Intensive Care Med (2017) 43:1438–1439
DOI 10.1007/s00134-017-4836-7

CORRESPONDENCE

The dynamic arterial elastance: a call for a cautious interpretation

Discussion on "Predicting vasopressor needs using dynamic parameters"

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Initial correspondence from Drs. Jozwiak, Monnet and Teboul

Dear Editor,
We read with great interest the article by Monge García et al. [1] that emphasizes the ability of dynamic arterial elastance (Ea_{dyn}), defined as the pulse pressure variation (PPV)/stroke volume variation (SVV) ratio, to predict the mean arterial pressure (MAP) response to volume expansion in preload-responsive patients.

However, we want to point out two issues, which should temper the authors' enthusiasm. First, to avoid any mathematical coupling, PPV and SVV must be simultaneously obtained from two independent signals: for instance, the arterial pressure curve for PPV and the esophageal Doppler signal for SVV, as suggested by the authors [1]. However, it is unrealistic to apply this approach in patients with shock, where arterial pressure monitoring is used either alone or, in complex cases, in combination with an advanced hemodynamic monitoring technology but not with esophageal Doppler [2]. If transpulmonary thermodilution systems are used, it could be tempting to use the pulse contour-derived SVV in the denominator of the Ea_{dyn}, with inherent misinterpretation of Ea_{dyn}.

Second, according to the authors [1] and as supported by previous data [3], a low Ea_{dyn} would predict that fluid administration cannot increase MAP, even in cases of preload responsiveness. We are scared that a low Ea_{dyn} value would discourage clinicians from infusing fluids, with inherent risks of under-resuscitation. It should be more clearly stated that a low Ea_{dyn} should not contraindicate administration of fluids in preload-responsive patients but rather should suggest initiation of vasopressors in combination with fluid infusion.

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Reply from Drs. Monge García, Pinsky and Cecconi

We thank Drs. Jozwiak, Monnet and Teboul for their valuable comments on our editorial "Predicting vasopressor needs using dynamic parameters" recently published in *Intensive Care Medicine* [1]. They emphasized a potential mathematical coupling on dynamic arterial elastance (Ea_{dyn}) calculation when using pulse pressure-derived stroke volume variation (SVV), since both SVV and pulse pressure variation (PPV) are obtained from the arterial pressure waveform. Their argument is not sound from a mathematical point of view.

Mathematical coupling is a concept in which one would wrongly accept the agreement between two variables measuring physiologically related parameters without realising that the two variables are indeed coupled. For instance, validating the agreement of PPV vs SVV as markers of fluid responsiveness using the same monitor would be an example of mathematical coupling.

On the other hand, the use of PPV and SVV to predict changes in PP and SV or CO is not affected by mathematical coupling since the variables are used to study different physiological aspects (i.e. prediction vs response). In practice, the fact that two variables are measured by the same device does not mean that their use is necessarily mathematically coupled. The same authors have already published several papers using identical technology and methodology [4].

The argument of mathematical coupling would hold if Ea_{dyn} as the ratio between PPV and SVV would not change in different clinical situations. Let us hypothesise a study in which Ea_{dyn} stays the same in each patient despite changes in arterial load as a result of fluid loading or use of vasopressor. If pulse pressure-derived SVV were mathematically coupled to PPV (they are indeed physiologically coupled), Ea_{dyn} should therefore not discriminate between responders and non-responders [5] and that could explain why a monitor would fail to track these changes.

We agree that the reliability of Ea_{dyn} depends on how the pulse contour algorithm estimates stroke volume (SV) and its changes over a respiratory cycle. If this estimation is reliable, Ea_{dyn} should be valid and reflect the dynamic changes in arterial load.

We agree that the goal of fluids during hemodynamic optimization is not only to improve mean arterial pressure but also to increase cardiac output and oxygen delivery to the tissues. In this context, Ea_{dyn} could help to decide if a hypotensive preload-responder patient will require only fluids or fluids and vasopressors.

Finally, scientific knowledge progresses with new discoveries being made, even when their applicability at the bedside may not be ready yet.

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Compliance with ethical standards

Conflicts of interest

JLT and XM are members of the medical advisory board of Pulsion Medical Systems. MJ has no conflict of interest to declare.

Accepted: 6 May 2017
Published online: 11 May 2017

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