Focus on flow: Imaging the human microcirculation in perioperative and intensive care medicine

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Citation for published version (APA):

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Chapter 4

Quality and Consistency in Microvascular Research
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British Journal of Anesthesia, 2009; 102: 886
Letter

We read the recent article by Maier and colleagues [1], in which they assess the microcirculatory effects of phenylephrine during cardiopulmonary bypass. The authors are to be commended for focussing their research on the microcirculation, as that is where actual delivery of oxygen and nutrients to tissue takes place. Their study adds to the body of evidence that systemic haemodynamic measurements do not necessarily reflect microvascular perfusion. However, having extensive experience with the technique used by the authors to visualize the microcirculation, that is, sidestream dark-field (SDF) imaging, we feel the following comments may be of great importance. Many different scoring systems and video acquisition procedures have been developed in microcirculation research. This has the potential for hampered comparison between similar studies, or worse, false conclusions. This is why a round table conference was held in 2006. Using the Delphi methodology, a vast number of recommendations were made in order to improve quality and consistency in microvascular research [2].

Unfortunately, the authors did not fully adhere to these recommendations. Although there are multiple differences from the consensus statement, two may be critical and are discussed below. First, it was recommended to measure at least three, but preferably five sites, per patient per time point, because of the intrinsic variability of the microcirculation. This also allows for better reporting of an index of heterogeneity. The latter is not stated and they only measured two sequences per time-point. It is therefore possible that the measurements they have made do not truly represent the state of the microcirculation. This may be reflected by the unexpectedly low baseline microvascular flow index (MFI) of 2.5 in anaesthetized patients before cardiopulmonary bypass. Secondly, it was recommended to report both MFI, as the authors did, and an index of functional capillary density, which was omitted. The problem with this is that MFI is a semi-quantitative way to describe microvascular flow but does not take into account the number of vessels per area. This is important because with SDF imaging, different imaging sites are used at different time points which may hence have different capillary densities. Obviously from a perspective of oxygen and nutrient delivery to tissue, a large capillary density with some sluggish and some continuous flow would be preferable over very low capillary density albeit with only continuous flow. Because an index of perfused vessel density was not reported, the given MFI values may not truly represent the state of the microcirculation. Of course, trade-offs have to be made in microvascular research between detail of analysis and the time it takes to perform the analysis. However, it was recently suggested that using a fast-track analysis approach, it is quite reasonable to report on both indices of microvascular perfusion [3].

In summary, failure to adhere to the recommendations mentioned above may have led to a biased representation of the microcirculation. This is not to say that the results are false by definition. However, we feel that they should be approached with caution. Their conclusion would be greatly strengthened by reporting on more microvascular sites per time point and by extending the analysis to include an index of functional capillary density. Although the former is not feasible, it is relatively easy to perform the latter using the existing videos of
the microcirculation. Therefore, we would strongly recommend the authors to do so.

References

