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1. One Monitoring Device Does Not Fit All

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3. Limitation of monitoring devices

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6. Enrico Giustiniano is an Edwards Lifescience European Proctor for Acumen monitoring system

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One monitoring device does not fit all

- Letter to the Editor -

we read with interest the paper by Yahagi et al. [1] about the reliability and the agreement of the cardiac output measurement between the ClearSight non-invasive method connected to the EV1000 Clinical Platform (Edwards Lifesciences, Irwin, CA, USA) and the pulmonary artery catheter (PAC) thermodilution method connected to the Monitor KitTM (Edwards Lifesciences, USA) in patients submitted to transcatheter aortic valve implantation (TAVI).

The Authors concluded that the non-invasive method “is not as accurate as transpulmonary thermodilution for measuring CO. Therefore, ClearSight cannot be used in patients with severe AS undergoing TAVI”.

Although we congratulate the Authors for the painstaking work and agree with their conclusion, we consider that some topics are worthy of discussion and clarification.

In our opinion, TAVI is not the proper setting to compare ClearSight and PAC methods since they provide measurements in two different points of the circulation: downstream and upstream of the aortic valve, respectively. The surgical maneuvers, during the aortic valve placement, alter the blood pressure waveform and consequently its pulse contour analysis and CO computing. Further, the PAC measures the right ventricle cardiac output, while the ClearSight measures the left ventricle cardiac output. These two CO measurements should be equivalent if the tricuspid and aortic valve are normal. On the contrary, in case of tricuspid regurgitation (for the PAC) and aortic stenosis and/or regurgitation (for the ClearSight), the CO measurements can be profoundly affected. The Authors cited the issue of aortic regurgitation among the limitations of the study, but they would have better
clarified the issue of the aortic valve diseases affecting the measurements. Then, such differences should have been expected, even without a specific targeted study.

Moreover, blood pressure, that is the result of the interaction between heart, blood volume and circulatory bed, is notoriously expected to be different when measured invasively or not invasively [2].

Conversely, Wang et al. [3], found an acceptable agreement and discrepancy between these two methods of hemodynamic monitoring in cardiac surgery. The Authors, using the same devices in a larger sample, found that the mean ClearSight CO was 4.21 L/min, and the mean PAC CO was 3.90 L/min while the mean bias was 0.32 L/min, with a 95% confidence interval of 0.22–0.42 L/min, and a percentage error as low as 26.4%. We guess that Wang and colleagues considered the limitations of comparing two different sites of measurement of CO along with the issue of the valvular disease because they excluded patients with cardiac valvular disease (tricuspid and aortic valves).

In addition, method used to average the ClearSight CO by Yahagi et al. may be questioned, since they considered just two values to compute an average value of ClearSight CO, whilst they average 6 values to compute an accurate PAC CO.

We also believe that the systemic vascular resistances (SVR) analysis deserves some comments. Today, the SVR (or SVRI if indexed) measurement is a debatable issue. As reported by Magder, the principles behind SVRI computation are not applicable to human circulation: the Poiseuille’s Law implies that resistance within a pipe is determined by the ratio of the pressure gradient between the two ends over the inside flow. Human circulation cannot be considered as a pipe or an electric circuit. In fact, this oversimplification does not consider the auto-regulatory mechanisms, one for each organ, which make the blood flow vary according to the tissue demand, and that we cannot “measure” bedside, so far [4,5]. Furthermore, these mechanisms are differently affected by anesthesia or diseases. Thus, the standard SVRI computation method is limited and is not so helpful, if not
misleading, for hemodynamic assessment. In addition, from a mere mathematical perspective, computing SVRI value from CO to explain the discrepancy between the CO measurements is redundant and cannot lead to any significant finding.

In conclusion, we consider that in general and if properly employed, the non-invasive method of CO measurements can be helpful and reliable for the intraoperative assessment and management of hemodynamics. Clearly, the operator should know pros and cons along with the limitations of such device. The surgical setting must be considered one of the most important factors that can limit the reliability of hemodynamic assessment. Finally, we want to emphasize that the cardiac index should be preferred over the CO, as it represents a more patient-related value of blood flow.
References


