

IS INCREASED ERYTHROCYTE LITHIUM SODIUM COUNTER TRANSPORT A USEFUL MARKER FOR ESSENTIAL HYPERTENSION?

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ABSTRACT

Background: Essential hypertension is a very common and wide spread problem. It is associated with maked morbidity and mortality. The pathogenesis of essential hypertension needs to be determined. **Objective:** To compare the rate of sodium counter transport in mild and moderate essential hypertensives with normotensive subjects. **Subjects and Methods:** The study was conducted on age and sex matched 20 mild essential hypertensives (G2), 20 moderate essential hypertensives (G3) and 20 normotensives (G1). All cases were diagnosed after taking detailed history, complete physical examination and laboratory investigations. Lithium efflux and maximum rate (V_{max}) of Lithium-Sodium countertransport was measured in red blood cells. **Results:** Increase in Lithium efflux and V_{max} of Lithium- Sodium counter transport of mild and moderate essential hypertensives was highly significant (p<0.001) than that of normotensives. **Conclusions:** Lithium efflux and V_{max} of sodium coutertransport is raised in mild and moderate essential hypertensive as compared to those in normotensive subjects. This can be used as a marker for the diagnosis of essential hypertension.

Key words: Essential hypertension, Lithium- Sodium, counter transport, Erythrocyte

INTRODUCTION

During the last eighty years, evidence has been accumulated that the widespread use of salts in modern societies may not be entirely harmless. Both the clinical studies and investigations suggest strong evidence that salt plays an important role in the pathogenesis and maintenance of essential hypertension.^{1,2}

It has been found that elevated V_{max} of lithium sodium counter transport is not only one of the characteristic features of essential hypertension but is also found in normotensive offspring of hypertensive patients. Moreover, this abnormality of ion transport is not reported in secondary hypertension.³⁻⁴ Lithium-sodium counter-transport is an operational mode of sodium hydrogen exchange transport system involved in the regulation of cell pH in vascular and kidney cells.⁵⁻⁶ It appears that the correlation between lithium-sodium counter transport and essential hypertension could be mediated by increased proximal convoluted tubular, sodium re-absorption sodium retention, plasma volume expansion and increased cardiac output.⁷ Abnormalities of the kinetic properties of cell membrane sodium-hydrogen exchange, seen by increased red cell lithium -sodium counter transport play an independent role in the

development of left ventricular hypertrophy and vascular remodeling. An increased sodium hydrogen exchange may also induce sodium and water retention, facilitates smooth muscle contraction, increase total peripheral resistance thus causing hypertension.⁸ The objective of present study was to compare the rate of lithium-sodium counter transport in mild & moderate essential hypertension with normal subjects.

SUBJECTS AND METHODS

The study was conducted on 20 normotensive subjects (G1), 20 mild essential hypertensives (G2) (diastolic BP 90-104mmHg) and 20 moderate essential hypertensives (G3) diastolic BP 105-114 mmHg) between 20-60 years of age with equal sex distribution.

Lithium-sodium counter transport in subject's red blood cells was measured according to the method described by Wood et al.⁹ Blood was drawn in tubes containing ethylene diaminetetra-acetic acid (EDTA). The red blood cells were separated, washed and loaded with lithium by suspending in a medium containing lithium chloride. The lithium loaded cells were incubated in sodium free and sodium enriched media for measurement of lithium efflux.

Fractions of cell suspension were diluted with distilled water and lithium countertransport was measured by flame photometer.

V_{max} of countertransport (millimoles of lithium efflux per liter of red blood cells per hour) was computed from the linear regression of lithium loss as a function of time. Results were expressed as mean

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significance of difference between groups was measured by applying student's t test.

RESULTS

There was no significant difference in lithium efflux values at zero hour both in mild and moderate hypertensives as compared to that of controls. At two and four hours, the rise in lithium efflux in mild and moderate hypertensives was highly significant ($P < 0.001$) than that of controls. (Table I)

Table :I Comparison of Mean Lithium Efflux between Controls (G1), Mild (G2) and Moderate essential Hypertensives (G3). Lithium efflux in mm/L RBCs (Mean \pm SD)

Time(hrs)	Group 1	Group 2	Group 3	Pvalue
0	0.009 \pm 0.010	0.003 \pm 0.005	0.005 \pm 0.080	P>0.05 (NS*)
2	0.36 \pm 0.03	0.75 \pm 0.02	0.08 \pm 0.06	P<0.001(HS**)
4	0.72 \pm 0.04	1.52 \pm 0.04	1.67 \pm 0.09	P<0.001(HS**)

The increase in Vmax in lithium-sodium countertransport of mild hypertensives was highly significant ($P < 0.001$) as compared to that of normotensive controls. Elevation in Vmax of lithium-sodium countertransport of moderate hypertensives was also highly significant ($P < 0.001$) as compared to that of controls and mild Hypertensives. (Table II)

Table II: Comparison of Vmax of Lithium Sodium Countransport between Controls (G1) Mild (G2) and moderate Essential Hypertensives (G3)

Group 1 Mean \pm SD	Group 2 Mean \pm SD	Group 3 Mean \pm SD	P value Mean \pm SD
0.18 \pm 0.01	0.38 \pm 0.01	0.42 \pm 0.02	P<0.001(HS*)

It was observed that increase in lithium efflux in moderate hypertensives at zero hour was non-significant ($P < 0.05$) than that in mild hypertensives. The difference in Lithium efflux values at two and four hours in moderate hypertensives was highly significant ($p < 0.001$) as compared to that in mild hypertensives.

It was observed that there was statistically significant ($P < 0.001$) difference in Vmax of lithium-sodium countertransport between mild and moderate essential Hypertensives. (Table III)

Table III: Comparison of mean Lithium Efflux between Mild (G2) and Moderate essential hypertensive (G3) (Lithium in mM/LRBCs)

Time (hr)	Group 2	Group 3	P value
0	0.003 \pm 0.005	0.005 \pm 0.080	P > 0.05(NS)
2	0.75 \pm 0.02	0.86 \pm 0.06	P < 0.001(HS)
4	1.52 \pm 0.04	1.67 \pm 0.09	P < 0.001(HS)

(NS) Nonsignificant, (HS) Highly significant.

Table: IV Comparison of Vmax of Lithium-Sodium countertransport between Mild (G2) and Moderate Essential Hypertensives (G3) Vmax of Lithium-Sodium Countertransport (mean \pm SD)

Group 2	Group 3	Pvalue
0.38 \pm 0.01	0.42 \pm 0.02	P<0.001(HS)

DISCUSSION

In present study, it was observed that there was a highly significant ($p < 0.001$) increase in Vmax of lithium sodium counter transport in mild and moderate essential hypertensives as compared to that of controls. Moreover, the elevation in Vmax of countertransport activity in moderate essential hypertensives was highly significant ($P < 0.001$) as compared to that in mild essential hypertensives. Thus the abnormality of countertransport varied with the severity of essential hypertension. These results of elevated countertransport agreed with the results of study of several researchers.⁹⁻¹³ On the contrary, some of the investigators have come up with different results as well. Nasadini et al (1991) and Trevisan (1992) reported that although Vmax of lithium sodium countertransport is increased in essential hypertensive patients, yet there is a considerable overlap with values in normotensive subjects with approximately 50% of hypertensive showing normal lithium sodium countertransport activity. Further studies on the said activity will explore the link between sodium countertransport activity and essential hypertension.

CONCLUSION

The results show that Lithium Efflux & Vmax of sodium countar transport is raised in mild to moderate essential hypertensive patients and it can be used as a marker for diagnosis of essential hypertension.

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