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Mexican College of Interventional Cardiology and Endovascular Therapy (COMECITE) international multidisciplinary consensus statement regarding catheter-based pulmonary artery monitoring

Declaración de consenso internacional y multidisciplinario del Colegio Mexicano de Cardiología Intervencionista y Terapia Endovascular (COMECITE) sobre la monitorización invasiva de la arteria pulmonar

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ABSTRACT

The Swan-Ganz (SG) catheter is an indispensable tool for invasive hemodynamic monitoring but is underused due to controversy for misunderstandings after several confounding studies. The Mexican College of Interventional Cardiology and Endovascular Therapy (COMECITE) invited a select group of international specialists in interventional cardiology, critical cardiology care, and general intensive care for a consensus statement on SG catheter use, endorsed by COMECITE and the Mexican College of Critical Care (COMMEC). The consensus recommends the SG as a diagnostic tool in cardiogenic shock from any etiology and at any class and level, involving one ventricle or both; during worsening heart failure/hemodynamic instability, despite adequate treatment; for differential diagnosis during failed treatment for respiratory distress, hypotension, and or progressive renal failure; for simultaneous monitoring of the pulmonary artery and right atrial pressures during severe right heart-related shock. The consensus encourages centers with low SG utilization to include and master its hemodynamic monitoring benefits.

RESUMEN

El catéter de Swan-Ganz (SG) es una herramienta indispensable para la monitorización hemodinámica invasiva, pero está subutilizado debido a la controversia después de varios estudios con resultados que llevaron a interpretaciones erróneas. El Colegio Mexicano de Cardiología Intervencionista y Terapia Endovascular (COMECITE) invitó a un grupo selecto de especialistas internacionales en cardiología intervencionista, cuidados cardiológicos críticos y cuidados intensivos generales para una declaración de consenso sobre el uso del catéter SG, avalada por COMECITE y el Colegio Mexicano de Cuidados Críticos (COMMEC). El consenso recomienda el SG como herramienta diagnóstica en el choque cardiogénico de cualquier etiología y de cualquier clase y nivel, con compromiso de un ventrículo o de ambos; durante el empeoramiento de la insuficiencia cardiaca e inestabilidad hemodinámica, a pesar del tratamiento adecuado; para el diagnóstico diferencial durante el tratamiento fallido de dificultad respiratoria, hipotensión o insuficiencia renal progresiva y para la monitorización simultánea de las presiones de la arteria pulmonar y la aurícula derecha durante un choque grave relacionado con el corazón derecho. El consenso alienta a los centros con baja utilización de SG a incluir y dominar sus beneficios en el monitoreo hemodinámico.

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INTRODUCTION

It has been more than fifty years since the Swan-Ganz (SG) catheter was first used for invasive hemodynamic monitoring and there has been ongoing controversy regarding benefits and risks of its use.[1-4]

The Mexican College of Interventional Cardiology and Endovascular Therapy (COMECITE: *Colegio Mexicano de Cardiología Intervencionista y Terapia Endovascular*) invited a select group of international specialists in interventional cardiology, critical cardiology care, and general intensive care, to discuss the current use of invasive pulmonary artery monitoring, its benefit/risk and to publish a consensus statement on SG catheter use, endorsed by COMECITE, the Mexican College of Critical Care (COMMEC: *Colegio Mexicano de Medicina Crítica*) through its cardiovascular care working group, plus other invited medical organizations.

MATERIAL AND METHODS

The consensus group emerged from members of COMECITE, COMMEC and SCAI plus international experts on cardiogenic shock (CS), further electing chair, co-chair, and the rest's specific functions.

The meetings took a nominal group technique format, which consisted of the face-to-face discussion on video conference, in which each member presents their proposal and their reasons, without a time limit. Delphi rounds finally solved disagreements.[5-8]

The consensus group defined the authors' nomination from the beginning of the consensus work and modified it during its process. According to the International Committee of Medical Journal Editors (ICMJE), were authors all the people who contributed and who strictly complied with every one of the following aspects:

1. Contributed substantially to the conception or design of the work; or the acquisition, analysis, or interpretation of data.
2. Wrote the work or critically reviewed it.
3. Approved the final version for publication.
4. Confirmed the accuracy and completeness concerning every part of the work.

The acknowledgments section mentions the contributors who have not complied with every one of the four points outlined above, but worth mentioning for relevant participation.

The magnitude of consensus' contribution ordered the authorship and the corresponding author designation, with a preponderance of the person who originated the idea and who presides and coordinates. In case of disagreement and dispute over the order, an anonymous vote in a ranking format of importance decides, and, in extreme cases, the consensus might call an internal or external judge.[9]

CURRENT KNOWLEDGE

The Society for Cardiac Angiography and Interventions (SCAI) stated on 2019, a classification of the CS (document endorsed by the American College of Cardiology [ACC], the American Heart Association [AHA], the Society of Critical Care Medicine [SCCM], and the Society of Thoracic Surgeons [STS]).[10]

This statement stresses the relevant accurate invasive hemodynamic information obtained by the utilization of the pulmonary artery catheterization during the monitorization for CS, measuring directly right atrial pressure (RA), pulmonary artery pressure (PA), pulmonary capillary wedge pressure (PCWP), mixed venous oxygen saturation and cardiac output (CO), which derives cardiac index (CI), systemic vascular resistance (SVR), pulmonary vascular resistance (PVR), pulmonary artery pulsatility index (PAPi), and cardiac power output (CPO).

This tool is essential for early recognition, differential diagnosis, phenotyping, therapeutic titration, escalation to mechanical circulatory support (MCS), weaning of therapies, prognosis, and identification of univentricular versus biventricular failure. This expert panel recommends invasive pulmonary artery monitoring in CS and recognizes the reluctance for its utilization based on currently unjustified controversy.

Unfortunately, the controversy about the invasive right heart monitoring currently provokes its underuse, surely with a significantly negative impact on CS patients, because the old studies did not include a significant volume of

patients with CS or those treated with MCS, while there is indeed a significantly lower mortality in CS under SG monitoring (29.7% versus 38.1%). This kind of monitoring, when properly managed and interpreted, may help to identify worsening heart failure and CS and will help to guide treatment in clinically conflicting and mixed shock conditions.[4]

Finally, severe right ventricle dysfunction may require continuous right heart monitoring, particularly during intense bi-ventricular failures, such as right coronary-related myocardial infarction with significant right ventricle involvement, in which the simultaneous monitoring of the pulmonary artery and right atrial pressures, is valuable to determine the diastolic relationships between both.[11]

Several medical organizations wrote current guidelines for invasive right heart monitoring (American College of Cardiology Foundation, American Heart Association, European Society of Cardiology, Heart Failure Society of America, International Society of Heart and Lung Transplantation), as follows:[12]

1. On anesthesia induction on CS patients for coronary bypass graft surgery (class I; level of evidence C).
2. To estimate intracardiac filling pressures on respiratory distress or impaired perfusion with clinical discrepancy (class I; level of evidence C).
3. On heart failure persistence despite therapeutic adjust and any of the following (class IIa; level of evidence C):
   a. Uncertain systemic or pulmonary vascular resistance, fluid or perfusion status.
   b. Unresponsive hypotension.
   c. Worsening renal function.
   d. Need for vasopressors.
   e. On candidates for mechanical circulatory support or heart transplantation.
4. On patients with mechanical circulatory support (class I; level of evidence B).
5. On hemodynamic instability due to unknown worsening mechanism or refractory heart failure (class IIb; level of evidence C).
6. To withdraw mechanical circulatory or pharmacologic support.

RECOMMENDATIONS

Regarding the utilization of the Swan-Ganz catheter for continuous right heart monitoring, this consensus recommends:

1. The SG catheter is a hemodynamic diagnostic tool; it is not a device for treatment.
2. Do not utilize the SG catheter to monitor respiratory insufficiency without heart failure.
3. Indicate the SG catheter on any cardiogenic shock from any etiology and at any class and level, involving one ventricle or both.
4. Consider the SG catheter:
   a. During worsening heart failure/ hemodynamic instability, despite adequate treatment.
   b. For differential diagnosis during failed treatment for respiratory distress, hypotension, and or progressive renal failure.
5. Consider simultaneous monitoring of the pulmonary artery and right atrial pressures during severe right heart-related shock.
6. Encourage centers with low SG utilization to include and master its hemodynamic monitoring benefits.

REFERENCES

1. Frazier SK, Skinner GJ. Pulmonary artery catheters: state of the controversy. J Cardiovasc Nurs. 2008; 23 (2): 113-121; quiz 122-123. doi: 10.1097/01.JCN.0000305073.49613.db.
2. Carrillo-López A, Fiol-Sala M, Rodríguez-Salgado A. El papel del catéter de Swan-Ganz en la actualidad. Med Intensiva. 2010; 34 (3): 203-214.
3. Hadian M, Pinsky MR. Evidence-based review of the use of the pulmonary artery catheter: impact data and complications. Crit Care. 2006; 10 Suppl 3: S8. doi: 10.1186/cc4834.
4. Isseh IN, Lee R, Khedraki R, Hoffman K. A critical review of hemodynamically guided therapy for cardiogenic shock: old habits die hard. Curr Treat Options Cardiovasc Med. 2021; 23 (5): 29. doi: 10.1007/s11936-021-00903-8.
5. American Society for Quality. Available in: https://asq.org/quality-resources/nominal-group-technique
6. Delphi Technique a Step-by-Step Guide. 2021. Available in: https://www.projectsmart.co.uk/delphi-technique-a-step-by-step-guide.php
7. Sample JA. Nominal group technique: an alternative to brainstorming. J Ext March. 1984; 22 (2).
8. Thangaritam S, Redman CWE. The Delphi technique. Obstet Gynaecol. 2005; 7 (2): 120-125.

9. International Committee of Medical Journal Editors. Defining the role of authors and contributors. Available in: http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html
10. Baran DA, Grines CL, Bailey S, Burkhoff D, Hall SA, Henry TD et al. SCAI clinical expert consensus statement on the classification of cardiogenic shock: This document was endorsed by the American College of Cardiology (ACC), the American Heart Association (AHA), the Society of Critical Care Medicine (SCCM), and the Society of Thoracic Surgeons (STS) in April 2019. Catheter Cardiovasc Interv. 2019; 94 (1): 29-37. doi: 10.1002/ccd.28329.
11. Hrymak C, Strumpher J, Jacobsohn E. Acute right ventricle failure in the intensive care unit: assessment and management. Can J Cardiol. 2017; 33 (1): 61-71. doi: 10.1016/j.cjca.2016.10.030.
12. Ponamgi SP, Maqsood MH, Sundaragiri PR, DelCore MG, Kanmanthareddy A, Jaber WA et al. Pulmonary artery catheterization in acute myocardial infarction complicated by cardiogenic shock: A review of contemporary literature. World J Cardiol. 2021; 13 (12): 720-732. doi: 10.4330/wjc.v13.i12.720.

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