

**Letter to
the Editor**

Beyond the Delusory Machine of Goal-Directed Perfusion: A Holistic Approach to Oxygen Delivery in Cardiac Surgery

Ignazio Condello **Dear Editor**

I would like to commend the authors of the manuscript titled “Intraoperative Goal-Directed Perfusion in Cardiac Surgery with Cardiopulmonary Bypass: The Roles of Delivery Oxygen Index and Cardiac Index” for their insightful and well-structured analysis. This study highlights the significant benefits of Goal-Directed Perfusion (GDP) protocols in optimizing patient outcomes during cardiopulmonary bypass (CPB) in cardiac surgeries. The findings underscore the efficacy of GDP in reducing ICU stay duration, hospital length of stay, and postoperative complications. Such evidence supports the implementation of GDP as a standard practice, promising enhanced patient recovery and overall healthcare efficiency.¹⁾ Your work sets a strong foundation for future research and clinical application in this crucial area of cardiac care. However, I would like to bring to your attention the often-overlooked aspect of preoperative oxygen debt in patients undergoing cardiac surgery. These patients, due to mechanical ventilation, altered venous return, valvulopathies, depressed ejection fractions, and pulmonary hypertension, typically present with low cardiac output even before surgery. While GDP during CPB can partially compensate for this oxygen deficit, adverse

conditions such as anemia and prolonged CPB times may hinder full compensation. Additionally, inflammation, microcirculatory alterations, microembolic gas activity, the effects of anesthetics, and hemodilution during CPB can further exacerbate this condition. In addition, it is concerning that, according to a recent survey, only 40% of intensivists worldwide use the Swan–Ganz catheter to monitor cardiac output. This indicates a significant gap in the comprehensive monitoring necessary for optimal oxygen delivery management. Therefore, it is imperative to consider a more holistic approach encompassing preoperative, intraoperative, and postoperative phases. Addressing the oxygen deficit in the preoperative phase, along with implementing targeted therapies postoperatively—such as fluid management, inotropes, and phosphodiesterase inhibitors can further optimize patient outcomes. Given the comprehensive benefits observed with GDP, I believe extending the scope of research to include preoperative and postoperative oxygen management would provide a more complete strategy for improving cardiac surgery outcomes. This approach can potentially lead to even greater reductions in mortality and enhance patient recovery trajectories. I am keen to hear the authors’ perspectives on this holistic approach and the potential integration of extended oxygen management protocols in future research and clinical practice. Once again, congratulations on your valuable contribution to the field. Your work is a significant step forward in enhancing the standards of care in cardiac surgery.

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Reference

- 1) Pratomo BY, Sudadi S, Setianto BY, et al. Intraoperative goal-directed perfusion in cardiac surgery with cardiopulmonary bypass: the roles of delivery oxygen index and cardiac index. *Ann Thorac Cardiovasc Surg* 2024; **30**: 23–00189.

Repl to Condello

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We appreciate the thoughtful comments provided in the letter.

We agree that the primary objective in managing critically ill patients is to ensure the balancing of oxygen consumption with oxygen demand on an individual basis. The challenge is that the availability of proper standardized monitoring is greatly variable, from non-invasive (plethysmograph) to invasive monitoring (Swan–Ganz).

Our manuscript “Intraoperative Goal-Directed Perfusion in Cardiac Surgery with Cardiopulmonary Bypass: The Roles of Delivery Oxygen Index and Cardiac Index” focused on the use of CPB in cardiac surgery because CPB standard operational had not been established. And we know that CPB has an important role in cardiac surgery, mainly to make sure the body’s metabolism is functioning well. So, we need to make a meta-analysis of Cardiac Index or oxygen delivery monitoring in CPB compared with a conventional method. As a result, we have the advantage of using individual Cardiac Index or oxygen delivery monitoring in cardiac surgery. We also concur that improving oxygen delivery can significantly reduce morbidity in cardiac surgery. Comprehensive perioperative monitoring of the Cardiac Index, encompassing preoperative, intraoperative, and postoperative phases, can indeed serve as a guideline for fluid therapy, inotropic support, or vasoactive treatments. We appreciate the feedback and look forward to incorporating these considerations into future research and clinical practices.