Letter to the Editor

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Perioperative POCUS when the heart stops: futility or utility?

POCUS perioperatorio cuando el corazón se detiene: ¿sirve o no sirve?

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ABSTRACT. The incidence of cardiac arrest associated with anesthesia is approximately 5.6 per 10,000 cases and the precipitating causes are often known. Transesophageal echocardiography is the modality of choice during unexplained hemodynamic instability or cardiac arrest; but its utility is limited by the need of extensive user training. On the other hand, surface ultrasound has the advantage of simpler user training requirements and offers evaluation of multiple organs. Although its use intraoperatively is limited by poor access to the patient, and postoperatively by dressing and air, it still can be feasible if transesophageal echocardiography is not possible. This manuscript develops a protocol for using POCUS during a cardiac arrest, and emphasizes practical tips for image acquisition and communication of its interpretation.

RESUMEN. *La incidencia de paro cardíaco asociado a la anestesia es de aproximadamente 5.6 por 10,000 casos y las causas son a menudo desconocidas. La ecocardiografía transesofágica es la modalidad de elección durante la inestabilidad hemodinámica no explicada; pero su utilidad es limitada por la necesidad de un entrenamiento extensivo del usuario. Por otra parte, el ultrasonido de superficie tiene la ventaja de requerimientos de entrenamiento más simples y ofrece la evaluación de múltiples órganos. Aunque su uso intraoperatorio es limitado por el pobre acceso al paciente y postoperatoriamente por los apósitos y el aire, ésta puede ser confiable si la ecocardiografía transesofágica no es posible.*

INTRODUCTION

The incidence of cardiac arrest associated with anesthesia is approximately 5.6 per 10,000 cases and the precipitating causes are often known[1]. Transesophageal echocardiography (TEE) is the modality of choice during unexplained hemodynamic instability or cardiac arrest; but its utility is limited by the need of extensive user training. This may be a call to action for training in basic TEE during anesthesia residency. On the other hand, surface ultrasound (US) has the advantage of simpler user training requirements and offers evaluation of multiple organs. Although its use intraoperatively is limited by poor access to the patient, and postoperatively by dressing and air, it still can be feasible if TEE is not possible.

There are a variety of protocols for imaging during cardiopulmonary resuscitation (CPR), most of them described for emergency and critical care, such as the Cardiac Arrest Sonographic Assessment (CASA), Focused Echocardiography in Emergency Life support (FEEL), Focused Echocardiographic Evaluation in Resuscitation (FEER) and Cardiac Arrest Ultra-sound Exam (CAUSE), each one has a different order of evaluation[2]. Additionally, the American Society of Echocardiography published the Guidelines for the Use of Echocardiography as a Monitor for Therapeutic Intervention in Adults in 2015 that can be applied in case of hemodynamic instability or unexplained arrest[3]. Nonetheless, there are no specific protocols for the use of point-of –care ultrasound (POCUS) during perioperative cardiac arrest.

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The 2010 American Society of Echocardiography and the American College of Emergency Physician Consensus Statement recommends point-of-care echocardiography to guide termination or continuation of resuscitative efforts[4]. Cardiac POCUS differentiates cardiac standstill from fine ventricular fibrillation (VF)[2]. POCUS has also identified the etiology of cardiac arrest leading to a prompter treatment[5]. POCUS has a pooled sensitivity (0.95, 95% CI: 0.72-0.99) and specificity (0.80, 95% CI: 0.63-0.91) in predicting return of spontaneous circulation during cardiac arrest[6].

The pitfalls of POCUS during resuscitation include lack of experience of the sonographers to differentiate weak myocardial contraction and profound bradycardia with cardiac standstill[4]. Another drawback is that it could delay the resuming of chest compressions by 8.4 s (95% CI, 6.7-10.0 [$p < 0.0001$][7]. The evaluation of the inferior vena cava (IVC) and hypovolemia are not included by many protocols, due that a distended IVC can be found with no forward flow[8]. Small pneumothoraces can occur from rib fractures during CPR that do not need acute intervention[8] and a distended right ventricle (RV) during resuscitation is often due to hypoxia, acidosis or arrhythmias, and this RV strain is not necessarily due to pulmonary embolism[2,8,9].

Non-technical skills are paramount when POCUS is performed during CPR. Team coordination and effective communication are needed in such crisis situation. Not all cardiac arrests warrant POCUS and a team leader should decide the need based on the situation[10]. During cardiac arrest, the different views obtained will follow an order according to the pre-test probability of the etiology of the arrest.

Below is a protocol developed to explain the use of POCUS during a cardiac arrest

The advantage of this protocol is that compiles other protocols but emphasizes the practical tips for image acquisition and communication of its interpretation. It can be used in low-resource settings where there is no TEE machine or staff training in per- forming this tool:

1. Boot-up the US machine, choose temporary identification[10], select the cardiac setting, use a phased array probe and load the probe with gel. Position US machine with operator on contralateral side of person performing chest compressions.
2. Place the probe to obtain a subcostal view during cardiac compressions, set up depth and gain. The subcostal view is the core view during CPR as it is the most easily accessed window without interrupting thoracic compressions[10]. Save multiple video clips during the 10-second window of check pulse and rhythm. Team must count down 10 seconds and command after nine seconds *«Continue CPR»*[11]. *Never* delay CPR for taking ultrasonographic loops.
3. Start to review the videos during the cardiac compressions: look for pericardial fluid, RV: left ventricular size ratio, cardiac standstill, fine VF[11].
4. Report your results to the CPR leader[9]. This communication must be done during ongoing CPR with statements such as «no significant observation», «bad quality», «heart is squeezing/contracting», «cardiac standstill», «enlarged right ventricle», «pericardial effusion»[11].
5. Leader must close the loop that the information was received and do changes accordingly.
6. If the subcostal view is not optimal, try a parasternal long axis view during the second pause for check pulse and rhythm. In case there is concern about a pulmonary embolism and the cardiac images are inconclusive, a 3-point proximal deep venous thrombosis (DVT) exam can be done[10]. It is performed with a linear probe while CPR is running. Report your findings to the leader.
7. If CPR still continues and diagnostic is not clear, on a case-by-case basis, the Morrison and splenorenal space can be scanned to rule out bleeding and to look for lung sliding on the bilateral anterior surface of each hemithorax and save the loops. Tension pneumothorax exam can be performed but the lung sliding evaluation must be coordinated with the ventilation during CPR. One must bear in mind that tension pneumothorax is a clinical diagnosis and a rare cause of perioperative arrest. Always report your findings to the leader.
8. Team leader must decide discontinuation when US is non-contributory and/or its use in the post-resuscitation phase as follow up[10].

The images stored will serve for debriefing, educational purposes and research. If time allows, and the loops were identified it can be stored in the patient chart as a backup.

CONCLUSION

POCUS can be an adjunct to elucidate the cause of perioperative arrest and guide the therapeutic efforts, but as diagnostic-dependent and operator- depended tool, an appropriate clinical integration of the findings is very much needed.

REFERENCES

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1. Moitra VK, Einav S, Thies KC, Nunnally ME, Gabrielli A, Maccioli GA et al. Cardiac arrest in the operating room: resuscitation and management for the anesthesiologsit: Part 1. Anesth Analg. 2018;126:876-888.
2. Blanco P, Martínez Buendía C. Point-of-care ultrasound in cardiopulmonary resucitation: a concise review. J Ultrasound. 2017;20:193-198.
3. Porter TR, Shillcutt SK, Adams MS, Desjardins G, Glas KE, Olson JJ et al. Guidelines for the use of echocardiography as a monitor for therapeutic intervention in adults: A report from the American Society of Echocardiography. J Am Soc Echocardiogr. 2015;28:40-56.
4. Hu K, Gupta N, Teran F, Saul T, Nelson BP, Andrus P et al. Variability in interpretation of cardiac standstill among physician sonographers. Ann Emerg Med. 2018;71:193-198.
5. Long B, Alerhand S, Maliel K, Koyfman A. Echocardiography in cardiac arrest: an emergency medicine review. Am J Emerg Med. 2018;36:488-493.

6. Tsou PY, Kurbedin J, Chen YS, Chou EH, Lee MG, Lee MC. Accuracy of point-of- care focused echocardiography in predicting outcome of resuscitation in cardiac arrest patients: A systematic review and meta-analysis. Resuscitation. 2017;114:92-99.
7. Clattenburg EJ, Wroe P, Brown S, Gardner K, Losonczy L, Singh A et al. Point-of- care ultrasound use in patients with cardiac arrest is associated prolonged cardiopulmonary resuscitation pauses. A prospective cohort study. Resuscitation. 2018;122:65-68.
8. Gardner KF, Clattenburg EJ, Wroe P, Singh A, Mantuani D, Nagdev A et al. The Cardiac Arrest Sonographic Assessment (CASA) exam. A standardized approach to the use of ultrasound in PEA. Am J Emerg Med. 2018;36:729-731.
9. Aagaard R, Caap P, Hansson NC, Botker MT, Granfeldt A, Lofgren B. Detection of pulmonary embolism during cardiac arrest ultrasonographic findings should be interpreted with caution. Crit Care Med. 2017;45:e695-e702.
10. Atkinson P, Bowra J, Milne J, Lewis D, Lambert M, Jarman B. International Federation for Emergency Medicine Consensus Statement: Sonography in hypotension and cardiac arrest (SHoC): An international consensus on the use of point of care ultrasound for undifferentiated hypotension and during cardiac arrest. CJEM. 2017;19:459-470.
11. Breitkreutz R, Walcher F, Seeger FH. Focused echocardiographic evaluation in resuscitation management: concept of an advanced life support-conformed algorithm. Crit Care Med. 2007;35:S150-161.

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