# Review of: "Ventriculo-Arterial Coupling Is Associated With Oxygen Consumption and Tissue Perfusion in Acute Circulatory Failure"

carmine dario vizza[1], Giovanna Manzi

1 Sapienza University of Rome

Potential competing interests: The author(s) declared that no potential competing interests exist.

In the postoperative period of cardiac surgery, blood loss, third space fluid loss due to cardiopulmonary bypass induced inflammation or transient cardiac stunning can cause hemodynamic instability.

Fluid challenge, inotrope and vasopressor support are pivotal to restore hemodynamic stability increasing oxygen consumption ($VO_2$) rate and thus guaranteeing the perfusion of target organs.

With the aim to investigate baseline parameters associated with $VO_2$ responsiveness after hemodynamic therapeutic intervention, Andrei S. et al. performed an observational cohort study in a university affiliated cardiothoracic ICU between 2015 and 2017, enrolling 61 mechanically ventilated patients needing fluid challenge and/or norepinephrine infusion [1].

Maintaining the same ventilator settings during the study period, the authors evaluated VA coupling, assessed by echocardiography, and oxygenation parameters (e.g. $DO_2$ and $VO_2$). The research showed that, independently of the hemodynamic intervention used, $VO_2$ responders had at baseline lower LVEF and higher Ea/Ev ratio.

In this way, the paper highlighted the importance to assess VA coupling in cardiological intensive care units, supporting current literature.

Guinot and colleagues previously demonstrated that baseline Ea/Ev ratio predicts stroke volume (SV) increases in response to norepinephrine infusion in cardiac postoperative hypotensive subjects. That is, norepinephrine infusion corrects arterial hypotension in all subjects but improves SV only in patients having an altered VA coupling, thus having mainly inotropic effects in patients with baseline left ventricle dysfunction [2].

Moreover, recent studies showed the prognostic value of VA coupling in critical setting, reporting its usefulness in the identification of patients at risk of early in-hospital events such as need for intra-aortic balloon pump or continuous renal replacement therapy or death [3].

However, studies reporting the VA coupling ability to predict $VO_2$ responsiveness are lacking thus the authors tried to fill this gap.

Despite some limitations, the paper is thought-provoking, mainly about the choice of pharmacological support. The Authors evaluated the effects of fluid challenge and norepinephrine on systemic oxygenation parameters. Theoretically norepinephrine infusion, causing an increase in Ea without a concomitant significant rise in Ev, should worsen VA coupling. Conversely, inotropes such as dobutamine and levosimendan could increase Ev without increasing Ea, improving cardiovascular performance. In this regard, Guarracino et al. tested the effects of levosimendan on VA coupling in 15 patients with stable angina and LV dysfunction before elective coronary surgergy. Levosimendan administration

optimized VA coupling, acting both as vasodilator and as inotrope, resulting to be favorable for these patients [4]. Clinicians may be interested in knowing the effects of dobutamine and levosimendan on $VO_2$ in critically ill patients.

In conclusion, non-invasive assessment of VA coupling, index of cardiovascular performance, is welcomed in cardiological intensive care units to gauge patients' prognosis and to guide clinical decision making. In this context smartphone applications can support physicians in the mathematical calculations. A brief discussion reporting the effects of the main vasopressors and inotropes on VA coupling and on systemic oxygenation, with the underlying pathophysiological actions, may be useful to guide clinicians in therapeutic decisions.

***References***

1. Andrei S, Nguyen M, Longrois D, Popescu BA, Bouhemad B, Guinot PG. Ventriculo-Arterial Coupling Is Associated With Oxygen Consumption and Tissue Perfusion in Acute Circulatory Failure. Front Cardiovasc Med. 2022;9:842554. Published 2022 Feb 23. doi:10.3389/fcvm.2022.842554
2. Guinot PG, Longrois D, Kamel S, Lorne E, Dupont H. Ventriculo-Arterial Coupling Analysis Predicts the Hemodynamic Response to Norepinephrine in Hypotensive Postoperative Patients: A Prospective Observational Study. Crit Care Med. 2018;46(1):e17-e25. doi:10.1097/CCM.0000000000002772
3. Trambaiolo P, Figliuzzi I, Salvati M, et al. Ventriculo-arterial coupling in the intensive cardiac care unit: A non-invasive prognostic parameter. Int J Cardiol. 2022;348:85-89. doi:10.1016/j.ijcard.2021.12.026
4. Guarracino F, Cariello C, Danella A, et al. Effect of levosimendan on ventriculo-arterial coupling in patients with ischemic cardiomyopathy. Acta Anaesthesiol Scand. 2007;51(9):1217-1224. doi:10.1111/j.1399-6576.2007.01428.x