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Dyspnea in pregnancy. Can POCUS be the game changer?

Disnea en el embarazo. ¿Puede el POCUS cambiar el paradigma/enfoque diagnóstico?

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Abstract

Dyspnea is a common symptom during pregnancy, but it can present a diagnostic challenge. While it may often be attributed to physiological changes it may also signal serious underlying conditions such as asthma crisis, infection, pulmonary edema (PEd), pulmonary embolism, and amniotic fluid embolism.

Point-of-care ultrasound (POCUS) is a swift and effective bedside modality for assessing acute or critical medical conditions. It can be used as an alternative or alongside traditional formal ultrasound conducted by a radiology-cardiology service. This review explores the role of POCUS in the parturient experiencing shortness of breath, highlighting the potential value of maternal cardiopulmonary POCUS in obstetric anesthesia, facilitating timely treatment and providing immediate differential diagnosis in potentially unstable patients.

As an example, a case is discussed involving a sudden onset of PEd and loss of consciousness in a 48-year-old patient who underwent a category-1 cesarean section under general anesthesia. POCUS identified severely decreased global systolic function and confirmed pulmonary edema through the presence of B-Kerley lines, providing a swift guidance for intraoperative inotropic support and fluid management while excluding other causes of pathological dyspnea in pregnancy.

Key words

Obstetric anesthesia; Dyspnea; High-risk pregnancy; Peripartum cardiomyopathy; Point of care systems; POCUS.

Resumen

La disnea es un síntoma común durante el embarazo, pero puede representar un desafío diagnóstico. Aunque a menudo se atribuye a cambios fisiológicos, también puede ser indicativa de afecciones subyacentes graves como crisis asmática, infección, edema pulmonar (EPA), tromboembolismo pulmonar y embolia de líquido amniótico.

La ecografía en el punto de atención (POCUS, por sus siglas en inglés) es una modalidad rápida y eficaz a la cabecera del paciente para evaluar condiciones médicas agudas o críticas. Puede utilizarse como alternativa o complemento a la ecografía formal tradicional realizada por los servicios de radiología o cardiología. Esta revisión explora el papel del POCUS en la gestante con disnea, destacando el valor potencial del POCUS cardiopulmonar materno en anestesia obstétrica, para facilitar el tratamiento oportuno y proporcionar un diagnóstico diferencial inmediato en pacientes potencialmente inestables.

Como ejemplo, se discute un caso de aparición súbita de EPA y pérdida de conciencia en una paciente de 48 años de edad que fue sometida a una cesárea de emergencia bajo anestesia general. El POCUS identificó una disminución severa de la función sistólica global y confirmó EPA mediante la presencia de líneas B de Kerley, lo cual proporcionó una guía rápida para el soporte inotrópico intraoperatorio y el manejo de líquidos, al tiempo que se excluyeron otras causas de disnea patológica en el embarazo.

Palabras clave

Anestesia obstétrica; Disnea; Embarazo de alto riesgo; Miocardiopatía periparto; Sistemas en el punto de atención; POCUS.

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INTRODUCTION

Cardiovascular diseases affect 1% to 4% of pregnancies worldwide and are among the leading causes of maternal mortality. (1) While obstetric hemorrhage remains the primary cause of maternal death globally, cardiovascular conditions represent a significant and growing contributor, particularly in high-income countries. (2) Dyspnea is often the initial symptom of many of these conditions; however, it also occurs in 60-70% of healthy pregnant individuals due to physiological adaptations. These include increased cardiac output and compensated respiratory alkalosis, which result in higher tidal volume and heart rate, and relatively lower blood pressure. (3) Other contributing factors include anemia, the upward pressure of the growing uterus on the lungs, increased pulmonary blood volume, and nasal congestion. While dyspnea is often benign and clinically unimportant it could be a sign of underlying serious pathologies such as asthma crisis; infection; pulmonary edema (PEd); pulmonary embolism (PE); pneumothorax; peripartum cardiomyopathy (PPCM); left ventricular (LV) dysfunction; amniotic fluid embolism (AFE). (3) Therefore, establishing a differential diagnosis is crucial as delays in identifying these conditions can significantly contribute to preventable maternal morbidity and mortality.

In this context, basic ultrasound skills can be effectively adapted to maternal Point-of-Care Ultrasound (POCUS) to aid in diagnosing respiratory and cardiac conditions, expediting the initiation of targeted therapy, and assessing treatment response. POCUS has shown the advantage of reducing the time to establish the etiology of acute dyspnea, while maintaining high overall accuracy. (4) Focus Assessed Transthoracic Echocardiography (FATE) and lung ultrasound (LUS) are identified as POCUS primary applications in obstetric anesthesiology, since hypotension and respiratory insufficiency are the most common perioperative complications. (4,5) These core POCUS applications should serve as the foundation for obstetric anesthesiologist seeking proficiency, as targeted training can significantly enhance diagnostic accuracy.

This review highlights the importance of FATE and LUS as bedside tools for pregnant patients experiencing shortness of breath, helping to establish the etiology of dyspnea, ruling out differential diagnoses, and facilitating timely treatment.

This work aims to provide a non-systematic review of POCUS in obstetric anesthesia, offering recommendations to equip anesthesiologists with the knowledge needed to manage parturients presenting with dyspnea.

EVIDENCE REVIEW

A search was conducted in PubMed (Medline), Google Scholar, SciELO, Embase and Cochrane Library using the terms: "POCUS" "anesthesia," “pregnancy”, "obstetric anesthesia," "dyspnea". The search languages were only English and Spanish. This structured search yielded 52 articles for analysis. Any articles failing to provide relevant information, duplicate articles, unavailable full texts and articles published more than 20 years ago were excluded. Finally, 27 articles with relevant information for this review were selected.

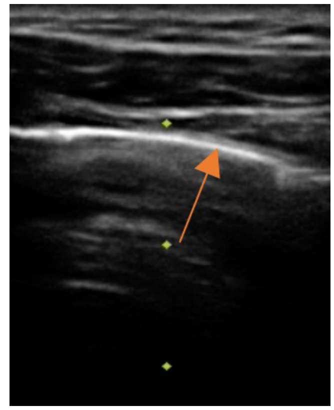
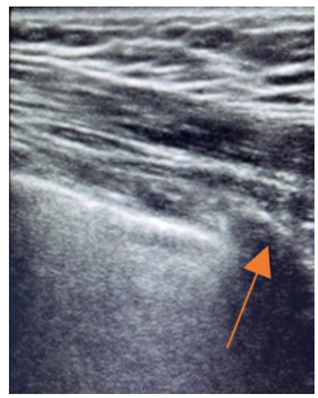
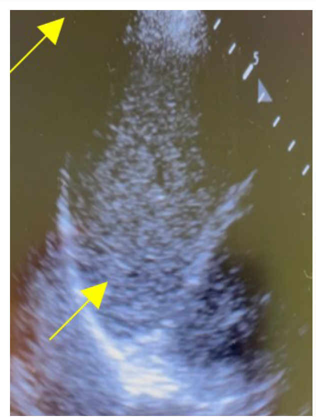
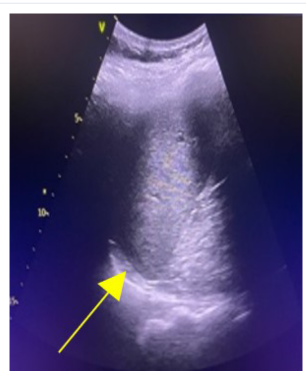
DEVELOPMENT

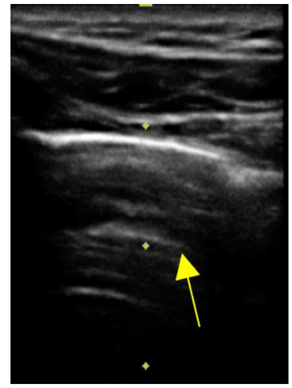
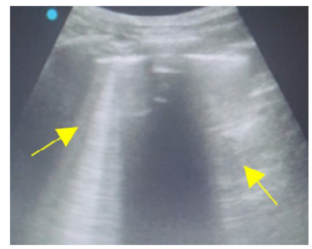
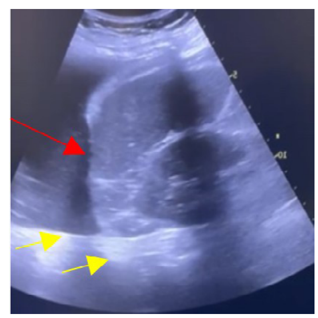
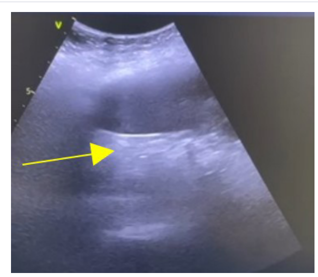
LUS technique in pregnant patients with dyspnea

An ultrasound system with a low-frequency (2–5 Hz) curvilinear probe (preferred) should be used, otherwise a phased array cardiac probe. LUS demonstrated accuracy comparable to the standard of care in diagnosing various cardiopulmonary conditions presenting with acute dyspnea, including pneumonia, pleural and pericardial effusion, pneumothorax and PEd. Notably, LUS exhibited greater sensitivity than chest X-ray (CXR) for detecting free pleural effusion (6) and has been the most studied POCUS modality in this situation. Apparently, it plays a significant role in cases of preeclampsia complicated by PEd, demonstrating an area under the receiver operating characteristic curve of 0.961 and showing strong interobserver agreement. (7,8)

The proposed protocol in pregnancy is a shortened version of the BLUE protocol (9), as shown in Table 1. The BLUE protocol, originally developed for diagnosing acute respiratory failure (hence ‘BLUE’ from respiratory distress) in the intensive care unit, has been adapted for other settings, such as dyspnea in the emergency room, with diagnostic accuracy comparable to standard imaging modalities. (9) This protocol assists in diagnosing and differentiating conditions such as pulmonary embolism, exacerbations of obstructive diseases, pneumothorax, pulmonary edema, and consolidation. The assessment begins by evaluating lung sliding on the anterior and posterior chest walls, identified as a bright, horizontal, hyperechoic line between the rib shadows. Next, the examiner checks for the absence of Kerley B lines. The evaluation concludes by confirming the presence of the curtain sign bilaterally at the level of the posterior axillary lines, with diaphragmatic elevation considered a normal finding. It is important to note that pregnant patients often have difficulty lying flat, as a result of the compression of the aorta and the inferior vena cava at the intra-abdominal level by the gravid uterus; this may result in a low-output situation (reduction in stroke volume and cardiac output) due to decreased venous return. This situation further deteriorates in a parturient with dyspnea or orthopnea. Hence, the recommendation is to conduct the patient examination with the patient in a semi-recumbent position elevated at 30–45 degrees (or even semi-sitting if the patient has orthopnea) and using left uterine displacement or a wedge to relieve the compression of the great vessels by the gravid uterus.

Table 1. Lung ultrasound. Key assessments for ruling in/out conditions in pregnancy.

Finding	View	Location	Image
Lung sliding	Anterior / lateral	Anterior apical and lateral view - the probe is positioned longitudinally at the second or third intercostal space along the midclavicular/midaxillary line. The pleura is the echobright shimmering line with the "ants marching" appearance. The intercostal muscle is seen between the ribs.	
Lung pulse	Apical	Lung pulse refers to the subtle pleural movement transmitted by cardiac activity, best observed during apnea and near the sternum where the internal thoracic artery is located. Meaning: impaired regional ventilation (COPD, Asthma, selective intubation, atelectasis).	
Curtain sign (right side)	Costophrenic	The diaphragm appears as a hyperechoic structure separating the lung from the liver ("curtain"), mirror artefact could be present below (image). The probe is placed usually at the right posterior axillary line at the level of the costophrenic angle and visualizing the diaphragm with the liver below.	
Curtain sign (left side)	Costophrenic	The diaphragm appears as a hyperechoic curtain between lung and spleen. The probe is placed at the left posterior axillary line at the level of the costophrenic angle and visualizing the diaphragm with the spleen below.	

Finding	View	Location	Image
A Kerley Lines	Anterior, lateral and posterior	Hyperechoic and horizontal lines originating at regular intervals from the pleural line, indicating normal lung aeration.	
B Kerley lines	Anterior / lateral and posterior	Vertically oriented lines resembling a beam of light or comet tail radiating from the probe to the bottom of the screen, moving with the lung sliding and obliterating A-lines.	
Pleural effusion	Costophrenic	Appears as a hypoechoic area, cranial to the diaphragm, characterized by absence of the curtain sign (red arrow). The spine sign corresponds to the vertebral bodies in the thoracic cavity above the diaphragm (yellow arrow). Plankton sign: lung collapsed by large exudative effusions may be seen swirling in a fluid motion with hyperechoic debris.	
Consolidation	Lateral and costophrenic	Hepatization of the lungs ("tissue" like sign) Pleural effusion with dynamic air bronchograms. Shred sign: Consolidated lung tissue appears as a subpleural hypoechoic region that has an irregular (shredded) deep border (fractal line) abutting normally aerated lung.	
Atelectasias	Costophrenic	Jellyfish sign or "lung flapping" representing distal segment of collapsed lung swimming within a large pleural effusion. Static air bronchograms.	

Source: Authors.

For pneumothorax evaluation, the optimal scanning location is the anterior or lateral apical chest. The absence of lung sliding in this region may indicate pneumothorax, while its presence effectively rules it out at the probe site. Formal protocols recommend scanning the midaxillary line for further assessment. Though less likely in obstetric patients, pneumothorax is prioritized early in the BLUE protocol due to its life-threatening potential.

For pleural effusions, the lung bases and parenchyma are evaluated using phased array or curvilinear probes at the posterolateral basal zones. The probe is positioned at the costophrenic angle, with the diaphragm visualized as a hyperechoic line between the lung and liver/spleen. A pleural effusion presents as a hypoechoic area above the diaphragm (absence of the curtain sign). Additionally, as an extension of LUS, we recommend examining the costophrenic view caudally to detect ascites, perihepatic, perinephric or intra-abdominal fluid. This is especially important in patients with preeclampsia, as shown in a prospective cohort study involving 112 patients with severe preeclampsia that reported a 52% rate of ascites, which is associated with an increased risk of adverse maternal and perinatal outcomes. (10)

Pulmonary edema is identified on ultrasound as vertical "laser like" B-lines, resembling beams of light extending from the probe to the bottom of the screen, obscuring normal A-lines. B-lines are the result of interlobular septum thickening increasing the density most likely due to fluid accumulation in the interstitial space and the alveoli. In contrast, A-lines are horizontal, indicating normal lung aeration. In non-pregnant patients, B-lines have a 95% sensitivity and 97% specificity for detecting PEd. (9) Causes range from non-obstetric conditions like pneumonia and acute respiratory distress syndrome, to obstetrical diseases, such as preeclampsia and peripartum cardiomyopathy. Timely management hinges on determining whether the edema is cardiogenic or non-cardiogenic, a distinction well-suited for this protocol aided by cardiac POCUS.

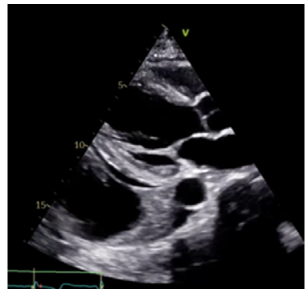
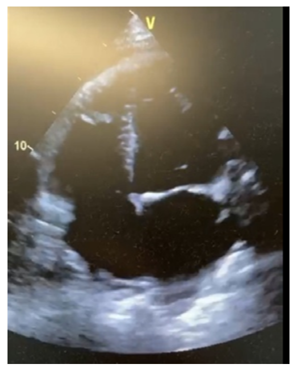
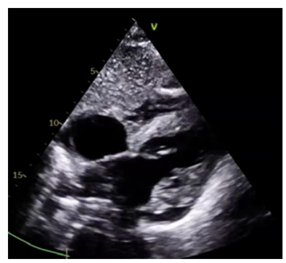
Focus assessed transthoracic echocardiography in pregnancy (FATE)

A high-frequency phased array probe should be used. Several characteristics of pregnant women make FATE examination easier, including anterior and left lateral displacement of the heart; frequent use of a left lateral tilted position to avoid aortocaval compression; spontaneous ventilation; and general receptiveness to ultrasound technology. Nevertheless, evaluating a parturient with dyspnea presents unique challenges – particularly if she is anxious or unable to remain still. Additionally, the gravid uterus may hinder subcostal image acquisition and contribute to hemodynamic alterations during examination.

Maternal cardiac arrest is a critical scenario where POCUS may proof to be invaluable in emergency settings once the return of spontaneous circulation has been achieved. However, it should not delay immediate interventions such as intubation, cardiopulmonary resuscitation, defibrillation, or perimortem emergency cesarean section. Nevertheless, in near-miss cases—events that could have serious consequences but where promptly diagnosed and addressed—POCUS can yield valuable information for diagnosing life-threatening conditions. The FATE protocol can help identify reversible causes of dyspnea, including cardiac tamponade, pericardial effusion, pleural effusion, right-sided dilation (suggestive of pulmonary embolism), left-sided dilation, or hypovolemia. Furthermore, one study highlighted its high negative predictive value for heart failure, making it a reliable tool for excluding these conditions as the primary cause of dyspnea in emergency department patients. (3) We suggest using a modified version of the Rapid Obstetric Screening Echocardiography (ROSE) protocol which is a cardiac ultrasound technique documented for emergent obstetric patients. (11) This modified version uses a sequence with short and long axis parasternal views, as well as an apical 4 chamber view. Additionally, the subcostal view shall be included to assess IVC size at the end of inspiration, providing valuable information for fluid status evaluation and guidance, as suggested by a recent report in obstetrics. (12) The protocol with usual images, syndromic diagnoses, and their corresponding obstetrical pathology are shown in Table 2. The same as in LUS, the recommendation is to position for the examination in pronounced left lateral or semi-recumbent position with left uterine displacement to optimize hemodynamics. This prevents aortocaval compression from gravid uterus and facilitates echocardiographic views by bringing the heart closer to the chest wall. A normal right ventricle (RV) should be visualized as two-thirds of the size of the left ventricle, best viewed in the apical 4-chamber view. A RV similar in size to the left ventricle suggests dilation and eventual dysfunction, often seen in acute conditions like pulmonary embolisms or amniotic fluid embolism. The parasternal long axis view allows assessment of LV filling and volume status. Ventricular walls that come into proximity during systole (kissing heart) suggest underfilling, common in hypovolemic shock or septic shock, and requires volume resuscitation. In cases of suspected cardiac dysfunction, a left ventricle that looks dilated or exhibits poor contractility throughout the cardiac cycle may be suggestive of cardiogenic shock and additional volume could further compromise hemodynamic instability. When using subcostal view to assess the IVC, start with the probe marker oriented toward the patient's head, then rotate the probe toward the right shoulder and angle it caudally to visualize the IVC. The hepatic vein helps confirm that it is the IVC and not the abdominal aorta.

Integrating the FAST (focused assessment with sonography in trauma) protocol with both FATE and BLUE protocols enhances the accuracy of a pre-hospital differential diagnosis of dyspnea in adults presenting to the emergency department. (13) Similarly, we recommend using this approach (Table 3) in cases of pathological dyspnea during pregnancy, to help differentiate

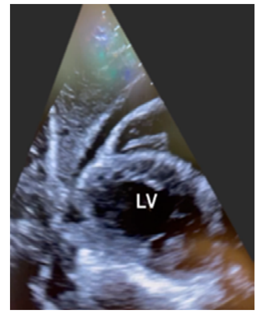
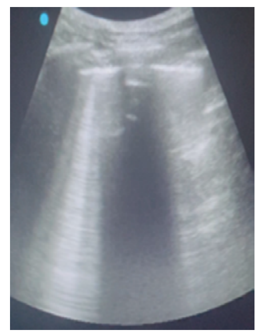
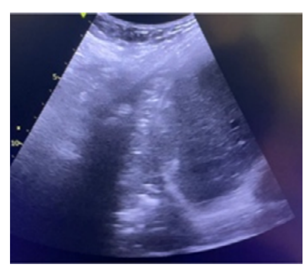
Table 2. FATE protocol in pregnancy (ROSE modified version) and key assessments in pregnancy.

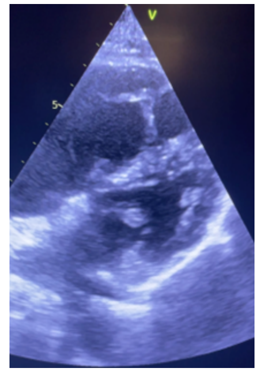
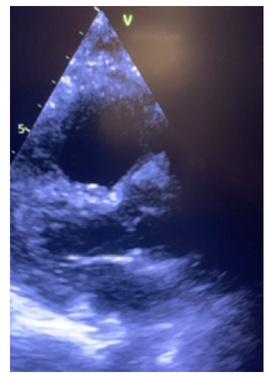
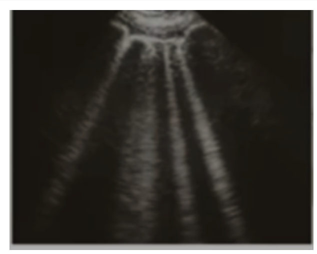
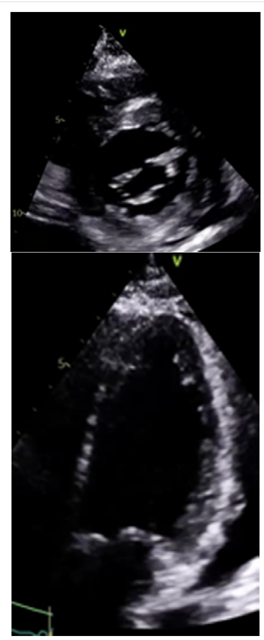
View	To rule out	Obstetrical diagnosis	Image example
Parasternal long axis	LV dysfunction	PPCM	
	Atrial enlargement.	MS/MR/diastolic dysfunction	
	Valvulopathies	Aortic or mitral valve	
	Pericardial effusion	Pericarditis	
	Pleural effusion	Fluid overload- TRALI	
	Dynamic LVOT obstruction	Hypertrophic cardiomypathy	
Two chamber parasternal short axis. Mid papillary view, mitral valve view and aortic valve view.	Segmental wall motion abnormalities sweeping from apex to base	ACS: NSTEMI /STEMI Spontaneous coronary artery dissection	
	RV dysfunction/dilation	AFE PE Fluid overload- TACO	
	Presence of septal bowing	PE TACO	
Four chamber apical. Pitfalls: moderator band (identifies RV).	Chamber dilation -LV dilated -RV dilated	PPCM / MR PE / AFE / Fluid overload	
	Chamber collapse	Tamponade	
	Biventricular function -LV dysfunction -RV dysfunction	PPCM / ACS AFE / PE	
	Mitral valve pathology	MR /MS	
	Aortic valve pathology	AR/AS/Aortic Dissection	
	Pericardial effusion	Pericarditis	
	Apical ballooning	Stress induced cardiomyopathy	
Subcostal and sub-xyphoid IVC	IVC dilation	Preeclampsia, Fluid overload, TACO, Cardiogenic shock	
	Complete IVC collapse	Postpartum hemorrhage / Sepsis/ Hyperemesis / Trauma/ Bleeding	

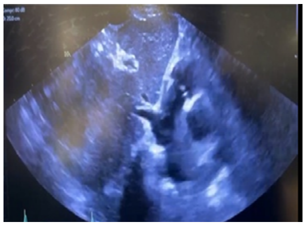
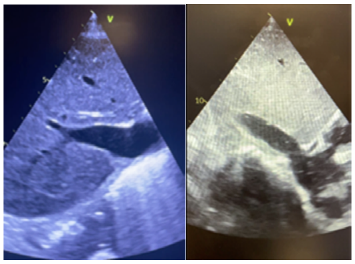
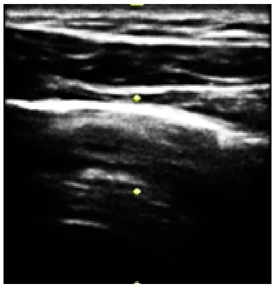
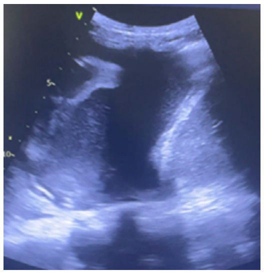
ACS: Acute Coronary Syndrome, AFE: Amniotic Fluid Embolism, AR: Aortic Regurgitation, AS: Aortic Stenosis, IVC: Inferior Vena Cava, LV: Left Ventricle, LVOT: Left Ventricle Outflow Tract, MR: Mitral Regurgitation, MS: Mitral Stenosis, NSTEMI: Non-ST Elevation Myocardial Infarction, PPCM: Peripartum Cardiomyopathy, PE: Pulmonary Embolism, RV: Right Ventricle, STEMI: ST Elevation Myocardial Infarction, TACO: Transfusion Associated Circulatory Overload, TRALI: Transfusion-Related Acute Lung Injury.

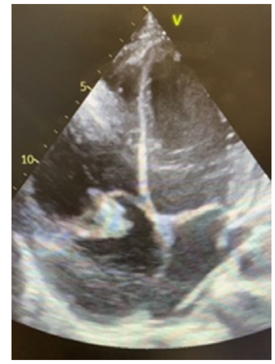
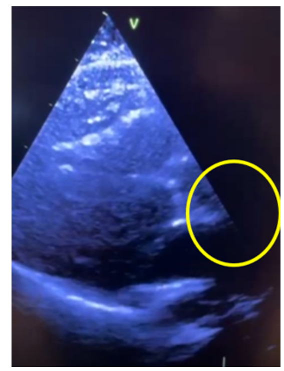
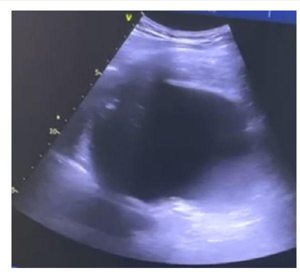
Source: Authors.

Table 3. Differential diagnosis made by POCUS in a parturient with pathological dyspnea.

Disease	FATE	LUS	Additional features	Image
Peripartum cardiomyopathy	Left ventricular systolic dysfunction (<45%) LV could be dilated +- pericardial effusion Spontaneous echo contrast and intracavitary thrombi (advance cases)	Diffuse B Kerley lines +- pleural effusion	Risk factors Last month of pregnancy or within 5 months of delivery	 
Pneumonia or Aspiration pneumonitis	Normal	Consolidation focal B lines. Hepatization of the lungs Pleural effusion with dynamic air bronchograms	Test (+) for virus / bacteria Xray / Crackles on Auscultation Fever / UTI symptoms	 
Pneumothorax	Normal	Lack lung sliding usually apical view Lung point sign (image, only 60% sensitivity) Barcode sign at M-mode	Xray Auscultation	

Disease	FATE	LUS	Additional features	Image
Pulmonary embolism	RV dilation, septum flattening (D-sign) or leftward deviation of the IV septum RV systolic dysfunction Hyperactive RV apex + underfilled LV (McConnell sign)	Pulmonary infarct (consolidation) or atelectasis (lung pulse)	Prior DVT in upper or lower extremities Risk factors	
Amniotic fluid embolism	RV dilation and dysfunction	B Kerley lines	Coagulopathy + hypotension. Uterine atony (85%) Sudden onset Occurs during labor or placental delivery	
Severe preeclampsia with pulmonary edema	Diastolic dysfunction or normal	B Kerley lines	High blood pressures Headache Facial edema Several features	
Acute coronary syndrome	Regional wall motion abnormalities (parasternal short axis and apical 4 chamber) +- LV/RV dysfunction	Normal or features of pulmonary edema	ST changes Troponins Angina	

Disease	FATE	LUS	Additional features	Image
Tamponade	IVC dilated Chamber echogenic compression or collapse Usually start with diastolic collapse. Pericardial effusion Low cardiac index	Normal	Pulsus paradoxus Beck triad EKG alternans or low voltage Equalization of blood pressures (CVP MAP)	
Hypovolemia	IVC collapse Hyperdynamic LV “Kissing heart”	Normal	Peripartum Bleeding or trauma Signs of hypovolemia Tachycardia	
Fluid overload (Pulmonary edema)	IVC dilated and non-collapsible RV normal or dilated	B Kerley lines Pleural effusion	Edema Rales during auscultation lung fields	
Asthma / COPD crisis	Normal	Jellyfish sign or “lung flapping” + pleural effusion. Lung pulse (+) Static air bronchograms.	Post-surgery or post-cesarean section with general anesthesia. Inadequate pain control	
Massive atelectasis	Normal	Jellyfish sign or “lung flapping” + pleural effusion. Lung pulse (+) Static air bronchograms.	Post-surgery or post-cesarean section with general anesthesia. Inadequate pain control	

Disease	FATE	LUS	Additional features	Image
Mass (Vegetations, Thrombus or tumors)	Mass Vegetation (aortic, mitral or tricuspid)	Usually normal	Murmur Fever Subacute dyspnea and progressive history of congenital heart condition or rheumatic disease	
Valvulopathies	Long parasternal helpful to identify aortic stenosis (image). Mean gradient in apical 5 chamber. Mitral valve coaptation defect	Usually normal	Murmur	
Subcapsular hematoma, ascites or intrabdominal fluid	Normal	LUS and abdominal helpful to assess hemidiaphragm function, hematoma, paralysis or presence of perihepatic / splenic fluid. *The presence of subcutaneous emphysema significantly limits the utility of LUS	Complication of HELLP and preeclampsia. Major trauma Bleeding	

Source: Authors, based on Easter et al. (14), Aksu (15) y Del Colle et al. (16).

diseases such as asthma crisis, pneumonia, fluid overload, AFE, PPCM (peripartum cardiomyopathy), PE, hypovolemia, and cardiac tamponade.

In clinical practice, we submit the case of a pregnant patient who experienced acute dyspnea and loss of consciousness, prompting an emergency category one cesarian section under general anesthesia. POCUS was performed, providing essential diagnostic insights that guided her perioperative management.

Clinical scenario

A 48-year-old woman, G3P0A0, of African descent with a history of chronic hypertension presented with an in vitro fertilization (IVF) pregnancy with oocyte donation in Nigeria, resulting in trichorionic/triamniotic triplets.

At around six weeks of gestational age (GA), she returned to Canada and received antenatal follow-up care at Mount Sinai Hospital-Toronto (University of Toronto affiliated hospital). Unfortunately, one of the fetuses experienced intrauterine demise at approximately 21 weeks of gestation.

The patient presented to the hospital at 35+5 weeks, with shortness of breath and a productive cough. She reported experiencing chest pressure and unusual fatigue over the preceding two days, along with elevated blood pressure (BP: 165/107). Further questioning revealed high blood pressure readings and leg swelling for the past three weeks. The physical examination revealed puffy eyelids, significant pitting edema, bibasilar crackles, and a respiratory rate of 30 per minute. Oxygen saturation was 96% on room air, and body temperature was 37.1°C. Pre-eclampsia, influenza/pneumonia, and pulmonary edema were suspected, initiating immediately oxygen through nasal prongs, labetalol and magnesium sulphate.

The obstetric team requested a chest X-ray which revealed an enlarged cardiac silhouette, hazy opacities throughout the mid to lower lungs, possible septal lines indicating pulmonary edema, and potential suspicious areas of infection. The ECG showed sinus tachycardia and prolonged QT interval. Due to persistently elevated blood pressure (190/110) that did not respond to labetalol, the decision was made to place an arterial line under local anesthesia. Furosemide 40 mg intravenous was administered and the internal medicine team was consulted.

Shortly after, the patient experienced a rapid progression of dyspnea and developed orthopnea, becoming unable to tolerate supine position. She experienced shortness of breath and briefly lost consciousness but quickly regained it after left uterine displacement. The decision was made to transfer her to the operating room (OR) for emergency delivery. During the transfer the patient experienced another episode of pre-syncope. In the OR her initial vitals were BP 165/100, heart rate (HR) 105 bpm, and 92% oxygen saturation. Rapid sequence induction was performed using remifentanil 60 mcg, propofol 140 mg and succinylcholine 140 mg, followed by intubation with video laryngoscopy (GlideScope blade 3) and an endotracheal tube #6.5 on the first attempt. The patient was placed on mechanical ventilation, and sevoflurane was initiated for anesthesia maintenance. The patient required vasopressors, using primarily several norepinephrine boluses of 6 mcg. The delivery was successful, and the newborns required additional care in the Neonatal Intensive Care Unit.

The operative time was 90 minutes, with an estimated blood loss of 1.2 liters. Intraoperative fluids were administered based on blood pressure parameters and pulse pressure variation. The patient also received midazolam (2 mg), rocuronium (50 mg), tranexamic acid (1000 mg), a continuous infusion of magnesium (1 g/hour), and oxytocin (3 IU bolus, followed by 40 Units/L or 4.8 U/hour). Intravenous morphine (10 mg) was administered. Due to hypocalcemia, calcium chloride (1 g IV) was given.

During the surgical procedure, the anesthesia team conducted cardiac and lung POCUS (Video 1) in the operating room under general anesthesia. The assessment revealed a moderate to severe decline in the left ventricular global systolic function with global hypokinesia, particularly of the anterior wall in the parasternal short axis view. The right ventricle was normal, but a large pericardial effusion was present. LUS showed diffuse B-Kerley lines, left atelectasis and pleural effusion.

The subcostal inferior vena cava (IVC) view showed no collapsibility, suggesting that additional fluids might not be beneficial. Based on these POCUS findings, peripartum cardiomyopathy was suspected, and the patient was admitted to the ICU for further management after initiating norepinephrine and dobutamine.

In the ICU, the differential diagnosis ruled out infection based on negative influenza and COVID-19 tests, with no evidence of embolism on chest computed tomography. A comprehensive transthoracic echocardiogram (TTE) confirmed peripartum cardiomyopathy,

Video 1. POCUS sequence.

1) Parasternal short-axis view, demonstrating global hypokinesis, especially anterior wall. Left ventricular ejection fraction less than 30%. Pericardial and pleural effusion hindering visualization. 2) Apical 4-chamber view, evidencing pericardial effusion and decreased left ventricular ejection fraction. 3) Subxyphoid inferior vena cava (IVC) view, indicative of a plethoric IVC. Evidence of pleural effusion with B-lines. 4) Lung ultrasound left costophrenic. B Kerley lines and pleural effusion, lack of "curtain sign" in left costophrenic view.

Source: Authors.

revealing a mildly dilated left ventricle with global moderate-to-severe systolic dysfunction, as assessed by a biplane left ventricular ejection fraction (LVEF) of 31% while on inotropic support. The right ventricle (RV) appeared normal, with no significant valvular abnormalities (Video 2). A mild circumferential pericardial effusion and a large left pleural effusion were noted (Figure 1).

She received continuous IV infusions of propofol, fentanyl and dexmedetomidine along with furosemide 20 mg every 8 hours for the first 24 hours. The patient required norepinephrine and dobutamine for the first three days. The systolic function subsequently improved to normal by day 3, as a TTE revealed a mildly dilated left ventricle with normal systolic function (LVEF 56%).

After four days, she was successfully extubated and discharged from the ICU. The patient was discharged from the hospital on the eighth postoperative day. During the second postpartum month she followed up with cardiology undergoing cardiac computed tomography. The results concluded no significant coronary artery disease. A Magnetic Resonance of the heart indicated no evidence of myocardial scar, fibrosis, or infiltration with a LVEF of 45%.

Video 2. Formal Transthoracic echocardiogram (TTE) performed by cardiology, while the patient was in the ICU on a dobutamine infusion, confirming the diagnosis of peripartum cardiomyopathy.

Source: Authors.

Figure 1. Left pleural and pericardial effusion in parasternal long axis. The image shows the difference between pleural and pericardial effusion.

Source: Authors.

CONCLUSION

Dyspnea is common in the final months of a normal pregnancy, affecting approximately 60% to 70% of women in the third trimester, and is one of the most frequent symptoms prompting emergency room visits. (17) The overlap between normal physiological changes and the signs and symptoms of serious pathology presents a significant diagnostic challenge.

Acute dyspnea could be present in a life-threatening situation where there is no time for a formal TTE, especially in the emergency setting. Nevertheless, POCUS performed by an anesthesiologist can be helpful in establishing the etiology during pregnancy. Evidence indicates that LUS and FATE serve as the first rapid and non-invasive assessment tool to accurately differentiate cardiac, pulmonary, or extra-pulmonary causes in patients with acute dyspnea. (4) A recent report established that more than 60% of severe preeclamptic patients had B-lines on LUS, correlating with high blood pressure readings and acute-onset breathlessness. (18) However, a recent prospective study showed that only 10% of 63 women with severe preeclampsia developed PEd. (8) Initially, an infectious source was suspected in this case, mainly because of the productive cough and sub-febrile status. This diagnostic ambiguity is frequently encountered in cases of peripartum cardiomyopathy (PPCM), as reported in the literature. (19-21) While the diagnosis of PPCM is primarily clinical and often challenging, confirmation typically requires a formal (TTE). (22)

The diagnosis in this patient was confirmed in the ICU by a formal TTE. Notably, this clinical case presented multiple risk factors for PPCM: gestational hypertension, multiple pregnancy, African descent, egg donation and advanced maternal age. A late diagnosis and failure to recognize the disorder may result in devastating consequences since maternal mortality could be as high as 20% to 50%. (21,23) Therefore, prompt diagnosis is crucial, and POCUS plays a key role in addressing this challenge, identifying severe decreased global systolic function, confirming PEd with the presence of B-Kerley lines, and excluding other causes of pathological dyspnea.

The overall presentation discusses a near-miss case of a rapidly progressing disease characterized by pulmonary edema and hemodynamic instability, requiring intubation prior to the emergency cesarean section. Intraoperative POCUS provided rapid guidance for fluid management by revealing a plethoric IVC, preventing potential volume overload in an established PEd. Although POCUS in this context should not delay immediate interventions such as an emergency cesarean section, it should be considered an extension of the physical examination. This is particularly relevant when assessing a patient with severe preeclampsia in which an initial POCUS assessment and follow-up enable the detection of lung interstitial edema, left pleural effusion, and left ventricular dysfunction, facilitating timely treatment in a potentially unstable patient. (24)

It is well established that POCUS has become an essential skill in anesthesiology (25), as emphasized by ASA's Ad Hoc Committee on POCUS (26) and the European Society of Anesthesiology and Intensive Care Medicine (ESAIC) (27) in their recent updated version, outlining guidance for training and competency in diagnostic POCUS. Moreover, in obstetrics, complications such as postpartum hemorrhage, PEd, uterine rupture, and AFE demand immediate diagnosis and intervention. In these scenarios, implementing O-POCUS (Obstetric Point-Of-Care UltraSound) by the anesthesiologist in pregnant patients is an additional approach to improving fetal and maternal outcomes, without requiring assistance -often delayed- from colleagues in cardiac anesthesia, radiology, or critical care medicine. (28) However, there remains a critical need to train anesthesiologists and build expertise in the use of POCUS for obstetric care. This review contributes to its integration in the perioperative and emergency setting.

ETHICAL DISCLOSURES

Protection of human and animal subjects

The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data

The authors declare that they have adhered to their institutional protocols regarding publication of patient data.

Right to privacy and informed consent

The authors declare that no patient data have been disclosed in this article.

The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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Contributions by the authors

JPG: study planning, data collection, narrative review, preparation of the entire manuscript.
CA: Review, preparation of the entire manuscript.
FZ: Review of the article prior to submission including spelling and grammar, and intellectual content.

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