Author's response to reviews

Title: Arterial dP/dtmax accurately reflects left ventricular contractility during shock when adequate vascular filling is achieved.

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Version: 2 Date: 22 December 2011

Author's response to reviews: see over
Reviewer's report

Title: Evaluation of left ventricular contractility in endotoxin-induced shock using arterial dP/dtmax

Version: 1 Date: 31 October 2011

Reviewer: Inez Rodrigus

Reviewer's report:

The only remark/question I have for the authors is the following:

Is there enough evidence to use a PPV cut-off value of 11%? It seems that you only mention one reference, but it is used as a key number in your paper.

As the purpose of our experiment was not to predict fluid responsiveness, it was not possible to determine the optimal PPV cut-off value. However, we think that there was enough evidence to consider that adequate vascular filling was obtained when PPV ≤ 11%. Indeed, the PPV cut-off value of 12% (hence, adequate vascular filling corresponding to PPV ≤ 11%) is the best discriminative value in clinical settings. We add 3 references: 21-22-23.

- p. 6, first paragraph

Sentence suppressed:

On the basis of clinical settings, it is usually recognized that adequate vascular filling is achieved when PPV is ≤ 11% [20].

Sentences added:

Adequate vascular filling was defined as PPV ≤ 11%. On the basis of clinical settings, this PPV threshold value allows the best discrimination between responders and nonresponders to intravascular fluid administration[20-23].

Reviewer's report

Title: Evaluation of left ventricular contractility in endotoxin-induced shock using arterial dP/dtmax
In this manuscript Morimont P et al investigated whether arterial dP/dt obtained by using fluid filled catheters can be used to assess LV contractility status in an experimental model of shock induced by lipopolysaccharide administration in pigs. They found a significant correlation between arterial dP/dtmax and end-systolic elastance (Ees) as well as arterial and LV dP/dtmax. This correlation was even better when adequate vascular filling was achieved. However, correlation between LV dP/dtmax and Ees did not significantly change when adequate vascular filling was achieved. The main weakness I found in the manuscript is the originality. Previous studies performed in patients already showed that Aortic dp/dt(max) and LV dp/dt(max) are closely correlated through the vascular loading properties and LV dp/dt(max) can be derived from Ao dp/dt(max), which has potential as a noninvasive method of determining LV contractility (Masutani et al Circ J 2009; 73(9):1698-704). Moreover, De Hert SG et al (J Cardiothorac Vasc Anesth 2006; 20(3):325-30) also showed that changes in arterial dP/dt max and LV dP/dt max are positive correlated which arterial dP/dt max can be used as estimation of cardiac contractility. Thus, the only new information of the manuscript is the match of a load independent index of systolic performance (Ees) with arterial dP/dtmax.

In contrast to previous studies, the originality of our research lies in the influence of vascular filling on the accuracy of dP/dt_{max} to predict LV contractility. To our best knowledge, this is the first study that analyzes the influence of vascular filling assessed with PPV method on arterial dP/dt_{max}. 

1. We change the title in order to emphasize this key point:
Evaluation of left ventricular contractility in endotoxin-induced shock using arterial dP/dt max

Arterial dP/dt max accurately reflects left ventricular contractility during shock when adequate vascular filling is achieved.

2. We further discuss our approach in contrast to previous studies:

- P.6, last sentence and P.7, first paragraph

Paragraph modified (sentences added):

In perioperative patients, De Hert et al. showed that changes in femoral dP/dt max accurately reflected changes in LV dP/dt max during various interventions. However, absolute values of LV contractility are required for potential ventriculo-arterial interaction analysis [24]. These authors also found that leg elevation induced significant increase in central venous pressure and LV end-diastolic pressure, but arterial and LV dP/dt max remained unaltered [18]. However, it is well recognized that static indices (like central venous pressure or LV end-diastolic pressure) are poor indicators of vascular filling and preload responsiveness [11]. Masutani et al. showed that LV dP/dt max can be predicted from aortic dP/dt max but their method requires aortic impedance which is difficult to calculate in clinical practice[25]. Therefore, assessing LV contractility from arterial dP/dt max when adequate vascular filling is achieved, could be a simple and accurate method with the potential for ventriculo-arterial interaction analysis.

Major Compulsory Revisions

1) Results section (Page 5): During state of shock Ees, arterial and LV dP/dt max decreased. Were those differences statistically significant?

Yes, during the state of shock, Ees, arterial and LV dP/dt max significantly decreased (p < 0.05).

2) Again, after catecholamine infusion the increase of those parameters is statistically significant?
Yes, after catecholamine infusion, Ees, arterial and LV dP/dt\textsubscript{max} significantly increased (p < 0.05).

3) To show LV performance parameters as figures would be easier for readers for understanding the results specifically pre and post treatment.

As suggested, we add a figure showing the time course of LV contractility assessed by both methods:

- P. 5, third paragraph, modified

The effects of endotoxin infusion and catecholamine administration on arterial pressure, HR, ejection fraction (EF) and cardiac output (CO) are summarized in Table 1. *The evolution of LV contractility assessed by both Ees and arterial dP/dt\textsubscript{max} is shown in Figure 1. The endotoxin induced significant decrease in LV contractility, Ees significantly decreased from 1.63 ± 0.4 to 1.18 ± 0.55 mm Hg/mL during the state of shock. Arterial and LV dP/dt\textsubscript{max} significantly decreased from 1004 ± 41 and 2414 ± 514 to 795 ± 305 and 1235 ± 224 mm Hg/sec, respectively. However, *during* catecholamine infusion was responsible for significantly increased LV contractility, Ees significantly increased to 2.5 ± 0.77 mm Hg/mL and arterial and LV dP/dt\textsubscript{max} significantly increased to 1872 ± 491 and 3181 ± 485 mm Hg/sec, respectively.

- Figure 1, added

*Figure 1. LV contractility assessed by both Ees and arterial dP/dt\textsubscript{max} Basal conditions (‘basal’), immediately after endotoxin infusion (‘endo’), during shock with and without catecholamine infusion (‘catechol’ and ‘shock’ respectively). Values are given as mean ± SD. All directional changes in contractility were significant (p < 0.05) for each challenge, except between ‘basal’ and ‘endo’.*

4) Did the authors match arterial dP/dt\textsubscript{max} with other load independent indices such as dP/dt\textsubscript{max}-end diastolic volume relation and preload-recruitable stroke work (PRS\textsubscript{W})?

We did not compare arterial dP/dt\textsubscript{max} with other load independent indices because Ees is considered as the reference method for assessing LV contractility.