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The authors reply:

We have been very interested by the comments of Dr. Brimioulle and colleagues regarding our study recently published in this journal (1). It is noteworthy that contractility remains one of the fundamental ventricular mechanical characteristics that cannot be directly assessed and explains the abundance of methods proposed to distinguish between cardiac performance and ventricular contractility, per se. The slope of the end-systolic relationship obtained from pressure-volume loops generated when varying either preload or afterload has obtained some general agreement from the scientific community. However, the transposition of such a method to the clinical setting remains problematic. To significantly simplify the methodology, several authors have proposed assessing contractility with sufficient accuracy by using a single-beat approach (2). The main advantage of this method is that it requires only recording of the ventricular pressure wave while precluding the need for continuous ventricular volume measurement. However, due to the absence of actual validation, in particular regarding the right ventricular dynamics, the prominent goal of our work was to compare computations of ventricular contractility in various experimental conditions based on the single-beat method with those simultaneously provided by using the multiple-beat method, referred to as the gold standard. The comments of Dr. Brimioulle and colleagues are essentially relative to the accuracy of volume measurements, therefore questioning the validity of our conclusions. In particular, Dr. Brimioulle and colleagues pointed out that the isovolumic phase of ventricular contraction was not really observed. Although we agree with their pertinent comments, observation of the lack in strictly isovolumic ventricular contraction is not necessarily due to poor accuracy in volume measurements but also may result from blood regurgitation through the tricuspid valve. Whatever the real mechanism involved to explain the change in ventricular volume during theoretical isovolumic phase, it is important to note that the single-beat method is based on the fitting of the pressure wave with a sinusoidal function, regardless of the quality in assessing the volume change profile. To obtain peak isovolumic ventricular pressure, as an extrapolation of the beating ventricle, we used standard and well-established fitting routines as available in Matlab (Levenberg-Marquardt procedure). In this way, we considered the onset of isovolumic contraction at the point where right ventricular change in pressure reached 10% of peak positive change in pressure over time, as mentioned in the Methods section, although we apologize if this was not properly represented in the corresponding illustration.

By using the single-beat method, we failed unfortunately to observe any significant change in ventricular contractility during positive pharmacologic manipulations of the right ventricular chamber (1). We hypothesize that, regardless of the fitting method used, the weakness of the single-beat method lies in the assumption that ventricular pressure profile during ejection can be really converted into a symmetrical sinusoidal wave. Our conclusions are similar to those of others who tested such an approach to gain more information about left ventricular characteristics (3). Nevertheless, we remain interested in any protocol aimed at exploring further resources to improve the methods of analyzing ventricular mechanics.

Bernard Lambermont, Patrick Segers, Vincent D'Orio, University Hospital of Liege, Medical Intensive Care Unit, Liege, Belgium

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AUTHOR QUERIES

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