

LETTER TO THE EDITOR

PLASMA RENIN ACTIVITY AND ELECTROLYTE BALANCE IN TWO-KIDNEY, ONE-CLIP HYPERTENSIVE RATS

Sir,

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Renal artery constriction produces chronic hypertension in the absence or presence of contralateral kidney (1). In 1934, Goldblatt and associates (5) constricted the renal arteries in dogs and produced chronic arterial hypertension. The two types of experimental renovascular hypertension produced by renal artery constriction are :

(i) *One-Kidney, one-clip hypertension* : (1K-1C hypertension) Constriction of left renal artery by placing a U-shaped silver clip around the renal artery, the contralateral kidney removed, produced chronic renovascular hypertension,

(ii) *Two-Kidney, one clip hypertension* : (2K-1C hypertension) Constriction of left renal artery by placing a U-shaped silver clip around the renal artery, the contralateral kidney being untouched.

The activity of renal renin-angiotensin system is known to be associated with renal artery constriction in both hypertensive models. In 1K-1C hypertensive rats renin-angiotensin activity is increased only in the early phase and in 2K-1C hypertensive rats plasma renin activity (PRA) remains increased in established phase also (3, 6, 7). Angiotensin II acts in two ways - (i) increases peripheral resistance by a direct action on the peripheral arterioles (vasoconstriction), and (ii) promotes renal sodium retention via aldosterone secretion (4).

The objective of the present work was to evaluate the status of plasma renin activity and electrolyte balance which would help in understanding the mechanism of renovascular hypertension.

Hypertension was developed in Charles-Foster strain of male rats (150-200 g) under anaesthesia 'Intraval Sodium' (40 mg/kg, i.p.). Two-kidney, one-clip hypertensive rats were produced by the application of U-shaped silver clip with an internal diameter of 0.2 mm on the left renal artery via a lumbar incision, contralateral kidney untouched.

The animals were housed in departmental animal house and fed standard balanced pellet diet and water *ad libitum*. After expected period for the development of hypertension (6-7 weeks after clipping), blood pressure was measured with the help of 'Encardiorite transducer'. PRA in these rats was assayed by bioassay according to the method of Pickens *et al.* (10). Plasma and urinary sodium, potassium were determined by standard flame photometry method.

Table I shows the values of blood pressure, plasma renin activity (PRA), plasma and urinary electrolyte and creatinine in two-kidney, one-clip hypertensive rats. The blood pressure of these seven rats was 170.57 ± 10.72 mm Hg while PRA for these rats measured was 22 ± 6 ng Ag/ml/hr (ng angiotensin/ml/hr). Maitra *et al.* (8) have recently demonstrated that the blood pressure of the sham clipped normotensive rats was 120 ± 3 mm of Hg and the PRA was 7 ± 2 ng Ag/ml/hr (8). Therefore, it is evident that the blood pressure and the PRA of the hypertensive rats were significantly higher when compared with the normotensive values. It has been reported that renin is increased in plasma and in the clipped kidney of the two kidney hypertensive animals. Injection of angiotensin (ang) antibody or infusion of angiotensin inhibitor into these rats results in the reduction of blood pressure (2). Studies with angiotensin I- converting enzyme inhibitor, captopril (SQ, 14225) showed that decrease in arterial pressure, during captopril administration was, in large part, due to decreased concentration of circulating and renal angiotensin II (9). Thus captopril decreases blood pressure in 2K-1C hypertensive rats by decreasing the angiotensin II level suggesting the involvement of renin-angiotensin system. Higher plasma renin activity observed in 2K-1C hypertensive rats is also suggestive of the involvement of renin-angiotensin system.

TABLE I : Blood pressure, plasma renin activity (PRA) and urinary sodium, potassium and creatinine values in two-kidney, one-clip hypertensive rats.

Blood pressure mm Hg	Plasma renin activity ng Ag/ml/hr	PLASMA LEVEL			URINE LEVEL		
		Sodium mEq/L	Potassium mEq/L	Creatinine mg%	Sodium mEq/L	Potassium mEq/L	Creatinine mg%
194	47.0	146	5.0	3.8	155	152	1.7
190	40.6	160	5.7	2.4	145	150.4	1.6
180	22.0	163	7.5	0.8	85	188.53	1.4
180	16.53	190	10.8	1.0	90	90.8	2.1
175	11.45	140	6.0	4.7	140	155.8	2.2
165	10.26	140	6.4	5.5	90	90.2	1.4
110	6.0	130	4.0	6.0	70	73.8	3.5
Mean 170.57	21.98	152.71	6.485	3.457	110.71	128.79	1.99
\pm S.E. \pm 10.72	\pm 5.99	\pm 7.61	\pm 0.83	\pm 0.79	\pm 13.07	\pm 16.38	\pm 0.28

(a) ng Ag/ml/hr = ng angiotensin/ml/hr

Table I also shows the plasma and urinary sodium, potassium and creatinine values in seven rats. However, these values are well within the normal range when compared with the normotensive values as reported earlier (11). Thus, the above result suggests that probably aldosterone stimulated sodium retention is not involved in the pathogenesis of established phase of two-kidney renovascular hypertension instead vasoconstriction may play some part in this action. These observations are well supported by the findings of Maitra *et al.* (8) who have earlier shown that in spontaneously hypertensive rats, a decrease of aldosterone secretion, secondary to captopril inhibition of angiotensin II formation, is partially responsible for the antihypertensive action of captopril while in 2K-1C hypertensive rats captopril inhibition of angiotensin II formation does not appear to be related to the suppression of aldosterone secretion.

It can be concluded from the above results that plasma renin activity is increased in 2K-1C renovascular hypertension and normal values for electrolytes indicate that perhaps renin-angiotensin-vasoconstriction mechanism plays a significant role in the maintenance of blood pressure in 2K-1C renovascular hypertensive rats.

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