MECHANISMS AND REGULATION OF NaCl TRANSPORT IN THE RENAL TUBULES

Electrophysiological study of inner medullary collecting duct of hamsters

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Summary

Electrophysiological properties of the hamster mid-inner medullary collecting duct ($IMCD_2$) cells were examined in isolated and perfused preparations by the intracellular impalement with conventional 1 M KCl microelectrodes and the cable analysis. The transmural voltage (V_T) was not different from 0 mV, and the basolateral membrane voltage (V_B) was -82 ± 0.9 mV (n=221). The transmural resistance (R_T) was 109 ± 11 Ω cm^2, indicating that the $IMCD_2$ consists of tight epithelia. The fractional apical membrane resistance (fR_A) was 0.98 ± 0.003 (n=10). Abrupt changes in luminal concentration of Na^+, K^+ or Cl^- did not alter the apical membrane voltage (V_A) and V_T. Neither 2 mM Ba^{++} nor 10 mM amiloride in the lumen affected V_A and V_T. The pretreatment of hamsters with deoxycorticosterone acetate (5mg/kg, sc) for 10-14 days caused only very small negative V_T. Amiloride in the lumen increased RT voltage divider ratio very slightly. An abrupt increase in K^+ concentration in the bath from 5 to 50 mM and an addition of 2 mM Ba^{++} to the bath depolarized the basolateral membrane by 39 mV and 29 mV, respectively. Neither Cl^- nor HCO_3^- conductance was demonstrated in the basolateral membrane. Effects of ouabain added to the bath or elimination of K^+ from the bath in decreasing VB were very small in the $IMCD_2$ as compared to the marked responses observed in the medullary thick ascending limb of Henle's loop and in the upper portion of the descending limb of the long-looped nephron. These findings are compatible with the view that the weak Na^+-K^+ pump and K^+ conductance in the basolateral membrane may mainly account for the maintenance of intracellular concentration of Na^+ and K^+. The $IMCD_2$ may little contribute to the transmural transport of Na^+ and K^+.