PLASMA RENIN ACTIVITY IN PATIENTS WITH CHRONIC RENAL FAILURE BEFORE AND AFTER HEMODIALYSIS

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Data about plasma renin activity (PRA) in chronic renal disease are rather controversial (1, 4, 5, 10, 11). An increase in plasma renin activity is recorded in isolated cases only. The deterioration of renal functions, leading to chronic renal failure and uremia, does not change significantly PRA level. Most frequently, PRA in chronic renal failure is normal (2) or decreased, and only in 15 per cent increased (3, 7) with no relation to blood pressure whatsoever. Hemodialysis in this condition may change PRA level because of the electrolyte variations in the blood and removal of body fluids. It is of interest to study the interrelation between PRA alterations and blood pressure in such patients. In the present preliminary report we would like to outline some of our observations in connection with this problem.

Material and methods

Seventeen patients with chronic renal failure, treated with chronic hemodialysis three times weekly for 8 hours, were investigated. Chronic glomerulonephritis was found in 14 patients, and chronic pyelonephritis — in three (in one associated with polycystosis renum, and in one — with gout). Renal hypertension was present in eight cases, and secondary anemia — in fourteen.

Blood for determination of PRA, blood urea, creatinin, serum electrolytes and acid-base equilibrium was taken just prior to the beginning of hemodialysis, and for a second time after its end. PRA was determined radioimmunologically using the test kit obtained from the firm BYK-Malinkrodt, based on the generation of Angiotensin I. In four patients PRA was estimated using the biological method of Pickens as modified by Serebrovskaja et al, simultaneously with the radioimmunoassay.

Results

The initial PRA level was normal in nine patients, decreased in six, and increased only in two (Fig. 1). There was no correlation between PRA level, on one hand, and blood pressure and serum electrolytes level, on the other. It is now accepted that normal renin activity takes place in controllable hypertension, while high PRA occurs in incontrollable renal hypertension. However, not all patients could be strictly assigned to either of the two groups (9). Some of our patients have a high PRA showing an appreciable increase after hemodialysis, but they are with a normal blood pressure.

Following hemodialysis (Fig. 2), in all the patients there was a decrease in blood urea from 223±72 mg% to 88±28 mg%, as well as in creatinin from 14.0±5.1 mg% to 7.7±2.8 mg%. Blood pH increased from 7.35±0.08 to 7.46±0.05. Serum sodium decreased slightly from 139±3.8 mEq/l to 134±

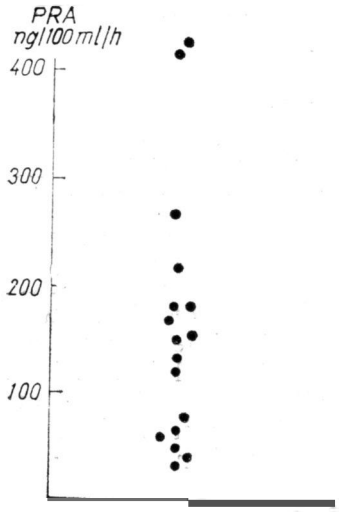

Fig. 1: Plasma renin activity level in the patients under study.

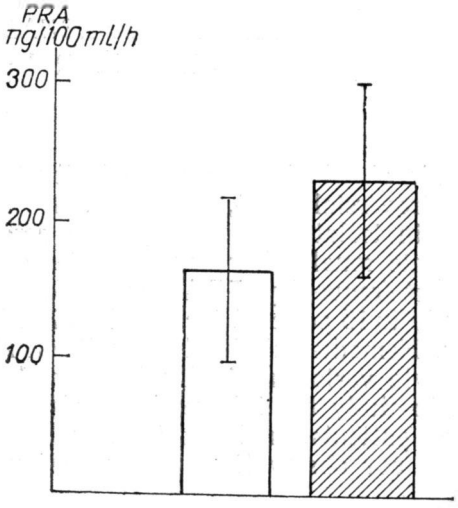

Fig. 2: Mean plasma renin activity level before and after hemodialysis.

±2.9 mEq/l, while serum potassium showed a marked fall in all patients from 6.01±0.80 to 3.26±0.51 mEq/l. Before hemodialysis, PRA was 168±124 ng/100 ml/h, and after that — 229±172 ng/100 ml/h, but the difference was insignificant (Table 1), because of the substantial individual values' scatter.

Table 1

	Before hemodialysis	After hemodialysis
Blood urea mg %	223±72	88±28
Creatinin mg %	14.0±5.1	7.7±2.8
pH	7.35±0.08	7.46±0.05
Serum sodium mEq/l	139±3.8	134±2.9
Serum potassium mEq/l	6.01±0.80	3.26±0.51

On the basis of PRA reaction, the patients were divided up in two groups as follows: 9 cases with an increase in PRA after hemodialysis, and 8 cases where PRA after hemodialysis remained unchanged or decreased. The electrolyte changes in either group were identical — a marked decrease in serum potassium, and a slight decrease in serum sodium (Table 2 and 3). However, the

Table 2

Patients with an increase in PRA after hemodialysis

Name	Blood pressure	PRA ng/100 ml/h		Serum potassium mEq/l		Serum sodium mEq/l	
		before	after	before	after	before	after
		hemodialysis		hemodialysis		hemodialysis	
D. G.	normal	180	330	5.5	3.1	144	134
L. M.	normal	410	545	4.8	3.0	140	136
G. A.	normal	61	172	7.2	3.1	142	133
M. M.	normal	267	564	5.1	2.7	134	137
B. G.	normal	23	145	6.7	3.8	138	134
K. A.	normal	417	528	4.8	3.0	144	140
K. V.	160/100	71	240	6.5	3.6	143	136
T. M.	170/110	150	286	6.9	2.8	142	133
D. V.	200/100	29	86	7.4	3.4	146	144

Table 3

Patients without an increase in PRA after hemodialysis

Name	Blood pressure	PRA ng/100 ml/h		Serum potassium mEq/l		Serum sodium mEq/l	
		before	after	before	after	before	after
		hemodialysis		hemodialysis		hemodialysis	
P. C.	normal	58	44	6.0	3,0	140	130
I. P.	normal	46	47	6.2	3.4	135	133
S. A.	200/120	181	170	5.1	3.2	132	112
G. B.	200/100	212	222	4.8	3.1	142	135
V. S.	180/100	111	85	7,8	3.8	140	138
M. M.	170/100	266	191	4.5	3.1	130	132
V. S.	190/105	120	40	6.2	3.5	147	139
E. P.	170/110	272	202	6,5	3.9	139	137

two groups differed by blood pressure indicators. In group one (nine patients with post-hemodialysis PRA increase) only 3 cases had hypertension; in group two (eight patients without PRA increase) 6 were with hypertension and only two had normal values.

The results in four patients from the former group, investigated with the biological method, were analogical.

No parallelism was established between the rate of serum potassium decrease and PRA increase. In patients without any change in PRA a decrease in potassium under the effect of hemodialysis was also established.

After hemodialysis, all patients lost weight ranging from $2^1/_2$ to 3 kg, attributed to the removal of body fluids mainly.

The blood pressure of patients in the course of hemodialysis did not show noteworthy changes.

Discussion

Our study confirms already established data about PRA level variations in chronic renal failure. We failed to find any correlation between blood pressure and plasma renin activity level, claimed by other authors (1, 3, 4, 7, 10, 11). The good renin secretion in chronic renal failure despite the advanced nephrosclerosis and destruction of the juxtaglomerular apparatus, is explained by hyperplasia of epitheloid cells in the media of the preafferent and interlobular arteries, containing granules which, according to Faarup (6), most likely secrete renin. It is possible that an extrarenal secretion of renin exists (13), as well as a decrease in natural renin inhibitors (7).

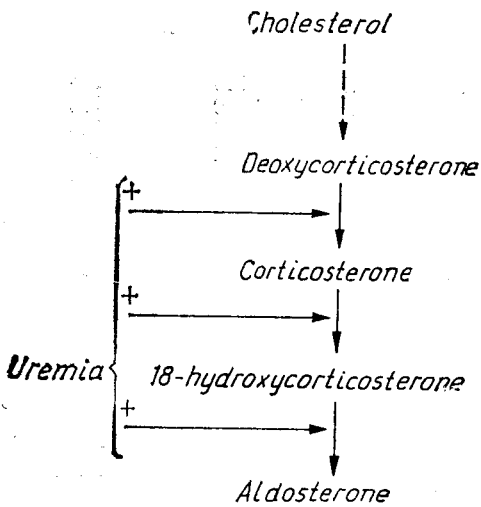

Fig. 3: Presumed influence of uremia on aldosterone synthesis.

The results of this study, pointing to a normal PRA in most of the patients with chronic renal failure, are in agreement with the data published by Cangiano et al (2).

PRA increase in almost half of the patients after hemodialysis is probably due to two main reasons. The first one is the marked decrease in serum potassium, associated with slight changes in serum sodium and a decrease in Na/K ratio. As well known potassium deficit leads to PRA increase (12). The second cause is the reduction of body fluids during hemodialysis, and diminution of extracellular fluid.

The question posed is why half of the patients do not show a PRA increase in spite of the stimulating influences referred to above. One has to bear in mind the possibility of destruction of a great part of the juxtaglomerular apparatus, and the secretion of renin from extrarenal sources with limited secretory capacity. Besides, secondary hyperaldosteronism in chronic renal failure may also take part in the blunted PRA reaction after hemodialysis. Secondary hyperaldosteronism in this condition is not so closely related to the renin-angiotensin system. The high serum potassium level suppresses renin secretion but exerts direct stimulation on aldosterone secretion. Along with that, high blood urea stimulates the enzyme 18-hydroxylase, and thus facilitates aldosterone synthesis even in the lack of other stimulators (8) (Fig. 3). Therefore, it is possible that secondary hyperaldosteronism, which is relatively independent from the renin-angiotensin system and is fixed in some patients, may lead to suppression of the renin reaction in hemodialysis. Perhaps for this reason a lack of PRA increase is more frequent in patients with hypertension. Certainly, the number of patients in our series is too small to justify such a conclusion. Moreover, it is necessary to investigate simultaneously the aldosterone secretion which will be the subject of further studies along this line.

Conclusion

1. PRA in patients with chronic renal failure is usually normal although high or low values may occur, which are by no means related to blood pressure.
2. After hemodialysis in patients with chronic renal failure, PRA increases in almost half of the cases, most likely due to serum potassium decrease, and reduction of body fluids.
3. In part of the patients PRA does not show an increase after hemodialysis regardless of the stimulating effect exerted by low potassium level and loss of fluids. In this category of patients hypertension is more frequently recorded.

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РЕНИНОВАЯ АКТИВНОСТЬ ПЛАЗМЫ БОЛЬНЫХ С ХРОНИЧЕСКОЙ ПОЧЕЧНОЙ НЕДОСТАТОЧНОСТЬЮ — ДО И ПОСЛЕ ГЕМОДИАЛИЗА

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РЕЗЮМЕ

Исследована ренинoвая активность в плазме крови при помощи радиоиммунологического и биологического метода в группе больных с хронической почечной недостаточностью, подвергнутых хрониодиализному лечению. Исследование проведено до и после гемодиализа. Обнаружено увеличение ренинoвой активности в плазме крови после проведения гемодиализа. Обсуждаются возможные патогенетические механизмы увеличения ренинoвой активности в плазме крови под влиянием гемодиализа.