

EVALUATION OF ERYTHROCYTE FILTRABILITY AND ITS RELATION TO GLOBULAR MEMBRANE (Na⁺, K⁺) — DEPENDENT ATPase IN HYPERTENSIVE PATIENTS

M. CARLOTA PROENÇA, M. HELENA RIBEIRO, J. BRAZ NOGUEIRA, J. NOGUEIRA DA COSTA and J. MARTINS E SILVA

Department of Biochemistry, Fac. Medicine and Arterial Hypertension Unit, Department of Medicine I, Hosp. Sta. Maria. Lisbon. Portugal.

SUMMARY

The values of erythrocyte filtration index and erythrocyte membrane (Na⁺, K⁺) - dependent ATPase activity were evaluated in 21 hypertensive patients (12 men and 9 women) aged 46.3 ± 9.7 years. The patients suffered from essential hypertension and the blood pressure values recorded were 171.9 ± 21.3 mmHg systolic and 110.6 ± 12.2 mmHg diastolic. The activity of erythrocyte membrane Na⁺, K⁺ ATPase is significantly lower ($p < 0.001$) among the patients (0.074 ± 0.029 μ moles Pi/mg prot/h) than in the healthy controls (0.160 ± 0.045 μ moles Pi/mg prot/h). The rate of erythrocyte filtrability was also significantly lower ($p < 0.001$) in respect to the controls (12.84 ± 2.40 μ l. seg.⁻¹ and 15.80 ± 1.75 , respectively). However, no correlation was found between the two parameters evaluated.

INTRODUCTION

The erythrocytes of hypertensive patients present a decreased flow of Na⁺/K⁺ in comparison with the values reported in normal erythrocytes.^{1,2}

Erythrocyte flexibility is influenced by changes of membrane permeability to ions.³ We have found, in hypertensive patients, a significant decrease of the activity of the (Na⁺ K⁺)-dependent ATPase in respect to the values reported in normal erythrocytes.⁴ A decreased value of erythrocyte filtrability rate in hypertensive patients has also been reported in a previous work by our group.⁵

This abnormality could partially be ascribed to globular hyperhydration following the failure of erythrocyte Na⁺/K⁺ pump.

MATERIAL AND METHODS

Venous blood samples were collected from 21 hypertensive patients characterized on Table I, and to a comparable group of healthy individuals.

The erythrocyte membranes were prepared according to the method of Cha et al,⁶ while protein concentration was assessed according to the method of Lowry et al.⁷ The activity of Na⁺K⁺-dependent ATPase was evaluated in compliance with the method described by Tausshy.⁸

The index of red cell filtrability, adjusted for the haematocrit values, was assessed according to the method of Reid et al.⁹

TABLE I — Clinical profile of patients

Total number	— 21
Sex	— 12 men; 9 women
Age (years)	— 46.3 ± 9.7 (mean ± SD)
Blood pressure (mmHg, mean ± SD)	
systolic:	171.9 ± 21.3
diastolic:	110.6 ± 12.2
Established duration of the disease (years):	5.8 (wide range of variation)
Significant systemic affects (number of effected patients):	
retinopathy, degree III and IV =	0
raised creatinine levels =	1
left ventricle overload =	3
stroke sequels =	4
Antihypertensive therapy	— 14 patients

RESULTS AND DISCUSSION

The results obtained are summarized on Table 2 and confirm those previously reported:^{4,5} the mean values for the ATPase system and erythrocyte filtrability were considerably lower in the hypertensives than in controls.

However, no correlation was found between the activity of (Na⁺ K⁻)-dependent ATPase and the erythrocyte filtration rate. This lack of correlation may suggest that erythrocyte filtrability is not affected by abnormalities of the sodium pump on the hypertensive patients. The influence of other membrane intrinsic factors, also disturbed in essential hypertension, on this parameter, has not been excluded.^{10,11,12} Alternatively, the changes of red cell filtration rate may not primarily denote a reduced flexibility but, contrariwise, represent other extraglobular abnormalities affecting general properties of blood rheology.

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TABLE 2 — Values (mean ± SD) of red cell filtration rate and (Na⁺, K⁺) — dependent ATPase in hypertensive and control subjects.

Groups	Na ⁺ , K ⁺ ATPase (μmoles Pi/mg prot/h)	Filtration (μl. sec ⁻¹)
Patients	0.074 ± 0.029	12.84 ± 2.40
Value of <i>p</i>	< 0.001	< 0.001
Controls	0.160 ± 0.045	15.80 ± 1.75

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Address for reprints: M. Carlota Proença
Departement of Biochemistry
Faculty of Medicine
Lisbon, Portugal.