Whether Eclampsia Requires Care in the ICU? : An Article

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Abstract
Pregnant women are at risk to develop complications due to illness related to pregnancy or due to aggravation of preexisting disease. The physiologic change of pregnancy, which can either be exaggerated in disease states (e.g. pre-eclampsia or postpartum hemorrhage), or women with underling medical conditions (such as cardiac or renal disease), increase the risk of woman dying during pregnancy or postpartum. Obstetric disorders are responsible for 50% to 75% of ICU admissions with mayor causes are preeclampsia-eclampsia, obstetric hemorrhage, and pelvic sepsis accounting 80% of obstetric ICU admissions. A multidisciplinary team including intensivist, obstetrician, maternal-fetal medicine specialist, anesthesiologist, neonatologist, nursing specialist is a key to optimize outcomes.

Keywords: eclampsia, intensive care unit

Preface
Pregnant women are at risk to develop complications due to illness related to pregnancy or due to aggravation of pre existing disease. Obstetric patients are generally young, fit, and good in physical shape, yet the potential for catastrophic complications is real. Regardless of therapeutic advances of the last century, maternal morbidity and mortality continue to occur. The physiologic change of pregnancy, which can either be exaggerated in disease states (e.g. pre-eclampsia or postpartum hemorrhage), or women with underling medical conditions (such as cardiac or renal disease), increase the risk of woman dying during pregnancy or postpartum. The changes present an exclusive challenge, to the obstetric team, when these patients develop complications and need intensive care.1

In developed countries, the rate of obstetric ICU admissions (admission during pregnancy or the postpartum period) is between 0,5 and 4 per 1000 deliveries and the overall case fatality rate is about 2%. The rate of obstetric ICU admissions reported in population-based studies is between 0,5 (Canada) and 15,5 (New Jersey) for 1000 deliveries. The average age of women admitted into ICU was comprised between 28 and 32 years, with nearly a quarter of women aged over 35 years. Most women were admitted in ICU units during the postpartum period (70 to 85%) and after a caesarean delivery (50% to 70% of cases) for an average stay of 2 days.2,3

Obstetric admissions to the intensive care unit (ICU) and maternal mortality continue to have a significant impact on maternal health care, despite the low rate of such admissions in developed countries. Unlike others, obstetric patient pose a major management challenge to ICU physicians and obstetricians due to altered physiology during pregnancy, consideration of fetal wellbeing, and the unique type of disorders to be dealt with.1
Methods

Article Review

Result and Discussion

Physiological Change in Pregnancy

Maternal cardiovascular changes start in the first trimester, peak at the end of the second trimester, and then plateau until delivery. Cardiac output increases by 30% to 50% from 8 to 28 weeks gestation and can worsen underlying cardiac conditions such as mitral stenosis. After the first trimester, supine positioning may decrease cardiac output and cause symptomatic hypotension due to decreased venous return from aorta compression. Therefore, pregnant patients in a supine position (on an operating room table or ICU bed) should be tilted 15° to 20° degrees to either side by using a pelvic tilt wedge, to displace the uterus laterally.

Plasma volume increases dramatically and is 50% higher by term. Red cell mass increases less, resulting in "physiologic anemia." One putative benefit of this is that decreased blood viscosity prevents excessive thromboembolic events by compensating for the hypercoagulable state resulting from an increase in coagulation factors. Another potential benefit is the ability to tolerate 500- to 1,000-mL blood loss during delivery without significant consequence. Patients with preeclampsia have significant intravascular hypovolemia and are more susceptible to the hemodynamic effects of obstetric hemorrhage. In addition, hemoconcentration in preeclampsia increases the risk of placental and other thromboembolic events. Arterial BP initially decreases, reaching its nadir at 28 weeks, gradually increasing to normal at term. Progesterone-mediated increase in tidal volume results in increased minute volume, decreased PaCO2, and respiratory alkalosis. Elevation of the diaphragm by the gravid uterus and hormonally induced changes in the shape of the chest wall reduce functional residual capacity, residual volume, and expiratory reserve volume. Glomerular filtration rate increases by 50%, resulting in a low serum creatinine (< 0.8 mg/dL). Renal insufficiency in pregnancy is defined by a serum creatinine > 1 mg/dL; adrenal excreted drugs should be dosed accordingly. Delayed gastric emptying and a relaxed esophageal sphincter increase the risk of aspiration during endotracheal intubation, seizures, and altered mental status. Adaptive alteration of the helper T cell immune response in pregnancy to T helper 2 type occurs to facilitate "immunetolerance" of the fetus; this could however, increase risk of some infections in pregnancy.4

During labor, cardiac output increases by 15% to 20% because of autotransfusion of 300 to 500 mL during each uterine contraction; blood volume increases by 500 mL after delivery of the placenta. Neonatal anesthesia with resultant sympathetic blockade may partially attenuate these changes. Cardiac output is also affected by anxiety, pain, maternal (supine) position, and Valsalva maneuver. The leukocyte count may increase to 15,000/mL and, rarely, as high as 25,000/mL. Gastric emptying is further delayed during labor. Diaphragmatic fatigue may sometimes occur following straining during prolonged labor.2,4

Causes of Critical Illness in Pregnancy

Obstetric patients require ICU admission for organ dysfunction caused by obstetric or medical disorders or both. In obstetric literature, these disorders are classified as direct causes of maternal morbidity or mortality if they result from obstetric complications (obstetric hemorrhage, hypertensive disorders of pregnancy, amniotic fluid embolism, fatty
liver of pregnancy, and surgical or anesthetic complications of cesarean section). Indirect causes include medical disorders not directly attributable to the pregnant state. Obstetric disorders are responsible for 50% to 75% of ICU admissions, with preeclampsia-eclampsia, obstetric hemorrhage, and pelvic sepsis accounting for 80% of obstetric ICU admissions across all geographic regions.\textsuperscript{4,5}

In contrast, medical disorders show wide geographic variation. Bronchial asthma, community acquired pneumonia, complex urinary tract infections, pulmonary thromboembolism, collagen vascular disorders, trauma, and drug abuse are common in developed countries, whereas viral hepatitis, military TB, parasitic infections, rheumatic heart disease and suicidal poisoning are common in tropical countries. Approximately 12% to 45% of ICU admissions are during the antepartum period, 50% are during labor or the first 24 h after delivery, and 10% to 15% are later in the postpartum period. Correspondingly, 25% of maternal deaths occur antepartum, 26% intrapartum, and 49% postpartum.\textsuperscript{4}

A Five-Step Approach to Critical Care in Pregnancy

We recommend a five-step systematic approach for the management of an obstetric patient in the ICU.

**Step 1: Is This a Medical or Obstetric Disorder?**

Manifestations of medical disorders closely mimic obstetric conditions. For example, preeclampsia, thrombotic thrombocytopenic purpura (TTP), and systemic lupus erythematosus may all present with hypertension, proteinuria, rising creatinine level, thrombocytopenia, and seizures. Similarly, acute viral hepatitis closely mimics acute fatty liver of pregnancy. The distinction is important because specific treatment is available for most medical disorders, whereas treatment options are limited for obstetric disorders. Prompt delivery reverses the progression of many obstetric disorders but may not alter the course of medical disorders.

**Step 2: Is There Multiple Organ System Failure?**

Multiple organ failure is common in obstetric and medical disorders; renal failure and coagulopathy in pregnancy deserve special mention. Acute renal failure is common because of altered systemic and renal hemodynamics in pregnancy. Although acute tubular necrosis is the usual underlying pathology in non-obstetric patients, 7% to 20% of obstetric renal failure is due to acute cortical necrosis. This form of severe ischemic renal damage occurs when shock is accompanied by microvascular thrombosis due to disseminated intravascular coagulation (DIC). Women with acute cortical necrosis have anuria (<100 mL urine/d) rather than oliguria and may be left with significant residual renal dysfunction requiring chronic dialysis. Thrombocytopenia and DIC are present in many obstetric disorders, and all pregnant patients in the ICU should routinely undergo DIC screen; thromboelastography is used in some centers.\textsuperscript{5}

**Step 3: Is there a Risk to the Mother and Fetus if Pregnancy is continued?**

Many obstetric disorders improve rapidly after delivery, and urgent delivery may be life saving. At times, urgent delivery is required for fetal distress, and sometimes the time required to stabilize maternal organ function may further compromise fetal outcome. The maternal risk from urgent delivery should be balanced against the risk to the fetus by delaying delivery. As a general principle, maternal well-being always takes precedence over that of the fetus. Occasionally, in complex situations like maternal brain death or terminal illness, the fetal condition assumes greater importance. Another situation involves the peri-viable period (22 to 24 weeks of gestation), when termination of pregnancy may
benefit the mother but neonatal outcomes are extremely poor. In such circumstances the
counsel of a medicalethicist should be sought.5

Step 4: Early Delivery—Vaginal or Cesarean Section, General or Neuraxial Anesthesia?
The mode of delivery (vaginal vs cesarean section) isbest determined by the indication for
delivery and thematernal clinical status. Vaginal delivery may not befeasible in most
emergency indications, as the durationof labor is unpredictable. Consequently, 70% of
critically ill patients in the ICU are delivered by cesarean section. Elective cesarean section is
normally performed underregional anesthesia, given the increased risk of complications
withgeneralanesthesia. However, in patients with shock, respiratory distress, seizures, andcoagulopathy, the risk of hypotension and local hematoma
with neuraxial anesthesia are significant. General anesthesia may, therefore, be preferred in
these women despite the high rate of intubation failure, crowded upper airways, and risk of
aspiration of gastric contents. Coordination between the intensivist, obstetrician,
anesthesiologist, and neonatologist is vital in this situation.5

Step 5: What Needs to Be Done to Optimize thePatient for Delivery?
The next step is to correct physiologic derangements and minimize any complications during
delivery. Twodoses of betamethasone (12 mg administered IM or IV, 12-24 h apart)
facilitate fetal lung maturation in deliveries between24 and 34 weeks. Hypotension
and hypovolemia should be corrected. Endotracheal intubation may be required for airway
protection, mechanical ventilation, or both. Seizures and severe hypertension must be
controlled. Anticoagulants are discontinued and appropriate blood products administered to
correct anemia, thrombocytopenia, and coagulation abnormalities. Serum fibrinogen level
≥100mg/Dl and platelet count >50,000/mL should be maintained; platelet
tcount >80,000/mL is required if neuraxial anesthesia is planned. The timing of
administration of blood products is critical in vaginal delivery, since labor may last for
several hours. Platelet transfusion, heparin, and desmopressin should be avoided if TTP is
suspected.5

Eclampsia

Eclampsia is defined as the development of convulsions and/orunexplained coma during
pregnancy or postpartum in patients with signs and symptoms of preeclampsia. In the
Western world, the reported incidence of eclampsia ranges from 1 in 2,000 to 1 in 3,448
pregnancies. The reported incidence is usually higher in tertiary referral centers, in
multifetal gestation, and in populations with no prenatal care.6

The pathogenesis of eclamptic convulsions continues to bethe subject of extensive
investigation and speculation. Several theories and etiologic mechanisms have been
implicatedas possible etiologic factors, but none of these have been conclusively proven.
Some of the etiologic mechanisms that are implicated in the pathogenesis of eclamptic convulsions have included cerebral vasoconstriction or vasospasmhypertensive encephalopathy, cerebral edema orinfarction, cerebral hemorrhage, and metabolic encephalo-
pathy. However, it is not clear whether these findings are causes or an effects of
the convulsions.6

The diagnosis of eclampsia is secure in the presence of generalized edema, hypertension,
proteinuria, and convulsions. However, women in whom eclampsia developexhibit a wide
spectrum of signs, ranging from severehypertension, severe proteinuria, and generalized
edema to absent or minimal hypertension, no proteinuria, and no edema. Hypertension is
considered the hallmark for the diagnosis of eclampsia. The hypertension can be severe (at
least 160 mm Hg systolic and/or at least 110 mm Hg diastolic) in 20–54% of cases or mild (systolic blood pressure between 140 and 160 mm Hg or diastolic blood pressure between 90 and 110 mm Hg) in 30–60% of cases. However, in 16% of the cases, hypertension may be absent. In addition, severe hypertension is more common in patients who develop antepartum eclampsia (58%) and in those who develop eclampsia at 32 weeks of gestation or earlier (71%). Moreover, hypertension is absent in only 10% of women who develop eclampsia after 32 weeks of gestation.\textsuperscript{6,7}

The diagnosis of eclampsia is usually associated with proteinuria (at least 1+ on dipstick). In a series of 399 women with eclampsia studied by the author, substantial proteinuria (≥3+ on dipstick) was present in only 48% of the cases, whereas proteinuria was absent in 14% of the cases. Abnormal weight gain (with or without clinical edema) in excess of 2 pounds per week during the third trimester might be the first sign before the onset of eclampsia, but edema was absent in 26% of 399 eclamptic women studied by the author. Several clinical symptoms are potentially helpful in establishing the diagnosis of eclampsia. These symptoms may occur before or after the onset of convulsions, and they include persistent occipital or frontal headaches, blurred vision, photophobia, epigastric and/or right upper-quadrant pain, and altered mental status. Patients will have at least one of these symptoms in 59–75% of the cases. Headaches are reported by 50–75% of the patients, whereas visual changes are reported in 19–32% of the patients.\textsuperscript{6}

The first priority in the management of eclampsia is to prevent maternal injury and to support respiratory and cardiovascular functions. During or immediately after the acute convulsive episode, supportive care should be given to prevent serious maternal injury and aspiration, assess and establish airway potency, and insure maternal oxygenation. During this time, the bed’s side rails should be elevated and padded, a padded tongue blade is inserted between the teeth (avoid inducing gag reflex), and physical restraints may be needed. To minimize the risk of aspiration, the patient should lie in lateral decubitus position, and vomitus and oral secretion are suctioned as needed. During the convulsive episode, hypoventilation and respiratory acidosis often occur. Although the initial seizure lasts only a few minutes, it is important to maintain oxygenation by supplemental oxygen administration via a face mask with or without oxygen reservoir at 8–10 L/min.\textsuperscript{7}

After the convulsion has ceased, the patient begins to breathe again and oxygenation is rarely a problem. However, maternal hypoxemia and acidosis may develop in women who have had repetitive convulsions and in those with aspiration pneumonia, pulmonary edema, or a combination of these factors. It is my policy to use transcutaneous pulse oximetry to monitor oxygenation in all eclamptic patients. Arterial blood gas analysis is required if the pulse oximetry results are abnormal (oxygen saturation at or below 92%). The next step in the management of eclampsia is to prevent recurrent convulsions. Magnesium sulfate is the drug of choice to treat and prevent subsequent convulsions in women with eclampsia. My policy is to give a loading dose of 6 g over 15–20 minutes, followed by a maintenance dose of 2 g/h as a continuous intravenous infusion. Serum magnesium levels are not monitored during the infusion because there is no established serum magnesium level that is considered “therapeutic.” Serum magnesium levels require monitoring in the presence of renal dysfunction and/or when there are absent reflexes. Approximately 10% of eclamptic women will have a second convulsion after receiving magnesium sulfate. In these women, another bolus of 2 g magnesium sulfate can be given intravenously over 3–5 minutes. An occasional patient will have recurrent convulsions while receiving adequate doses of magnesium sulfate. In this patient, recurrent seizures can be treated with sodium amobarbital, 250 mg intravenously over 3–5 minutes.\textsuperscript{6,7}
The next step in the management of eclampsia is to reduce the blood pressure to a safe range but at the same time avoid significant hypotension. The objective of treating severe hypertension is to avoid loss of cerebral autoregulation and to prevent congestive heart failure without compromising cerebral perfusion or jeopardizing uteroplacental blood flow that is already reduced in many women with eclampsia. My policy is to keep systolic blood pressure between 140 and 160 mmHg and diastolic blood pressure between 90 and 110 mm Hg. The rationale for keeping maternal blood pressures at these levels is to avoid potential reduction in either uteroplacental blood flow or cerebral perfusion pressure. This can be achieved with bolus of 5–10 mg doses of hydralazine or labetalol (20–40 mg intravenously) every 15 minutes, as needed, or 10–20 mg of nifedipine orally every 30 minutes for a maximum dose of 50 mg in one hour. Other potent antihypertensive medications such as sodium nitroprusside or nitroglycerine are rarely needed in eclampsia. Diuretics are not used except in the presence of pulmonary edema.

Maternal hypoxemia and hypercarbia cause fetal heart rate and uterine activity changes during and immediately following a convulsion. Fetal heart rate changes can include bradycardia, transient late decelerations, decreased beat-to-beat variability, and compensatory tachycardia. Changes in uterine activity can include increased frequency and tone. These changes usually resolve spontaneously within 3–10 minutes after the termination of convulsions and the correction of maternal hypoxemia. The patient should not be rushed for an emergency cesarean delivery based on these findings, especially if the maternal condition is not stable. It is considered to be advantageous to the fetus to allow in utero recovery from hypoxia and hypercarbia due to maternal convulsions. However, if the bradycardia and/or recurrent late decelerations persist beyond 10–15 minutes despite all resuscitative efforts, then a diagnosis of abruption placentae or nonreassuring fetal status should be considered.

The presence of eclampsia is not an indication for cesarean delivery. The decision to perform cesarean delivery should be based on fetal gestational age, fetal condition, presence of labor, and cervical Bishop score. My policy is to recommend cesarean delivery for those with eclampsia before 30 weeks of gestation who are not in labor and whose Bishop score is below 5. Patients having labor or rupture of membranes are allowed to deliver vaginally in the absence of obstetric complications. When labor is indicated, it is initiated with either oxytocin infusions or prostaglandin insin all patients with a gestational age of 30 weeks or more, irrespective of the Bishop score. A similar approach is used for those before 30 weeks of gestation if the cervical Bishop score is at least 5.

Maternal pain relief during labor and delivery can be provided by either systemic opioids or epidural anesthetics recommended for women with severe preeclampsia. Either epidural, spinal, or combined techniques of regional anesthesia can be used for cesarean delivery. Regional anesthesia is contraindicated in the presence of coagulopathy or severe thrombocytopenia (platelet count less than 50,000/mm3). In women with eclampsia, general anesthesia increases the risk of aspiration and failed intubation due to airway edema and is associated with marked increases in systemic and cerebral pressures during intubation and extubation. Women with airway or laryngeal edema may require awake intubation under fiberoptic observation with the availability of immediate tracheostomy. Changes in systemic or cerebral pressures may be attenuated by pretreatment with labetalol or nitroglycerine injections.
Characteristics and rationale of critically ill obstetric patients transferred to ICU

There are several causes of maternal mortality are estimated to be responsible for 75-80% of maternal deaths like eclampsia, high blood pressure, postpartum hemorrhage (PPH), infection/sepsis, unsafe abortion and prolong/obstructed labour. Eclampsia is one of the most common maternal complication due to raises of the blood pressure among pregnancy. These major direct causes mainly haemorrhage, and hypertensive disorders are also the leading causes of near-miss events. Due to these near-miss events, the patients are labeled as critically ill and require intensive care. Transferring these critically ill patients to Intensive care units (ICUs) is the current practice in all healthcare hospitals where this facility is available. Being situated in a remote area, our tertiary care hospital did not have this facility until recently. It should be evaluated the clinical and demographic characteristic as well as rationale for transfer of critically ill obstetric patient to ICU.

In Zainoel Abidin General Hospital there are 4 cases of eclampsia among 2016. The number of admission in ICU of this just one cases.

Yousuf et al shows that eclampsia is one of the leading cause of ICU admissions with 43.33% similar with other study, hypertensive disorders of pregnancy were the main maternal obstetric conditions responsible for 50% cases. Also in studies from Turkey, Netherlands, USA, and UK it has been shown that the most common acute condition that resulted in transfer to the ICU was eclampsia/ preeclampsia/ hypertensive disorders.

In the earlier study the mean stay in ICU was 4.47±2.53 days which is comparable to other study in which average ICU stay was 4.61 days, and to another in which the mean ICU stay was 3.7±4.6 days. However in one study the mean durations of stay in ICU was 7±5 days. In other study, the frequency of admission was 2.6 per 1000 deliveries and obstetric patients represented 2.4% of all ICU admissions. Admission was planned in 11 patients(18%) and unplanned in 49 (82%). The mean (SD) duration of stay in ICU was 1.6±1.5 days.

The need of ventilator support become one of rationale reason for ICU admissions. Yousuf et al has been shown that 25.3% patients required ventilator support, whereas 74.7% were managed with oxygen and inotropic support in the present study. This is consistent with a study in which ventilator support was required in 30% patients. In another study ventilator was required in 40.5% cases.

Maternal mortality rate in our study was 27.3%, which is comparable to other studies. In a study from India, however, it was on lower side at 21.6%, whereas in other local studies it was bit higher. Hence, it is apparent from this study that mortality in obstetric ICU patients managed by ventilator support can be fairly high. Maternal mortality was high among patients treated on ventilator support which needs further evaluation.

Eclampsia and the need of ICU admission

Maternal mortality rate is used to evaluate the quality of maternal care. Maternal death has become an extremely rare event in developed countries, with rates between 5–10 per 100,000 maternities, which has weakened its value as a quality-assurance indicator for maternity care. Since the criteria for major morbidity differ among institutions, the need to transfer to the intensive care unit (ICU) is used as an indicator of illness severity.

The acute physiology and chronic health evaluation (APACHE II) score are used to determine the degree of severity of illness and assess risk of mortality. Mirghani et al conducted a
A retrospective review of obstetric patients admitted to the intensive care unit. After reviewing all 60 patients’ records and ICU sheets, only 28 patients (46.7%) were thought to have illness that was sufficiently severe to necessitate ICU admission, while the remaining 32 patients (53.3%) were thought to be suitable for HDU care. The frequency of admission would have dropped from 2.6 to 1.2 per 1000 deliveries, and the ICU obstetric utilization rate from 2.4% to 1.1%. However, the maternal death rate of ICU obstetric admissions would rise from 3.3% to 7.1%. The mean APACHE II score for the 28 patients thought to merit ICU admission was 6.4±3.1 and mean stay 2.3±2.1 days compared to a mean APACHE II score of 3.9±2.4 and a mean stay of 1.0±1.0 days for those thought suitable for HDU care.

The relatively high ICU admission rate in our review might be due to the lack of a high dependency unit, where patients not suitable for forward observation were transferred to the ICU. The short ICU stay, with 60% of the patients observed in the ICU for 48 h or less, suggests that most of these patients did not have major morbidity. This might explain the lower mean APACHE II score (5.0±3.0) and a relative low ICU mortality rate of 3.3% compared with other published series from developed countries, which report an mortality rate as high as 4.5%.

For the conclusion that hypertensive related complications and haemorrhage are the leading causes for admission of obstetric patients to the ICU. Most of our obstetric patients admitted to the ICU would have been suitable for an intermediate care facility. The availability of high dependency care could reduce unnecessary admission to the ICU.

References