulation (58), uterine artery embolization (13), obstetric hysterectomy (8), tocolysis (8), and mechanical ventilation (2) [Table 3]. 64/150 (43.33%) women admitted to the HDU were for obstetric causes alone [Table 2]. 72 patients were admitted with Hypertensive disorders, 21 patients (14.00) with HELLP, PPH (46/150=30.67%), abruptio placenta (22/150=14.67%), placenta previa (22/150=14.67%) including placenta accreta (6/150= 4.0) and placenta percreta (8/150=5.33). A total of 11 patients had sepsis, 17 (11.33%) patients had ruptured ectopic pregnancy, 11(7.75%) were admitted with PROM/PPROM [Table 2].

A total of 86/150 (56.67%) of patients admitted had various medical complications along with obstetric indications. 26 patients (17.33) were in shock; 17(11.33%) patients had hemorrhagic shock, pulmonary edema (22/150=14.67%), ARF/CRF (17/150=11.33%), liver involvement/altered liver enzymes (28/150=18.67%), 9 patients admitted had overt diabetes mellitus and 3 of these had DKA, 5 patients (3.33%) with DIC. In addition, SLE (8/150 = 5.41%), cardiac disease (4/150=2.68%), DVT 5 (3.36%), postpartum cardiomyopathy each were also admitted [Table 2]. Majority of the patients recovered and were transferred to ward and discharged, 4 (4/150=2.72%) patients required transfer to ICU, 1 of these patients died of sepsis, post-partum cardiomyopathy and multiple organ dysfunction [Table 4]. 36 (29.75%) patients admitted had fetal IUGR, 14 (11.48%) with IUD, 102/150 (69.39%) delivered by LSCS and 18 (12.24%) vaginally [Table 4]. One hundred fifty pregnancies resulted in 108 (108/150=72.00%) live births including 2 multiple gestations. Prenatal mortality included four stillborn. 70 (57.85%) of the delivered babies required NICU admission, 33 (27.27) required ventilation and 10 (8.20%) of them died in the early neonatal period [Table 4].

Table 1: Study profile and clinical presentation (N=150)

Variables	No. of Patients	Percentage
Primigravida	47	31.3
Multipara	103	68.7
Hypertension present	72	48.0
Anemia (any)	78	52.0
Severe anemia	23	15.3
Hypotension	34	22.7
Tachycardia	98	65.3
Fever	13	8.7

Table 2: Major indications for Obstetric HDU admission

Indications	No. of Patients	Percentage
Obstetric causes only (no medical comorbidity)	64	42.7
Hypertensive disorders of pregnancy	72	48.0
HELLP syndrome	21	14.0
Postpartum hemorrhage (PPH)	46	30.7
Abruptio placentae	22	14.7

Placenta previa	22	14.7
Placenta accreta	6	4.0
Placenta percreta	8	5.3
Ruptured ectopic pregnancy	17	11.3
PROM/PPROM	11	7.3
Sepsis	11	7.3
Medical complications present (any)	86	57.3
Shock (any)	26	17.3
• Hemorrhagic shock	17	11.3
Pulmonary edema	22	14.7
Acute/Chronic renal failure	17	11.3
Liver involvement / elevated enzymes	28	18.7
Diabetes mellitus (overt)	9	6.0
• Diabetic ketoacidosis	3	2.0
DIC	5	3.3
Systemic lupus erythematosus	8	5.3
Cardiac disease	4	2.7
Deep vein thrombosis	5	3.3

Table 3: Interventions and procedures in HDU (N=150)

Intervention	No. of Patients	Percentage
Antibiotics	150	100.0
Blood / blood products	108	72.0
Steroids (“steroiding”)	84	56.0
Central venous monitoring	70	46.7
Magnesium sulfate therapy	66	44.0
Anticoagulation	58	38.7
Additional anticonvulsants	14	9.3
Uterine artery embolization	13	8.7
Obstetric hysterectomy	8	5.3
Tocolysis	8	5.3
Mechanical ventilation	2	1.3

Table 4: Maternal and perinatal outcomes

Outcome		No. of Patients	Percentage
Mode of delivery	LSCS	102	69.4
	Vaginal	18	12.2
	Laparoscopic removal for ruptured ectopic	16	10.9
Maternal	ICU transfer	4	2.7
	Maternal death	1	0.7
Perinatal	Live births (includes 2 multiple gestations)	108	72.0
	IUGR (reported)	36	29.8
	Intrauterine demise (reported)	14	11.5
	Stillbirths (reported separately)	4	—
	NICU admission (of delivered babies)	70	57.9
	Ventilation (of delivered babies)	33	27.3
	Early neonatal deaths	10	8.2

DISCUSSION

The present prospective observational study evaluates the performance of an obstetric High Dependency Unit (HDU) as an intermediate-level care model for high-risk pregnancies by characterizing indications for admission, admission physiology, interventions, and maternal–perinatal outcomes in 150 consecutively managed women. We found that women with combined medical–obstetric complications deteriorated earlier in gestation, presented with greater hemodynamic instability, and required more invasive monitoring and transfusion support than those with obstetric complications alone, translating into longer and more frequent prolonged HDU stays.

In the present study, the mean maternal age was 31.76 ± 5.57 years in the medical–obstetric group and 31.10 ± 5.10 years in the obstetric-only group, with 42.57% aged >35 years. These figures are higher than those reported by Dattaray C et al., (2013)[4] (24.9 ± 4.33 and 24.6 ± 4.23 years for the two groups) and broadly comparable to Masood A et al., (2018)[5] (30.9 ± 4.6 and 31.4 ± 4.3 years). They also align with age profiles from Al-Jabari AS et al., (2001)[6] (34.34 ± 5.63) and Marques CS et al., (2014)[7] (30.7 ± 6.52), underscoring that HDU cohorts frequently involve women in their early thirties. Mean gestational age at delivery was significantly lower in the medical–obstetric group than in the obstetric-only group (26.63 ± 11.57 vs 33.28 ± 4.23 weeks; $p < 0.001$), indicating earlier clinical deterioration where medical comorbidity co-exists. This gradient mirrors Dattaray C et al., (2013)[4] (32 ± 7.5 vs 36 ± 8.1 weeks) and Masood A et al., (2018)[5] (34.3 ± 3.4 vs 36.5 ± 2.3 weeks), each showing earlier delivery/need for escalated care with combined medical–obstetric complications.

At admission, medical–obstetric patients had higher rates of pallor (69.7%), tachycardia (72.1%), fever (15.1%), and hypotension (39.5%) than obstetric-only patients (28.1%, 56.2%, 0%, and 0%, respectively), whereas hypertension predominated in obstetric-only cases (70.3% vs 31.4%). These trends greater hemodynamic instability with medical–obstetric overlap are in line with case-mix patterns reported by Dattaray C et al., (2013)[4] and Masood A et al., (2018)[5], with our cohort demonstrating statistically worse clinical presentation for the medical–obstetric group ($p < 0.05$). Medical–obstetric patients required more aggressive support: blood/blood products in 79.1% and central venous pressure (CVP) line placement in 60.5%, versus 62.5% and 28.1% in obstetric-only patients. Magnesium sulfate and steroid administration were, however, more frequent in obstetric-only patients ($MgSO_4$ 62.5%; "steroiding" 79.7%) than in medical–obstetric patients (30.2% and 38.4%), reflecting the heavy burden of severe preeclampsia/eclampsia and late-trimester presentations in the obstetric-only group. These intervention patterns are consistent with prior reports: Dattaray C et al., (2013)[4] observed higher invasive line use in medical–obstetric patients (CVP 69.01% vs 26.47%), and Masood A et al., (2018)[5] similarly documented greater invasive support in mixed-etiology cases but noted that transfusion needs could be higher in obstetric-only patients in their setting. Overall, our between-group differences for resuscitation/invasive support were statistically significant ($p < 0.05$) and track with.

Pulmonary edema and obstetric hysterectomy occurred more often in the obstetric-only group (21.9% and 10.9%) than in the medical–obstetric group (9.3% and 1.2%), reflecting the predominance of severe hypertensive disorders and hemorrhage-related indications in the former. Mean HDU stay was longer in medical–obstetric patients (3.00 ± 2.19 days) than obstetric-only patients (2.29 ± 0.83 days), with prolonged stay ≥ 6 days in 15.1% vs 1.6%, respectively. These observations correspond to Masood A et al., (2018)[5], who also reported longer stays in medical–obstetric cases, and to Dattaray C et al., (2013)[4], who noted ≥10-day stays in 83.3% of medical–obstetric versus 15.3% of obstetric-only patients, underscoring the resource intensity of medical–obstetric overlaps.

Perinatal morbidity clustered more in the obstetric-only group: IUGR 39.7%, hyperbilirubinemia 18.8%, RDS 14.1%, NICU admission 67.7%, ventilation 30.6%, and longer mean NICU stay (13.18 ± 16.94 days). Corresponding figures in the medical–obstetric group were 19.0%, 5.9%, 4.7%, 47.5%, 23.7%, and 4.90 ± 9.33 days. Despite higher morbidity indices, alive-at-discharge was significantly better in the obstetric-only group (84.37%) than in the medical–obstetric group (48.83%), while early neonatal death was higher in the medical–obstetric group (11.9% vs 4.8%).

Prior cohorts show variability but broadly echo our gradients: Dattaray C et al., (2013)[4] and Masood A et al., (2018)[5] each reported greater IUGR and NICU utilization associated with maternal complications, though in their datasets IUGR and NICU admission were proportionally higher in medical–obstetric groups (e.g., NICU 23.9% vs 5.88%), highlighting that the direction and magnitude can shift with local epidemiology and thresholds for early delivery. In aggregate, our findings fit within the spectrum described by and remain compatible with broader high-risk HDU literature[6,7].

Referred patients presented with significantly worse hemodynamics (e.g., pallor 56.2%, tachycardia 71.9%, hypotension 28.1%) versus booked patients (34.5%, 37.9%, 0%), and required more aggressive resuscitation and invasive interventions. This referral-severity effect is well documented across high-risk obstetric pathways, including cohorts comparable to ours, reinforcing the value of structured triage and HDU-level stabilization before deterioration[4,5].

CONCLUSION

Women with coexisting medical disorders required HDU admission or delivery at earlier gestations, presented with greater hemodynamic instability, needed more aggressive resuscitation and invasive support, and had longer including more prolonged HDU stays than those with obstetric complications alone. Referred patients also arrived in poorer condition and demanded more intensive interventions. Despite this higher acuity, ICU transfers were few and maternal mortality was near-negligible, indicating that an obstetric HDU safely absorbs intermediate-level care and reduces ICU utilization without compromising maternal or fetal outcomes. When neonatal intensive care is not required, HDU care allows mother–infant rooming-in, supporting early breastfeeding, bonding, and mitigation of separation-related psychological stress.

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