

Guest Editorial

ROLE OF CRITICAL CARE UNITS: OBSTETRIC HDU/ICU

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INTRODUCTION

MMR in developed countries is < 20. MMR in India is 130 (2015) and in some of the states of India, it is even > 250. Every year 300000 pregnant women die in the world. If quality obstetric health care is provided in time, then we could save nearly 80% of these women in the world. Maternal mortality is "JUST THE TIP OF THE ICEBERG". There is a vast unseen base to this iceberg which is known as maternal morbidity (Near Miss). Maternal near miss case means a woman (in pregnancy/labor/ puerperium) who almost died due to any life-threatening complications but survived. For every maternal death that occurs, between 11 - 223 women experience a 'near miss' event in pregnancy.

Any pregnant woman can develop life threatening complications with little or no advance warning which can lead to physical, social, economic and psychological consequences of complications. All such women need access to quality maternal health services that can detect and manage life threatening complications.

In Europe and US, about 0.1 to 0.9% of women during pregnancy or labour require intensive care and monitoring. In India it varies from 8-16%.

Quality maternal health care means facility for invasive monitoring, skill-based services, skilled and experienced persons and 24hours monitoring. All these can be best accomplished in an obstetric ICU set up where services from

expert and trained medical, nursing and technical staff is available. They use Sophisticated State-of-the-art equipment, technology for intensive monitoring and immediate life-saving interventions and organ support that may be necessary.

What is a High Dependency Care Unit (HDU)?

A high dependency unit is an area in a hospital, where patients can be cared for more extensively than on a normal ward, but not to the point of intensive care. So, it is known as intermediate care units. Patients may be admitted to an HDU because they are at risk of requiring intensive care admission (step up) or at the same time, patients in the Intensive Care Unit who have had an improvement in their condition require a stay in the High Dependency Unit (HDU) before admission to a general ward (step down). The HDU is similar to ICU except that patients admitted to the HDU are usually less ill or beginning to recover from their operation. It is called step-down, step up, progressive & intermediate care units. HDU would not normally accept patients requiring mechanical ventilation, but could manage those receiving close monitoring. Patients with multi organ failure cannot be admitted in HUD. HDU will suffice when organ support is not vital. HDUs are the wards for people who need more intensive observation, treatment and nursing care than is possible in a routine ward but slightly less than that given in intensive care. The ratio of nurses to patients is 2:1 which is slightly lower than in intensive care but higher

than in general wards. It can be established in most obstetric unit in a room which is equipped for it. HDU is an option which fulfils the need of tertiary care centre.

Why dedicated Obstetric ICU/ HDU are required?

In developing countries like in India, incidence of high-risk pregnancy is approximately 7 to 8%. Care of critically ill patients is a unique challenge in obstetrics. When things go wrong in obstetrics they go wrong very fast. Any pregnancy can develop life threatening complications at any time with or without any warning. Medical conditions might present risk to the pregnancy. Pregnancy may modify the disease state. Drug therapy may be affected by altered pharmacokinetics. Drug therapy may have impact on the foetus. All these high-risk pregnancies can be saved by quality maternal health services, means 24 hrs vigilant monitoring with immediate life-saving interventions and organ support. This can be possible with facility of skill-based services in a dedicated critical care set up with sophisticated state-of-the-art equipment and technology. Obstetric patients are relatively young and healthy & they do recover rapidly.

Critically ill obstetric patient is safer in Obstetric HDU/ICU than MICU & SICU.

Usually Obstetric HDU/ICU is a part of obstetric department, near to Labour room and Operation theatre and so whenever is required, obstetric patient can be shifted easily and promptly to LR or Operation theatre. This is not routinely possible with MICU. Shifting of patient is very difficult particularly when patient is obstetric. In MICU & SICU, ICU beds do not have the facility to be converted into labour table.

Usually NICU is also nearer to obstetric department and so neonates can be taken care easily and promptly which may not be there with MICU/SICU. Obstetric HDU and Obstetric ICU are nearer to each other in the obstetric department and so step up and step-down facility can be used easily, which is not easily possible with MICU/SICU.

In Obstetric HDU/ICU, a trained or experienced senior dedicated full-time

obstetrician is available, and staff is dedicated and in trained in obstetric complications/emergencies.

Foetal monitoring is only possible in obstetric HDU/ICU, which is also not possible in MICU/SICU. Expenditure of hospital in maintenance of ICU decreased significantly because of Obstetric HDU.

Studies: In one study, objective was to establish the utilisation of high dependency care in a tertiary referral obstetric unit. Data of pregnant or recently pregnant women admitted to the obstetric high dependency unit from 1984 to 2007 were included to evaluate the admission rate. Four years' information of an ongoing prospective audit was collated to identify the indications for admission, maternal monitoring, transfers to intensive care unit, and location of the baby. The result was, the overall HDU admission rate is 2.67%, but increased to 5.01% in the most recent four years. Massive obstetric haemorrhage is now the most common reason for admission. Invasive monitoring was undertaken in 30% of women. Two-thirds of neonates (66.3%) stayed with their critically ill mothers in the HDU. Transfer to the intensive care unit was needed in 1.4 per 1000 deliveries conducted. Study concluded that obstetric high dependency care provides holistic care from obstetricians and anaesthetists while retaining the opportunity of early bonding with babies for critically ill mothers.

Another Study was conducted in the Rotunda Hospital, Dublin with 121 beds. It incorporates a two-bedded HDU, established in June 1996. Patients were also subdivided into those transferred to ICU in the period January 1994 to June 1996 (before on-site HDU facilities were available) and those transferred to ICU between June 1996 and June 1998 (after the HDU was established).

The total number of deliveries was 14096 before the establishment of the HDU and 12070 after. 123 patients were admitted to the HDU during the study period June 1996 to June 1998, representing 1.02% of all deliveries. 17 patients were transferred to a general ICU, 12 before the

HDU was established (representing 0.08% of all deliveries) and 5 after (0.04%). Before the HDU was established, length of stay in ICU was 3 days and 2.0 days after HDU. Prior to development of on-site HDU facilities at the hospital, ICU utilisation rate was 0.08% which decreased to 0.04% following the establishment of this facility. Although not statistically significant, there is an apparent trend toward decreased ICU admission rates following the establishment of the HDU. Transfer to ICU in the group before HDU, was necessitated predominantly by obstetric complications, with haemodynamic instability as a result of haemorrhage being the commonest ICU admission diagnosis. Following the advent of the HDU, the need for mechanical ventilation became the major indication for maternal ICU admission with an increasing number of patients with haemodynamic instability being managed within the HDU. Duration of ICU stay was short in both groups; interestingly, although not statistically significant, there is a trend toward reduced duration of ICU stay perhaps reflecting the availability of HDU care on discharge to the referring centre.

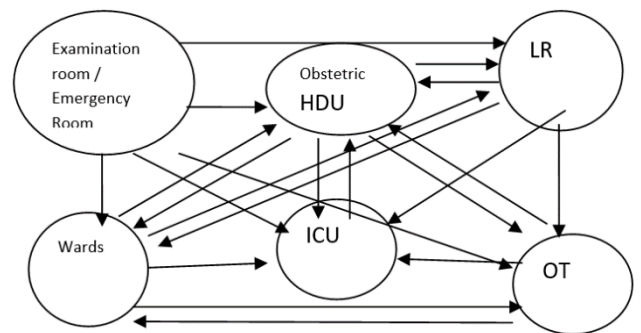
Wheatley *et al.* suggested that early intervention and treatment of the critically ill obstetric patient might prevent serious complications and avoid the need for ICU. In their study, almost 60% of the patients admitted to ICU could have been managed appropriately within the HDU setting. Study concluded that a population of critically ill obstetric patients can be managed successfully in an obstetric HDU with the advantage of concurrent expert obstetric and critical care management.

In another study conducted at Liverpool Women's NHS Foundation Trust, Liverpool, UK. In England, the Critical Care Minimum Data Set (CCMDS) was used to assess critical care activity. 4608 women were delivered and 239 (5.18%) were admitted to the HDU. Average length of stay was 1.97 days.

Obstetric HDU - Obstetric ICU and Triaging policy:

Safe Maternity is viewed as a basic human right worldwide. There is an agreement about the need for intensive care facilities for high risk and critically ill obstetric patients. In UK, nearly 30% hospitals are having HDU facility. All the referral Hospitals should have Obstetric HDU and all the District referral hospitals and Medical Colleges should have both Obstetric HDU and Obstetric ICU, if prerequisite are fulfilled for it's establishment. It is recommended that all pregnancies with complications may be managed in Obstetric HDU/ Obstetric ICU after initial examination in Triage area. Patients may be transferred directly to Obstetric HDU/ICU from an emergency department if required, or from a ward if they rapidly deteriorate, or immediately after surgery if the surgery is very invasive and the patient is at high risk of complications.

Obstetrician will take decision depending on the clinical condition and severity of illness, whom to admit in obstetric HDU/ICU or who will require routine care / delivery. During examination, a quick initial assessment is required to decide if she is an emergency or complicated case.



Obstetric Patient with following conditions / diagnosis may require admission in Obstetric HDU:

- a. Hemodynamic instability
- b. Respiratory dysfunction,
- c. Neurologic complications.
- d. Acute kidney injury
- e. Haematological complications

Patient with following parameters require admission in Obstetric HDU/ICU:

Obstetric HDU	Obstetric ICU
<ul style="list-style-type: none"> ✓ Systolic Blood Pressure <90 or >160 mm of Hg ✓ Diastolic Blood Pressure <50 or >110 mm of Hg ✓ Mean Arterial Blood Pressure <60 mm of Hg ✓ Heart Rate < 60 or >110 per minute ✓ Respiratory Rate: > 25 per minute ✓ Urine < 0.5ml /Kg/Hour (< 30 ml per hour) ✓ Any organ dysfunction 	<ul style="list-style-type: none"> ▪ Systolic B.P. < 80 mm Hg, or 30 mm Hg below patient's usual B.P. ▪ Heart rate <50 or >140 beats / minute ▪ RR < 8 or >35 per minute ▪ U/O < 400 ml in 24 hrs, or < 160 ml in 8 hrs and unresponsive to simple routine measures. ▪ GCS < 8 in the context of non-traumatic coma. ▪ Any unarousable patient. ▪ S. sodium <110 or >160 mmol L ▪ S.potassium <2.0 or > 7.0 mmol L ▪ pH < 7.1 or > 7.7 ▪ PaO2 < 6.6 kPa and/or PaCO2 > 8.0 kPa. ▪ SaO2 < 90% on supplemental oxygen. ▪ Need for advanced respiratory support ▪ Inotropic support ▪ DIC ▪ Multi-organ failure ▪ ARDS

SCOPE OF HDU: Following conditions may require admission in Obstetric HDU/ICU

Obstetric Complications	Pregnancy with Medical Complications
<ul style="list-style-type: none"> • Pregnancy / Labor Pain with Severe Anemia (< 7 gm %) and its complications. 	<ul style="list-style-type: none"> ▪ Pregnancy with Gestational Diabetes.
<ul style="list-style-type: none"> ▪ Accidental Hemorrhage- Placental abruption, couvelaire uterus 	<ul style="list-style-type: none"> ▪ Pregnancy with diabetic Ketoacidosis
<ul style="list-style-type: none"> ▪ Post Partum Hemorrhage 	<ul style="list-style-type: none"> ▪ Pregnancy with Cardiac Diseases
<ul style="list-style-type: none"> ▪ Placenta Previa 	<ul style="list-style-type: none"> ▪ Pregnancy with Jaundice
<ul style="list-style-type: none"> ▪ Adherent Placenta and other placental abnormalities. 	<ul style="list-style-type: none"> ▪ Pregnancy with Thyrotoxicosis
<ul style="list-style-type: none"> ▪ Obstetric hysterectomy 	<ul style="list-style-type: none"> ▪ Pregnancy with Thyroid storm
<ul style="list-style-type: none"> ▪ Severe Preeclampsia/ Hypertensive crisis 	<ul style="list-style-type: none"> ▪ Pregnancy with Pheochromocytoma
<ul style="list-style-type: none"> ▪ Eclampsia 	<ul style="list-style-type: none"> ▪ Pregnancy with other endocrinal crisis like Addison's disease etc.
<ul style="list-style-type: none"> ▪ Broad ligament hematoma 	<ul style="list-style-type: none"> ▪ Post-operative ARF and other renal problems
<ul style="list-style-type: none"> ▪ HELLP Syndrome 	<ul style="list-style-type: none"> ▪ Leukemia and other hemolytic disorders.

<ul style="list-style-type: none"> ▪ Pregnancy with DIC 	<ul style="list-style-type: none"> ▪ Pregnancy with Dengue
<ul style="list-style-type: none"> ▪ Sepsis & systemic inflammatory response syndrome (SIRS). 	<ul style="list-style-type: none"> ▪ Pregnancy with complications of Malaria
<ul style="list-style-type: none"> ▪ Pregnancy with Thrombophylia. 	<ul style="list-style-type: none"> ▪ Pregnancy with Asthma and other respiratory problems.
<ul style="list-style-type: none"> ▪ Multiple gestation with complications 	<ul style="list-style-type: none"> ▪ PPCM-Postpartum cardiomyopathy
<ul style="list-style-type: none"> ▪ Pregnancy with complications due to uterine anomaly and pathologies 	<ul style="list-style-type: none"> ▪ Pregnancy with appendectomy or any other surgical emergency
<ul style="list-style-type: none"> ▪ Hydatidiform Mole 	<ul style="list-style-type: none"> ▪ Pregnancy with OHSS. (Ovarian Hyperstimulation syndrome)
<ul style="list-style-type: none"> ▪ Ruptured Ectopic 	<ul style="list-style-type: none"> ▪ Pregnancy with Acute Pancreatitis
<ul style="list-style-type: none"> ▪ Burns during pregnancy 	<ul style="list-style-type: none"> ▪ Pregnancy with Trauma
<ul style="list-style-type: none"> ▪ Perforation during abortion 	<ul style="list-style-type: none"> ▪ Pregnancy with Poisoning
<ul style="list-style-type: none"> ▪ Postoperative patients requiring hemodynamic monitoring, or intensive nursing care 	<ul style="list-style-type: none"> ▪ Pregnancy with Cancer
<ul style="list-style-type: none"> ▪ Pulmonary edema due to peri-operative fluid overload, CCF, complication of severe pre-eclampsia or tocolytic therapy with β-agonists etc. 	

Many other such conditions when obstetrician decides that it is appropriate to admit the patient in Obstetric HDU/ ICU.

Isolation: Pregnancy with H1NI, Pyometra, HIV and infectious diseases should be admitted in Isolation Room in Obstetric HDU/ ICU.

Setting Up of HDU: Obstetric HDU should be a special part of an Obstetric unit. It should be near ICU and LR/OT. There should be at least one fully equipped obstetric theatre within the delivery suite. Where this is not possible, a lift, for the rapid transfer of women to theatre must be available. It should have nearby facility of Blood bank, fully equipped laboratory, radiology department and nearby NICU care. There should be provision for Emergency exit point in case of disasters.

PERSONNEL-STAFFING

Obstetrician leads the Obstetric HDU/ICU. He/she will decide when to call and whom to call from the list of multidisciplinary teams whenever is required, for management of the obstetric patient.

Obstetric HDU working team consists of Incharge-Experienced/Trained Full Time Obstetrician, EmoC/Medical Officers round the clock, Obstetric nursing staff (24x7)

nursing staff to patient ratio should be 1:2. Obstetric Anesthetists, Physician, Neonatologists, Surgeon, Radiologist's services should be made as an assured service. It is ideal to have back up support of these specialists and super specialists on call, if and when required.

For Obstetric ICU working team consists of Experienced/Trained Full Time Obstetricians, Obstetric Anesthetist, EmoC/Medical Officers round the clock. Obstetric support staff (24x7) nursing staff to patient ratio should be 1:1. All staff should be adequately trained in recovery care and cardiopulmonary resuscitation.

Services of Critical Care specialist or physician, neonatologist, surgeon, nephrologist, cardiologist, and radiologist should be assured on call. There should be back up support of other specialists and super specialists on call, if and when is required like Hematologist, Neurologist. Endocrinologist, Pulmonologist, Vascular Surgeon etc.

Monitoring & Management at HDU:

History - record the date, time and reason for requesting this level of care, name of clinician contacted, a summary of the current problems, review of the patient's observations and finding on clinical examination and a plan for ongoing care. Future review should be completely

documented

Immediately Initial assessment and resuscitation should be done.

Maternal observation: Temperature, Blood pressure, Heart rate, Respiratory rate, Transcutaneous oxygen saturation, Hourly Urine output should be recorded at least hourly in the acute phase of the illness.

Following Management is done as per case requirement:

Management: It includes initial assessment of the condition and resuscitation of the patient whenever required. Maternal organ function monitoring of cardiovascular, renal, pulmonary, hepatic, cerebral is done. Baseline and specific investigations as indicated are advised. Primary conditions like severe preeclampsia, hemorrhage, sepsis etc are treated. Anti-convulsant therapy is given, whenever is required. Inj. MgSO₄ is given as per protocol for Eclampsia patient. Fluid balance and electrolytes correction is taken care. Foetal condition is checked by CTG. Fluid therapy in the form of Crystalloid /Colloid/Blood is given. Utero-placental oxygen delivery is maintained. Left lateral position is given, if required. Oxygen via face mask, if required. Noninvasive and invasive Monitoring like B.P., RR, H.R., Pulse, SPO₂, ABP, CVP, ABG's, hourly UOP, lungs functions and others is done. Broad spectrum antibiotics are given for sepsis if requires to cover Gram negatives & anaerobes after discussion with microbiologist. Proper care for nutrition is taken. Enteral and parenteral nutrition is given. If required, inotropes are given. Pain management is done. Appropriate clinicians from relevant specialties are involved. Final Management is individualized and depends on the underlying clinical Condition.

Watch for other parameters mentioned earlier for admission in ICU. Approximately 2-3% of patients admitted to the obstetric HDU will require transfer to ICU. Portable monitoring with facility for invasive monitoring must be available to facilitate transfer of obstetric patients to the ICU.

Care for Foetus in Obstetric HDU/ICU:

Generally, fetal morbidity and mortality reflect maternal condition closely. Simple measures

such as avoidance of supine hypotension and oxygen via face-mask can improve uteroplacental oxygen delivery. Fetal condition should be observed by continuous electronic fetal heart monitoring. Corticosteroids should be given If < 34 weeks. Labor & Delivery is planned as per maternal indication or fetal indication. When required, delivery of a baby is considered.

Guidelines and Protocols to be followed

As HDU care involves management of critically ill obstetric patients, guidelines and protocols should be in place to encourage appropriate responses to these critical situations and justify actions that are sufficient and efficient, neither excessive nor deficient.

Discharge from Obstetric HDU to Ward:

Decision of discharging of a patient from Obstetric HDU is taken when a patient's physiologic status has been stabilized, patient is hemodynamically stable and the need for intensive monitoring is no longer necessary. When there is no active bleeding, no further continuous intravenous medication or frequent blood tests required, no invasive monitoring is required, no supplementary oxygen is required and patient is ambulatory, then the patient is discharged from obstetric HDU/ICU and transferred to a ward. When transferring a woman from HDU to the ward, a personal and detailed handover of care should be given. Average time in HDU is usually 24-72 hours. Patient should be discharge with full written document.

Indications of transfer from HDU to ICU:

When patient needs for advanced respiratory support, further inotropic support is required, pt develops DIC, Multi-organ failure, Adult respiratory distress syndrome and she is transferred to ICU for further care and support.

Transfer to ICU: When RR is outside the range 7 to 35 breaths / minute, Pulse is outside the range 40 to 140 beats / minute, B.P. < 80 mm Hg, or 30 mm Hg below patient's usual B.P., U/O < 400 ml in 24 hrs, or < 160 ml in 8 hrs and unresponsive to simple measures , GCS < 8 in the context of non-traumatic coma, any unarousable patient, S. sodium outside the range 110 to 160 mmol L, S. potassium outside the

range 2.0 to 7.0 mmol L, pH outside the range 7.1 to 7.7, PaO₂ < 6.6 kPa and or PaCO₂ more than 8.0 kPa, SaO₂ < 90% on supplemental oxygen.

Conclusion: The majority of women during their pregnancy, labor and postnatal period require routine obstetric care. A small but significant number, however, require critical care related to the pregnancy itself, aggravation of a preexisting illness or complications of the delivery. Any pregnant woman can develop life threatening complications with little or no advance warning which can lead to physical, social, economic and psychological consequences of complications. All such women need access to immediate maternal quality health services that can detect and manage life threatening complications.

HDU provides a level of care in between general ward and ICU set up. Women not requiring ventilator support can be managed in HDU, reducing the burden of ICUs. Treatment cost reduces, and above all it requires less expenditure to establish and manage HDU. A dedicated obstetric HDU with the knowledge, familiarity, experience and expertise of a senior obstetrician and a specialist team would be the best place to monitor and treat the critically ill obstetric pts. It allows continuity of antenatal, intra-partum and postnatal care can be provided by the same team. Delivery of the baby takes place in a more familiar and better-equipped environment with minimal disruption of mother-to-baby bonding. Care in an obstetric HDU may avoid exposure of the critically ill pregnant mother to a potentially hazardous ICU environment with the risk of hospital-acquired

infection. Patient satisfaction may be increased since it has more liberal family visitation policies. When patient needs for advanced respiratory support, inotropic support or when patient develops DIC, Multi-organ failure, adult respiratory distress syndrome, she is transferred to obstetric ICU for further care and management. Obstetric patients with High risk pregnancy and critical ill patients can be managed better in Obstetric HDU/ICU which is not possible in routine ward which will ultimately reduce MMR and morbidity.

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