22) Transport System by Brush Border Membrane Vesicles in Spontaneously Hypertensive Rats. Kiyoshi Hirano, Masaki Nagasawa, Mamoru Yokomatsu, Hikaru Koide, Division of Nephrology, Department of Medicine, Juntendo University School of Medicine, Tokyo, 113

It is well known that the hyperparathyroidism, the disorder of calcium metabolism, and the altered erythrocyte sodium ion transport are recognized in spontaneously hypertensive rats (SHR). We investigated the transport systems of phosphate (Pi), D-glucose, L-alanine, and sodium ion by renal brush border membrane vesicles (BBMV) prepared from 12-wk-old SHR and Wistar-Kyoto rats (WKY) in order to characterize renal tubular reabsorption. Rat renal cortex BBMV were isolated by a $MgCl_2$ -precipitation and purified by controlled pore glass column chromatography.

Uptake of labeled substrates by the isolated membrane vesicles was measured in triplicates by rapid filtration technique using $0.45\ \mu m$ filters (Millipore corp., Bedford, MA).

Results

Plasma Pi, total Ca, and ionized Ca concentrations in SHR were lower than that of WKY. Plasma sodium and creatinine concentrations were not different significantly. In the presence of sodium ion gradient, in the initial uphill phase at 20 sec, the rate of Pi, D-glucose, and L-alanine uptakes by BBMV prepared from SHR were lower than that prepared from WKY. However, uptake of the equilibrium point was not significantly different between SHR and WKY.

The Pi concentration of incubation medium was varied from 12.5 to 500 μM . Apparent K_m and V value were calculated from regression lines obtained from Eadie-Hofstee plots. It has been previously demonstrated that the V value of SHR was lower than that of WKY significantly. On the other hand, apparent K_m was not different between SHR and WKY.

In order to investigate the effect of parathyroid hormone (PTH) on Pi and D-glucose transport, parathyroidectomy (PTX) was performed, and results were showed in Table. Pi and D-glucose uptake by BBMV prepared from SHR with PTX were also lower than that prepared from WKY with PTX.

It was reported that sodium ion permeability of erythrocyte membrane in SHR was stimulated as compared with that in WKY. Pi, D-glucose, and L-alanine are all reabsorbed by Na^+ -gradient-dependent transport system in renal proximal tubulus. Sodium ion permeability of BBMV prepared from SHR was also stimulated as compared with that prepared from WKY.

Discussion

In this study, Pi, D-glucose, and L-alanine transport, which performed by Na^+ -gradient-dependent transport system, were all decreased in SHR compared with WKY. In the absence of PTH, these changes remained. Kinetic study of Pi transport pointed out the change of capacity of transport system.

It is hypothetical that the stimulation of sodium ion permeability recognized in SHR caused the decrement of Na^+ -gradient, and this decrement effected Na^+ -gradient-dependent transport system.

Effect of Parathyroidectomy on Na^+ -dependent Uptake of Phosphate and D-glucose by Brush Border Membrane Vesicles

	Control	PTX
Phosphate		
SHR	2.47 ± 0.15^a	3.38 ± 0.38^a
WKY	3.47 ± 0.19	4.58 ± 0.17
	<i>n</i> mole/mg. protein · 20S	
D-glucose		
SHR	0.96 ± 0.26^a	0.91 ± 0.06^b
WKY	2.50 ± 0.40	1.51 ± 0.10
	<i>n</i> mole/mg. protein · 20S	
	mean $\pm$ S.E.	

a : $P < 0.05$ compared with WKY

b : $P < 0.01$ compared with WKY