Role of a novel vasopressin receptor, Vp in intrarenal sodium transport and its pathophysiological significance

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Summary

Recently, we found a novel arginine vasopressin (AVP) receptor (Vp) in normotensive rat early proximal tubules (S_1) which was insensitive to the well-known V_1 and V_2 antagonists. To investigate a possible involvement of Vp receptor in hypertension, intracellular free calcium ($[Ca^{++}]_i$) and cellular ATP content were measured in S_1, medullary thick ascending limbs of Henle's loop (MTAL), and outer medullary collecting tubules (OMCT) isolated from young (4 week-old) and adult (14-16 week-old) Wistar-Kyoto (WKY) and age-matched stroke-prone spontaneously hypertensive (SHRSP) rat kidneys. AVP (10^{-7}M) transiently increased $[Ca^{++}]_i$, followed by sustained phase for 14-18 min in these nephron segments, except in S_1 from SHRSP. AVP (10^{-7}M)-induced $[Ca^{++}]_i$ transient in S_1 from SHRSP was significantly lower than that in S_1 from age-matched WKY, and the attenuation in adult rats was remarkably higher than that in young rats. $[Ca^{++}]_i$ transients by AVP in MTAL and OMCT from SHRSP were similar to those in MTAL and OMCT from age-matched WKY. DDAVP (10^{-7}M), a specific V_2 agonist, in MTAL and OMCT of both species transiently mobilized $[Ca^{++}]_i$, but not that in S_1 of both species. On the other hand, cellular ATP content in MTAL of WKY and SHRSP was significantly decreased by incubation with 10^{-7}M AVP under no substrate, but ATP in S_1 of WKY was conversely increased. Interestingly, cellular ATP contect in S_1 of adult SHRSP significantly decreased with the addition of 10^{-7}M AVP. These results suggest that Vp receptor stimulation in normotensive rat S_1 inhibits ATP-consuming ion tranport. Its property in hypertensive rat S_1 is gradually attenuated by aging. Accordingly, Vp receptor could be considered an important regulator involved in manifesting volume-expanded hypertension.