

실험쥐에서 여성호르몬에 의한 신장의 소듐 운반체 발현의 변화

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Effect of Female Sex Hormones on the Expression of Renal Sodium Transporters in Rats

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Introduction : Although a few animal experiments have suggested that sex steroid may alter renal sodium handling and expression of sodium transporters, conflicting results make their effects on the regulation of sodium complex. In the present study, we evaluated the effects of estradiol and progesterone on the expression of sodium transporters in ovariectomized rats and in rats with ovariectomy and adrenalectomy to minimize the effect of aldosterone.

Methods : In the first experiment, female Sprague-Dawley rats underwent ovariectomy, and then were randomized into four groups receiving daily subcutaneous injections of followings for 10 days: (1) vehicle (Con); (2) estradiol (Est); (3) progesterone (Prog); and (4) estradiol+progesterone (Est+Prog). In the second experiment, rats underwent ovariectomy and adrenalectomy, and then received daily injections of vehicle, Est or Prog with supplementation of dexamethasone. Expression of major renal sodium transporters was determined by semiquantitative immunoblotting of rat kidney. Body weight (BW), blood pressure (BP), fractional excretion of filtered sodium (FENa), and plasma aldosterone levels were also measured on the day of sacrifice.

Result : In the first experiment, Est led to a significant decrease in the protein abundance of NKCC2, NCC, γ -ENaC, and Na-K-ATPase (4.0%, 51.2%, 48.4% and 6.6% of Con, respectively; $p < 0.05$). Est also decreased plasma aldosterone levels, BP, and BW (Est vs. Con; aldosterone: 116.3 ± 44.4 pmol/L vs. 184.2 ± 33.4 pmol/L, $p < 0.05$; BP: 114.8 ± 3.9 mmHg vs. 131.5 ± 2.0 mmHg, $p < 0.05$; BW: 291.6 ± 41.0 g vs. 335.7 ± 28.8 g, $p < 0.05$). Est+Prog significantly decreased the abundance of NKCC2, NCC, and γ -ENaC (21.5%, 63.8% and 28.9% of Con, respectively; $p < 0.05$). Prog did not affect plasma aldosterone levels, BP or the expression of sodium transporters. There was no significant difference in FENa among all groups. In the second experiment, Est did not affect BP, FENa or the expression of sodium transporters except NKCC2 (850.6 % of Con; $p < 0.05$). Prog also did not affect BP, BW, FENa or the expression of sodium transporters except SGLT (15.5% of Con; $p < 0.05$).

Conclusion : Est decreased the expression of NKCC2, NCC, γ -ENaC, Na-K-ATPase, plasma aldosterone levels, and BP. After elimination of aldosterone effect, Est did not affect BP or the expression of renal sodium transporters except NKCC2, which indicates that the effect of Est is at least partially affected by plasma aldosterone levels.

Key Words : 에스트로겐, 여성호르몬, 소듐 운반체

Estrogen, Sex hormone, Sodium transporters