Molecular physiology of water balance

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TO THE EDITOR: In their review article on water balance, Knepper et al. (April 2 issue) discuss water channels (aquaporins) in renal tubular cells. They omit mention of the critical role played by aquaporin-1 in microvascular endothelia.

In the renal microvasculature, endothelial aquaporin-1 mediates the osmotic water efflux across descending vasa recta and is required for regulation of medullary blood flow, maintenance of the medullary interstitial gradient, and urinary concentrating ability. Aquaporin-1 is also highly expressed in the endothelium lining peritoneal capillaries, where it facilitates osmotically driven water transport during peritoneal dialysis. Peritoneal dialysis is a technique of renal-replacement therapy that is increasingly used worldwide to restore homeostasis, including water balance, in patients with end-stage renal disease. Studies in experimental models have shown that aquaporin-1 mediates up to 50% of ultrafiltration during peritoneal dialysis with crystalloid (glucose-based) solutions. In these models, pharmacologic regulation of aquaporin-1, either through induction with glucocorticoids or gating with furosemide-based compounds, enhances aquaporin-1–mediated water transport across the peritoneal membrane. These data show the important role of endothelial water channels in water homeostasis.

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THE AUTHORS REPLY: Morelle and colleagues point out several key roles of aquaporin-1 in microvascular endothelia that are relevant to our article. We agree with their points and add the following ones. Aquaporin-1 is strongly expressed in the endothelium of the descending vasa recta of the renal medulla. The resulting high water permeability of the descending vasa recta contributes to the countercurrent exchange process that permits perfusion of the renal medulla without dissipation of medullary solute gradients. Therefore, aquaporin-1 expression in the vasa recta is crucial to the ability of the kidneys to conserve water.

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