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ORIGINAL ARTICLE

Emergent transesophageal echocardiography in hemodynamically unstable obstetric patients

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ABSTRACT

Background: The obstetric population has an increasing incidence of comorbid conditions. These, coupled with the possibility of acute embolic events involving air, amniotic fluid, and thrombus, increase the likelihood of hemodynamic instability. Although the utility of transesophageal echocardiography to guide management in cardiac and high-risk, non-cardiac surgical populations has been well established, the emergent use in critically-ill parturients has not been comprehensively evaluated.

Methods: Using our departmental transesophageal echocardiography database of 28 293 examinations, parturients were identified who underwent emergent transesophageal echocardiography for evaluation of hemodynamic instability, including cardiac arrest, between January 1999 and March 2014. Transesophageal echocardiography findings and their impact on patient management were analyzed.

Results: Ten peripartum patients were evaluated. Six patients became unstable during dilation and evacuation procedures; one after a forceps delivery; one during and one after cesarean delivery; and one during a postpartum laparotomy. Six patients proceeded to cardiac arrest; however, all women survived their initial operation and resuscitation. Transesophageal echocardiography was instrumental in determining the etiology and guiding resuscitation in all 10 patients including emergent cardiac surgical intervention with cardiopulmonary bypass ($n = 2$). Seven patients survived to hospital discharge, but three died after experiencing neurologic complications.

Conclusions: Severe hemodynamic instability and cardiac arrest can occur in previously healthy parturients in pregnancy. Our data suggest that emergent transesophageal echocardiography is a valuable tool in determining the etiology and directing therapy of refractory hypotension or cardiac arrest in obstetric patients.

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Keywords: Cardiac arrest; Hemodynamic instability; Peripartum; Transesophageal echocardiography; Emergency

Introduction

The contemporary obstetric population presents with an increasing number of comorbidities such as morbid obesity, hypertension, coronary disease, diabetes, and liver dysfunction.^{1–3} Advances in assisted reproductive technologies and medical and surgical therapies have facilitated pregnancy in women with significant medical conditions in whom this was previously precluded.^{4,5} In addition, an increasing incidence of operative deliveries has resulted in higher risks for abnormal placentation

and subsequent maternal hemorrhage.⁶ Finally, uncommon but omnipresent risks for emboli (e.g. air, amniotic fluid, and thrombus) may alter maternal hemodynamics. Overall, these issues place obstetric patients at risk for peripartum hemodynamic instability.

While cardiac arrest in parturients has recently been estimated at one in 12 000 deliveries,³ the Centre for Maternal and Child Enquiries report indicates that rates for maternal collapse, defined as “an acute event involving the cardiorespiratory systems and/or brain resulting in a reduced or absent consciousness level (and potentially death) at any stage in pregnancy and up to six weeks after delivery,” to be as high as six in 1000 pregnant mothers.⁷ The International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science specifically identified

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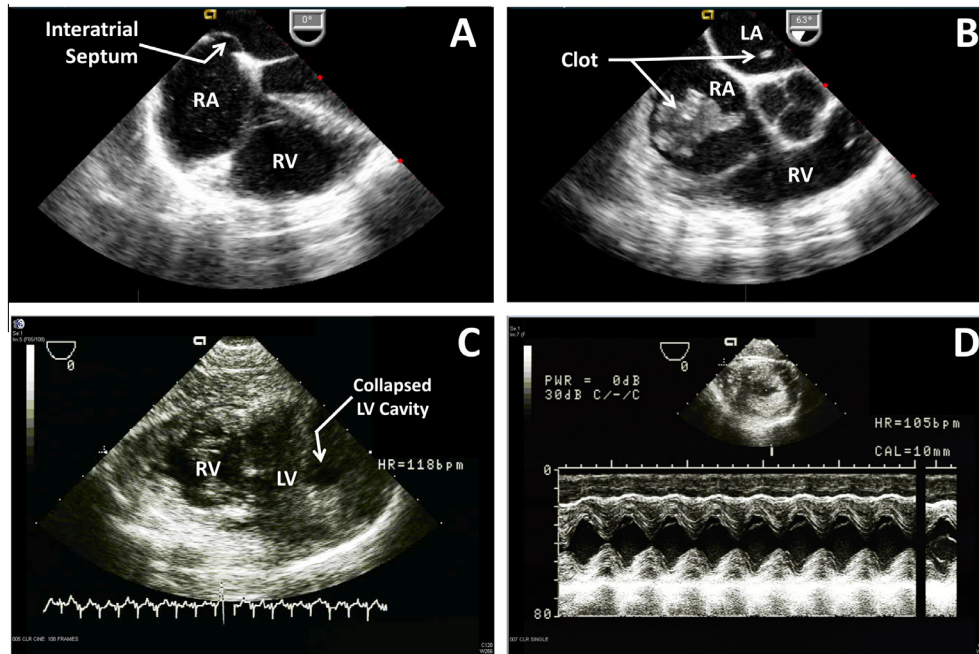


Fig. 1 Representative transesophageal echocardiography findings in obstetric patients with severe hemodynamic instability. (A) Modified mid-esophageal four chamber view: right atrial (RA) dilatation and bowing of the interatrial septum consistent with elevated right heart pressures due to pulmonary embolism. (B) Mid-esophageal right ventricular (RV) inflow-outflow view: visible clot burden in the right (RA) and left atrium (LA) after amniotic fluid embolism complicated by disseminated intravascular coagulation. (C) Transgastric mid-papillary short axis view at end systole: hyperdynamic, underfilled left ventricle (LV) with collapse of the ventricular cavity due to hypovolemia related to postpartum hemorrhage. (D) M-mode analysis of transgastric mid-papillary short axis view: near contact between the anterior and inferior LV walls with respiratory variation consistent with hypovolemia.

maternal resuscitation as an area for increased research because many current recommendations are based on data from non-pregnant women and studies using manikins.⁸ Guidelines on management of cardiac arrest in pregnancy have been published recently,⁹ and research on its optimal management is ongoing.^{3,10–12} The essential role of the anesthesiologist in multidisciplinary team-based management of critically ill obstetric patients has been well established.^{5,13–15}

Transesophageal echocardiography (TEE) has been used in the cardiac surgical operating room for over 20 years, and is widely available at teaching centers across the USA.¹⁶ The intraoperative utility of TEE for high-risk patients undergoing non-cardiac surgery has been well established, and is supported by current American Society of Anesthesiologists (ASA) and Society of Cardiovascular Anesthesiologists guidelines.^{17–19} These guidelines identify life-threatening hemodynamic instability as a class I indication for perioperative TEE, and recognize the utility of emergent or rescue TEE in helping to establish the etiology and guide therapy in intraoperative cardiac arrest.^{20–24} While individual case reports on TEE guidance for the obstetric patient in cardiac arrest exist,^{25,26} to our knowledge, a larger, more comprehensive analysis focused on the utility of emergent TEE in hemodynamically unstable parturients has not been performed. To assess the diagnostic benefit of TEE in guiding the resuscitation

of patients in the peripartum period, we evaluated a series of 10 parturients who underwent emergent TEE for evaluation of refractory hemodynamic instability, including cardiac arrest.

Methods

The study population consisted of peripartum patients who underwent an emergent TEE evaluation of hemodynamic instability, including cardiac arrest, between January 1999 and March 2014 at our institution. These patients were identified using the departmental TEE database of 28 293 examinations comprised of data collected per a Partners Human Research Committee-approved protocol with an informed consent waiver. Consistent with recent guidelines,⁷ the peripartum period was defined as any stage of pregnancy and up to six weeks after delivery.

Complete TEE examinations were exclusively performed by cardiac anesthesiologists with extensive experience in perioperative TEE using multiplane transducer probes (Philips Healthcare Inc., Andover, MA, USA; Siemens Healthcare, Malvern, PA, USA), and were documented in the patient's medical record. At a minimum, each examination consisted of assessment of chamber size and function, volume status, pericardial effusion, intracardiac mass/clot, valvular pathology, and aortic pathology.

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