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Ontogenetic analyses of calcium transport system and calcium-sensing receptors in developing kidneys

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Summary

Urine-concentrating ability is known to develop tremendously in the neonatal period. The nature of the development has recently been elucidated to be a qualitative change in its manner. In accordance with the achievement of urine-concentrating ability in the neonatal period, calcium transport system and calcium-sensing receptors in the kidneys show large changes in their properties, although their nature has not been clarified well.

To elucidate the nature of calcium metabolism in the neonatal kidneys, we focused our attention on calcium transport in the medullary thick ascending limb (mTAL) of Henle's loop, in which NaCl and calcium transport play important roles in urine-concentrating ability. The mTAL was microperfused in vitro in neonatal and adult mice kidneys. Intracellular pH (pHi) of the mTAL cells was measured by using microfluorescent dye BCECF. Neomycin (NEO), a calcimimetic agent for calcium-sensing receptor (CaSR), at a dose of 200 μM was applied to the mTAL cells. NEO acidified pHi from 7.29 +/- 0.04 (n=9) to 7.25 +/- 0.06 (n=7) in a minute when bathed in Hepes-buffered isotonic Ringer solution. Intracellular acidification was blocked by ambient Cl removal, whereas ambient Na removal or amiloride at 1mM in the basolateral solution did not affect the intracellular acidification by NEO. Bumetanide at 0.1 mM in the lumen did not affect NEO-induced acidification of the mTAL cells.

In the neonatal period, NEO did not decrease pHi on day 0 or day 1, whereas its acidifying effect emerged after day 7.

These results suggest that CaSR merge after the neonatal period and exerts Cl-dependent acidification, the role of which is still to be elucidated.