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Regulation of Collecting Duct AQP3 Expression : Response to Mineralocorticoid

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Adrenocortical steroid hormones are importantly involved in the regulation of extracellular fluid volume. The present study was aimed to examine whether aldosterone and/or glucocorticoid regulate the abundance of AQP-3, -2, and -1 in rat kidney. In protocol 1, rats were adrenalectomized followed by aldosterone replacement, dexamethasone replacement, or combined aldosterone and dexamethasone replacement (rats had free access to water but received a fixed amount of food). Protocol 2 was identical to protocol 1 except all groups received fixed daily food and water intake. In both protocol 1 and 2, aldosterone deficiency was associated with increased FENa and severe hyperkalemia. Semiquantitative immunoblotting revealed that aldosterone deficiency was associated with a dramatic downregulation of AQP3 abundance. Consistent with this, immunocytochemistry and immunoelectron microscopy revealed a marked decrease of AQP3 labeling in the basolateral plasma membranes of collecting duct principal cells. In contrast, AQP1 and AQP2 abundance and distribution was unchanged. Glucocorticoid deficiency revealed no changes in AQP3, -2, or -1 abundances. In protocol 3, sodium restriction (to increase endogenous aldosterone levels) or exogenous aldosterone infusion to either normal rats or vasopressin-deficient Brattleboro rats was associated with a major increase in AQP3 abundance. In protocol 4, aldosterone levels were clamped by infusion of aldosterone, while sodium intake was altered from low to a high level. Under these circumstances, there were no changes in AQP3 or AQP2 abundance, although the level of the Na-Cl cotransporter TSC was decreased. In conclusion the results uniformly demonstrate that aldosterone regulates AQP3 abundance independent of sodium intake. In contrast, changes in glucocorticoid levels in these models do not influence AQP3 or AQP2 abundance. Therefore, in the collecting duct aldosterone may regulate, at least in part, AQP3 expression in addition to regulating Na^+ and K^+ transport.