Study of the heterogeneity of cardiovascular function should extend to the human cerebral circulation

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TO THE EDITOR: In a recent issue of this journal, Charkoudian et al. (3) contended that variation between individuals is often regarded as a limitation on our ability to detect statistically significant differences. This dogma has been canonized through a preference for positive results and preference for data with low intersubject variability. That it is the integrated control through multiple mechanisms that facilitates homeostasis, however, does not obviate a functional variation between individuals in the relative magnitudes of these mechanisms. Indeed, there are much data to suggest that it is precisely this variability that, despite being generally disregarded, offers insight into the integrative function of physiological control systems.

The inverse relationship exhibited by the principle determinants of blood pressure (cardiac output and total peripheral resistance) is but one example where magnitudinal intersubject variation reflects the balance between mechanisms that yields a common physiological endpoint, in this case, mean arterial pressure that has relatively low intersubject variation. Charkoudian et al. (3) extended this idea, one which they have been promoting for at least 5 yr, to show that interindividual variability in hemodynamic control mechanisms is not only important in humans (2), but also in an animal model.

Recent data extend this notion to cerebral blood flow (CBF) control. Tzeng et al. (4) demonstrated an inverse relationship between cerebral autoregulation (CA) and baroreflex sensitivity (BRS). This study suggests that CA is augmented in individuals with lower BRS, hypothetically, to maintain adequate cerebral perfusion despite changes in perfusion pressure. Although these data do not address causality, they suggest that, like cardiac output and total peripheral resistance that reciprocally compensate to control mean arterial pressure, they counterbalance one another such that CBF is maintained. These findings may not come as a surprise, given effective CBF regulation certainly requires adequate maintenance of perfusion pressure by the arterial baroreflex. And yet, it is most common for only CA or BRS to be assessed, with only a handful of studies having measured both (1). As Charkoudian et al. (3) have implied for cardiovascular research, these findings advocate a paradigm shift in the way cerebrovascular research is considered. Take, for example, attempts to define “impaired” CA under various physical states [e.g. poststroke, hypercapnia (1)]; without careful consideration of the interindividual variability in CA, and moreover, the reciprocal status of BRS, what can be considered normal?

Therefore, in keeping with the sine qua non of physiology research, we agree with Charkoudian et al. (3) that unique insights are likely to be gained through consideration of the interplay between multiple control variables. This is especially germane for integrative physiology research, given that homeostasis arises out of the synergism of multiple processes, not the singular efficacy of just one.

DISCLOSURES

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REFERENCES


