

Infrarenal Aortic Cross-clamping and Renal Hemodynamics

To the Editor:—We have read with great interest the paper by Gamulin *et al.*¹ The study is well designed, and data clearly demonstrate that there were significant decreases in glomerular filtration rate and renal perfusion during and following aortic cross-clamping. However, we have certain reservations concerning the conclusion that infrarenal aortic cross-clamping was accompanied by a redistribution of renal blood flow toward the cortical compartment. Apparently, this conclusion was based on the rather subtle increase in hippuran extraction ratio (table 2) from 0.67 to 0.74 that occurred in association with the decrease in hippuran clearance. The interpretation is based on the assumptions that hippuran extraction is complete in the cortical compartment and absent in the medullary circulation and that the hippuran extraction ratio is related only to the relative perfusion rates of the cortex and medulla. This notion does not seem to be justified.^{2,3} Hippuran extraction in the cortex is dependent on several factors, including the plasma concentration of hippuran and the absolute perfusion rate.³ In essence, reductions in blood flow allow a prolonged exposure to the secretory mechanisms and could easily result in an increased efficiency of extraction. Therefore, it is inappropriate to conclude that the increased extraction ratio observed during and after cross-clamping implies that there was a “redistribution of the RBF toward the cortical compartment.” Indeed, other data in the literature suggest the opposite shift in renal blood flow from the cortical to the juxtamedullary compartments.⁴⁻⁶

In a recent study, 15- and 9- μm spheres were used to assess renal blood flow distribution. These experiments suggested a redistribution of renal blood flow toward the deeper nephrons following infrarenal cross-clamping.⁶ Other investigators using 15- μm spheres failed to observe shifts of intrarenal blood flow during infrarenal cross-clamping.⁷ This discrepancy probably is related to differences in methods. Results obtained by Cronenwett and Lindenauer⁷ agree with the fragment of the data from Gelman *et al.*⁶ that were gathered using 15- μm spheres: neither study showed significant shifts in renal blood flow distribution when it was determined with 15- μm spheres. It seems that the methods used in the latter study,⁶ involving assessment with two different sized microsphere sets, provided information that could not be obtained with microspheres of 15 μm in diameter only. The pathogenesis of the shift in intrarenal blood

flow from the cortical toward the juxtamedullary compartment may be related to an increase in renin release during aortic cross-clamping.⁸

In summary, the conclusion that infrarenal cross-clamping is accompanied by a shift of intrarenal blood flow toward the cortical compartment does not seem to be justified methodologically and does not fit other data in the literature either. The observations that infrarenal aortic cross-clamping in humans is accompanied by a severe reduction in total renal blood flow is well justified and is of clinical importance.

SIMON GELMAN, M.D., PH.D.

*Professor of Anesthesiology
Vice Chairman for Research
Department of Anesthesiology*

LUIS G. NAVAR, PH.D.

*Professor of Physiology and Biophysics
Nephrology Research and Training Center*

*The University of Alabama Medical Center
University Station
Birmingham, Alabama 35294*

REFERENCES

1. Gamulin Z, Forster A, Morel D, Simonet F, Aymon E, Favre H: Effects of infrarenal aortic cross-clamping on renal hemodynamics in humans. *ANESTHESIOLOGY* 61:394-399, 1984
2. Harvey RB: Effects of Acetylcholine infused into renal artery of dogs. *Am J Physiol* 211:487-492, 1966
3. Barger AC, Herd JA: Renal vascular anatomy and distribution of blood flow, *Handbook of Physiology: Section 8 (Renal Physiology)*. Edited by Orloff J, Berliner RW. Washington, D. C., American Physiology Society, 1973, pp 249-313
4. Abbott WM, Cooper JD, Austen WG: The effect of aortic clamping and declamping on renal blood flow distribution. *J Surg Res* 14:385-392, 1972
5. Abbott WM, Austen WG: The reversal of renal cortical ischemia during aortic occlusion by mannitol. *J Surg Res* 16:482-489, 1974
6. Gelman S, Patel K, Bishop S, Fowler KL, Smith LR: Renal and splanchnic circulation during infrarenal aortic cross-clamping. *Arch Surg* 119:1394-1399, 1984
7. Cronenwett JL, Lindenauer SM: Distribution of intrarenal blood flow following aortic cross-clamping and declamping. *J Surg Res* 22:469-482, 1977
8. Berkowitz HD, Shetty S: Renin release and renal cortical ischemia following aortic cross-clamping. *Arch Surg* 109:612-617, 1974

(Accepted for publication February 21, 1985.)