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Assessment of agreement and trending between haemodynamic monitors is still challenging

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Dear Editor,

We read with interest the article by Petzoldt et al. [1] who evaluated agreement and trending between three less invasive methods and transoesophageal echocardiography (TEE) in terms of stroke volume in patients with aortic valve dysfunctions. The authors found a coefficient of error (CE) of 3.6 ± 3.0 % for their reference method TEE, resulting in a precision of 7.2 % ($2 \times \text{CE}$). Bland–Altman analysis revealed percentage errors (PE) for the transpulmonary thermodilution (TPTD) of 14.9 % in the TPTD as a valid method in severe PE's of 26.3 and 26.2 % in aortic stenosis and insufficiency, respectively. The authors concluded that there was a tolerable agreement between TEE and TPTD as the PE fell in a range of ± 30 % [2] and therefore stated that the TPTD is a valid method in severe aortic stenosis (AS) and valvulopathy-induced aortic insufficiency (AI). The benchmark at ± 30 % (± 28.3 % to be more precise) refers to the assumption that intermittent thermodilution (ITD) by the pulmonary artery catheter has a precision of ± 20 % and means that if PE lies within a range of ± 30 %, methods are interchangeable with ITD as

they show a comparable individual error. In this study, TEE showed a superior precision (7.2 %) than ITD and, consequently, redetermining the range of an acceptable PE could be considered [3]. Claiming the new methods to have at least the same individual error as the TEE would result in an acceptable PE of ± 10.2 %. Applying this cut-off to the data, none of the three less-invasive techniques would be valid in comparison with the reference method TEE in terms of normal prosthetic valve function, as well as in AS and valvulopathy-induced AI.

Petzoldt and colleagues also evaluated trending of the less-invasive methods in comparison to TEE using the polar plot analysis [4]. In this analysis, paired data of the changes displayed by the monitors are converted to polar coordinates where agreement is shown by the angle with the polar axis (0° or 180° , respectively) and the magnitude of the change in stroke volume by the distance from the origin. To analyse and visualize good and acceptable trending, Petzoldt et al. [1] additionally drew horizontal lines at ± 10 and ± 20 % of the change of stroke volume within the polar plot and calculated the percentage of values lying within the horizontal 10 % limits. This analytical approach revealed a high percentage of values lying within these predefined limits for all three less-invasive methods (72–100 %) in comparison with TEE. This result led the authors to conclude that all of the test methods showed an acceptable ability to detect changes in stroke volume in patients with aortic valve dysfunction. Most strikingly, their polar plot analysis between TEE and TPTD in AS on the one side and between TEE and uncalibrated pulse contour analysis in AI on the other side showed the same percentage rate of 89 %, suggesting a comparable acceptable trending ability of both

methods. As the polar plot analysis is based on the conversion of the haemodynamic change to a radial vector, we would like to raise the issue if a horizontal line for the limits of agreement might be appropriate.

Conflicts of interest All conflicts of interests are declared. The authors declare no related conflict of interest. The ICMJE Form for Disclosure of Potential Conflicts of Interest and the Conflict of interest form are available to the Editorial Office.

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