

Intensive Care in Obstetric Cases: a plan for tackling maternal mortality

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ABSTRACT

The sharp increase in maternal morbidity and mortality in the United States is partly due to a progressively medically intricate obstetrical demographic. Approximately 1% to 3% of all Obstetrical patients need specialized care, necessitating prompt delivery and accessibility of essential care necessity. The changing environment in obstetrical severity creates a strain on obstetrical care providers, numerous of whom possess restricted experience in recognizing and addressing severe health conditions. The definitions of maternal care levels established by the American College of Obstetricians and Gynecologists and the Society of Maternal-Fetal Medicine assign hospitals according to the availability of maternity resources and emphasize the demand for specialized care resources and knowledge. The increasing demand for essential care abilities in the changing modern obstetrical environment presents a chance to the idea of providing care for high-risk obstetric patients. We outlined the main points. Principles in the avoidance of maternal morbidity and mortality, comprising the implementation of evidence-based instruments for risk classification and prompt referral of patients to centres with suitable resources; creative methods for hospitals to offer essential care consultations during labor and delivery; and education for obstetrical providers in high-impact critical care abilities, like bedside ultrasound. These essential interventions centered on critical care are vital in managing a progressively intricate obstetrical patient demographic while establishing an educational base for the preparation of upcoming obstetric practitioners.

Key Words: intensive care, maternal intensive care, obstetric comorbidity index, obstetrical, intensive care, bedside ultrasound, assessment instruments

INTRODUCTION

The recent spike in maternal mortality in the United States is partly due to a growing population of medically complex obstetric cases.^{1,2} Severe maternal morbidity—characterized as unforeseen results of labor and delivery that lead to notable short- or long-term health impacts for women—has surged by 200% from 1993 to 2014.³ Also alarming is the fact that many maternal deaths are preventable. A recent review indicated that 60% of maternal deaths could be avoided, underscoring the importance of clinical awareness, proper assessment, prompt diagnosis, and early intervention for high-risk obstetrical patients.¹ Critical care professionals focus on the medical treatment and observation of patients who are susceptible to end-organ dysfunction.⁴ It is estimated that 1% to 3% of all obstetrical patients need care at the intensive care unit (ICU) level, making the provision and accessibility of critical care essential.⁵ The American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine (SMFM) define levels of maternal care, categorizing hospitals according to the availability of obstetrical resources and stressing the necessity for critical care resources and expertise in this context.⁶ Almost a decade ago, D’Alton et al published a pivotal article⁷ that initiated a “shift” in our understanding and management of high-risk obstetrical patients. This article highlights that providing critical care education for maternal-fetal medicine (MFM) specialists and standardizing the management of

critically ill patients, including those with cardiac conditions, are essential strategies to address maternal morbidity and mortality.

This appeal has been embraced with excitement among MFM, yet the rising demand for critical care expertise and resources, along with the shortage of MFM specialists in certain areas, presents a chance to reimagine the delivery of critical care for high-risk obstetric patients for all obstetric trainees and personnel.^{8,9} We highlight the necessity for critical care services in labor and delivery while proposing a practical solution for a progressively intricate obstetric population. We emphasize the significance of employing evidence-based tools for assessing risk and swiftly diagnosing cardiopulmonary issues, creating a

framework for hospitals to deliver essential care consultations during labor and delivery while offering an educational base for students, residents, staff, and other obstetrical practitioners addressing high-risk cases. Screening Instruments for High-Risk Patients The development of “scoring instruments” for the prompt recognition of obstetrical patients susceptible to clinical decompensation has been recognized as a crucial approach by top experts in tackling maternal morbidity and mortality.¹⁰ In 2014, the National Partnership for Maternal Safety advocated for the implementation of evidence-based screening instruments, like the Modified Early Warning System (MEWS), to predict clinical deterioration in obstetrical care.

Obstetric Comorbidity Index Score

Patient Sticker Here

Maternal Condition	Points	Comments
Preeclampsia with Severe Features* or Eclampsia	5	
Preeclampsia / Gestational / Chronic Hypertension	2	
Congestive Heart Failure	5	
Pulmonary Hypertension	4	
Ischemic Heart Disease / Cardiac Arrhythmia	3	
Congenital Heart and/or Valvular Disease	4	
Multiple Gestation	2	
Intrauterine Fetal Demise	2	
Placenta Previa / Suspected Accreta / Abruptio	4	
Previous Cesarean Delivery / Myomectomy	1	
Autoimmune Disease / Lupus	2	
HIV/AIDS	2	
Sickle Cell Disease / Bleeding Disorder / Coagulopathy / Anticoagulation	3	
Epilepsy / Cerebrovascular Accident / Neuromuscular Disorder	2	
Chronic Renal Disease	1	
Asthma	1	
Diabetes on Insulin	1	
Maternal Age > 44	3	
Maternal Age 40-44	2	
Maternal Age 35-39	1	
Substance Use Disorder	2	
Alcohol Abuse	1	
BMI > 50	3	
BMI > 40	2	
*Severe Features: Systolic BP ≥ 160, diastolic BP ≥ 110, creatinine > 1.1, oliguria (<30 cc/hr), elevated AST or ALT, platelets < 100,000, persistent epigastric pain, headache, or scotomata, placental abruptio.	Total:	MD Notified:

Instructions for Use:

- 1) Circle comorbidities present in your patient and tally score at bottom.
- 2) Does this patient have any other high-risk features you think should be added to the list? _____
- 3) Notify Responding Clinician for patients with OB-CMI score > 6 or with any other concerns.
- 4) Document the OB-CMI score in the nursing handoff template.
- 5) Place completed sheet in locked bin behind desk.

Adapted from Easter et al.¹⁶

ALT, alanine transaminase; AST, aspartate aminotransferase; BMI, body mass index; BP, blood pressure; OB-CMI, obstetric comorbidity index.

Padilla. Critical care in obstetrics. *Am J Obstet Gynecol* 2021.

11 In 2017, the SMFM convened a panel to assess the practical use of MEWS.^{11,12} The panel determined that incorporating these instruments into electronic medical records and establishing an early warning system were vital methods for effectively identifying patients at risk of clinical deterioration.¹¹ While early warning systems may assist in recognizing patients at risk for morbidity, physiological-based screening instruments, such as MEWS, lack the specificity needed to pinpoint obstetrical patients at risk of clinical deterioration. Moreover, physiological alterations during pregnancy and the peripartum phase, including occasional tachycardia and tachypnea, create a distinct challenge in utilizing vital signs for identifying high-risk patients and forecasting clinical decline.

A screening instrument, which has demonstrated potential for forecasting severe illness in obstetric patients, is the sequential organ failure assessment (SOFA) score, a commonly utilized tool in critical care that evaluates end-organ dysfunction. The shift from relying solely on vital sign-based screening tools (MEWS) to employing those with end-organ and comorbidity evaluations (SOFA) represents a significant change in the strategy for detecting critical illness in obstetrics. This change reflects the trend observed in critical care medicine, where screening tools based on vital signs (systemic inflammatory response syndrome) are no longer advised and are being substituted with tools that emphasize end-organ dysfunction (SOFA). The creation of screening tools concentrating on identifying end-organ dysfunction and comorbidities has recently demonstrated potential in predicting clinical deterioration in obstetrical care.

In a prospective study conducted by Easter et al., involving 2828 obstetrical patients, the researchers discovered that a score of "0" correlated with the integration of comorbidity and physiology-driven risk prediction tools, which may enhance sensitivity and specificity in identifying at-risk women, already recognized as a significant avenue for future investigation.

To promote the establishment of risk appropriate maternal healthcare by healthcare

systems, the 2019 obstetrical care consensus on maternal care aims to categorize hospital systems based on the availability of specific services, focusing on critical care resources.

The consensus presents evidence indicating that treating the most critically ill women in higher acuity centers correlates with better outcomes, emphasizing the importance of transferring patients with severe comorbidities to hospitals equipped with the necessary resources and personnel to meet their expected demands.²³ Consequently, managing critical care resources, a key issue in the regionalization of maternal critical care, becomes vital in the event of possible resource shortages. Resource management planning has been a crucial element of healthcare throughout the coronavirus disease 2019 (COVID-19) crisis, as numerous hospitals have faced shortages of ventilators, medications, and blood products during this time.

For certain hospitals with minimal experience with critically ill obstetrical patients, the demand for clinicians skilled in caring for critically ill obstetrical patients became increasingly urgent. Nonetheless, this necessity is not exclusive to the pandemic. A critical care doctor, readily accessible during labor and delivery for high-risk obstetric patients, can offer valuable insights into critical care diagnoses and the shared management of end-organ dysfunction, while also educating the obstetrical team. Relying more on virtual electronic health record monitoring in the US healthcare system, like telemedicine, raises concerns about the effectiveness of this technology for providing essential care in obstetrics.

The intersection of critical care and obstetrics offers thrilling new opportunities for the provision of prompt, focused multidisciplinary care.²⁶ Besides telemedicine-driven critical care approaches, other models for delivering obstetrical critical care have also been suggested before. The "virtual ICU" represents a framework for delivering critical care where a multidisciplinary team offers organized obstetrical ICU-level support in unconventional environments like cardiac care units and neuroICUs.^{27,28} This "virtual ICU" approach integrates specialists and support personnel according to the particular, urgent requirements of the patient.

28 The objective is to customize care for a pregnant patient in critical condition by focusing on prompt detection of complications, thorough antepartum preparation, and effective use of resources. Different methods of providing obstetrical critical care (COSMIC, virtual ICU) can be integrated with current critical care technologies, like point-of-care ultrasound. This

can deliver prompt, actionable insights for obstetric providers in fluid management, particularly in light of recent studies revealing that 67% of patients with late-onset preeclampsia (with severe features) exhibit signs of pulmonary edema, as well as diastolic or systolic dysfunction on transthoracic echocardiography.

Point-of-care ultrasonography is an important instrument for the swift detection of typical obstetrical emergencies like intraabdominal bleeding. The Focused Assessment with

Sonography for Trauma protocol has been confirmed as effective in emergency and trauma environments. The detection of fluid in the abdominal area through an easily accessible ultrasound conserves time that could be wasted while waiting for computed tomography or other imaging outcomes. Intensivists are able to utilize bedside ultrasonography to swiftly evaluate intravascular hemodynamic status with reliable outcomes.



Ultrasonographic findings of pulmonary edema - Smart B-Lines automated B Line quantification on the TE7 ultrasound system

35 Essential Critical Care Skills in Obstetrics In the future, integrating critical care training; skills like point-of-care ultrasound; immediate critical care advisory services; and innovative resource allocation will be essential to meet the needs of an ever more complex parturient demographic. The integration of "specialty" skills into the educational curriculum of obstetrics and gynecology residency programs has been supported in the past. The ongoing crisis in maternal morbidity and mortality presents an opportunity for a fundamental shift in our educational strategy for high-risk obstetrical patients. In line with expert consensus, this can facilitate an "early tracking" of subspecialty care to adapt to the increasingly complex parturient population.

Currently, 38 prominent obstetrical organizations provide postgraduate education in point-of-care ultrasonography to healthcare providers. The SMFM, in collaboration with Banner University Medical Center, has integrated an introduction to critical care ultrasonography, along with other vital skills (airway management, intraosseous line placement) into their yearly Critical Care in Obstetrics course (Video 2).⁴⁰ Point-of-care ultrasound is a well-known instrument for obstetrical practitioners with new and impactful uses when assessing maternal anatomy linked to frequently diagnosed pregnancy conditions (preeclampsia). We acknowledged the necessity to create standardized, validated educational programs for obstetrics, gynecology,

and MFM trainees as well as for practicing obstetricians in point-of-care ultrasonography. Advancing a Maternal Critical Care Model A necessary “cultural” shift that enhances the speed and precision of our response to and management of critical illness during pregnancy is essential to address the challenges of today's obstetrical landscape. This transformation will necessitate a comprehensive strategy and a change in how we perceive obstetrical critical care and training.

o align with the established consensus on maternal care advocating for collaboration between ICUs and obstetrical departments, hospitals can employ multidisciplinary critical care teams for their highest risk obstetrical cases, as outlined by the “virtual ICU” approach, to fulfill the consensus requirements.^{27,28} Given the concerning levels of maternal morbidity and mortality in the U.S., we have arrived at a pivotal moment in our approach to delivering critical care. We need to utilize evidence-based screening tools for obstetrical comorbidities, advocate for the extensive use of on-site critical care resources, incorporate a multidisciplinary team approach, and foster early-career critical care education to enhance care for a more complex parturient population.

Key Aspects Include integrating validated, evidence-based screening instruments for comorbidities, like the OB-CMI, in the antenatal and peripartum context to enhance early identification of patients susceptible to clinical decompensation. Direct obstetrical patients with significant comorbidity to the suitable care level hospitals, as defined by the maternal care consensus criteria. Quickly recognize severe illness by utilizing a multidisciplinary team and on-site critical care consultations (labor and delivery) for patients at risk of clinical deterioration. Incorporate uniform educational channels for essential critical care concepts and abilities, such as point-of-care ultrasonography, equipping all obstetricians with the necessary skills to identify and stabilize a critically ill patient for transfer. Encourage creative strategies to ensure vital care management and assist hospitals lacking on-site critical care resources, as well as regions without level III or IV facilities.

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