Letters To The Editor

Last Word: Point:Counterpoint author responds to “The classical Guyton view that mean systemic pressure, right atrial pressure, and venous resistance govern venous return is/is not correct.

To the Editor: Mitzner (4) considers the concept so obvious that he asks why we even needed to have this debate. I agree! The key point is that the elastic properties of the system impose limits on the capacity of the system, and the heart can never surpass these.

Permutt’s (4) analysis is based on an elastic compartment analogous to lungs. He emphasizes the crucial but difficult to comprehend concept of the isovolumetric pressure-flow relationship in a system of elastic and collapsible tubes that can create flow limitation. Personally, I never understood cardiovascular physiology until I was presented with this comparison to respiratory physiology and I recommend readers who are unfamiliar with it to consult J. F. Green’s monograph (2) and the paper by Permutt and Caldini (3).

Green (2) suggests the analogy of a toilet instead of a bathtub. Besides being less aesthetically pleasing, it misses the key point of isovolumetric conditions. Perhaps further consideration of the bathtub model may help emphasize the importance of the isovolume condition of the elastic region. When the tub is filled to the top, increasing the force or flow from the tap does not affect flow from the drain because the inflow cannot raise the height of the water in the tub.

Baker and Rothe (4) raise the issues of multiple bathtubs or varying positions of the MSFP and the localization of venous resistance. Whereas these comments are valid, a close approximation can be made by a lumped parameter model that deals with the weighted effects of the different compliant regions and what Mitzner (4) appropriately calls the “effective equivalent resistance.” The formal mathematical analysis for these was presented by Permutt and Caldini (3). The “fussy” concept of MSFP is essential for understanding the limits of the system. This debate is about steady-state conditions, although the concepts still apply in dynamic situations. Consider, for example, the model of Burkoff and Tyberg (1).

Wang’s (4) comments refer to pulsatile flow. Clearly the heart is the source of these pulsations, but this must not be confused with the total flow through the system. Humans have normal cardiac outputs without pulsatile flow on a daily basis in the cardiac surgery suite. However, the importance of the volume of the circuit is also very obvious in these patients when flow limitation occurs; pump flow then can only be increased by adding volume and thus increasing the elastic recoil pressure.

REFERENCES


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