Hypertension after Bilateral Nephrectomy in the Rat

Jeffers, Lindauer, Twaddle and Wolferth[1] reported in 1940 that removal of three of the four kidneys in a pair of parabiotic rats resulted in hypertension in the nephrectomized animal. Grollman and Rule[2] found in two pairs of parabiotic rats that removal of the kidneys in one animal sufficed to induce hypertension. When these experiments were repeated by one of us (E. B.-M.) a definite rise in blood pressure was found only in three out of twenty-three pairs, however.

We have modified the procedure by joining three rats in parabiosis, one bilaterally nephrectomized between two normals. In such case the survival-time of the nephrectomized rat is regularly prolonged and it remains in a good general state for a week or longer. In all the six trios prepared, definite hypertension was observed in the nephrectomized animal. A moderate rise in blood pressure was also observed a few times in one or both of the normals. The rise in pressure in the nephrectomized animal occurred two to four days after the removal of the kidneys and the highest figures noted were 156, 144, 170, 190, 172 and 144 mm. mercury.

These results led us to investigate more systematically the blood pressure of single rats after total nephrectomy. A total of 39 normal adult rats were nephrectomized and the blood pressure determined daily until death occurred. A definite rise was observed in 13 rats (33 per cent) (see table); in all these, blood urea was high. In 14 animals a solution of Ringer with 0·5 per cent gelatin was allowed to flow through the peritoneal cavity at a rate of 1 ml. an hour during 1–3 hours, the animal being anæsthetized with nembutal (30 mgm./kgm.) or ether.

BLOOD PRESSURE 1–4 DAYS AFTER NEPHRECTOMY

1	2	3	4
80	120	104	
94	144	90	
	92	130	
90	80	124	
118	80	106*	200
112	116	148	
96	100	136	
104–128	116–116	104	124
100–104	108	96*–126	108
96–100	112	148	
92	80	140*–138	
100– 90	128		
116	128		
110	92*	140	

* Peritoneal washing.

From the table it is evident (1) that the rise in blood pressure mostly occurs during the second or third day after nephrectomy; and (2) that peritoneal washing does not lower the pressure but may increase it. In some cases there were indications of an improvement in the state after washing, though the blood urea showed only a moderate fall.

The results indicate that since hypertension may occur in the absence of kidneys, some extra-renal factor is of importance for the development and maintenance of this type of state of hypertension in the rat. It is tentatively assumed that the normal kidney inactivates some extra-renal factor producing hypertension under certain conditions.

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Stockholm. Aug. 21.

[1] Jeffers, W. A., Lindauer, M. A., Twaddle, P. H., and Wolferth, C. C., *Amer. J. Med. Sci.*, **199**, 815 (1940).
[2] Grollman, A., and Rule, C., *Amer. J. Physiol.*, **138**, 587 (1942).

Influence of Choline and Ethanolamine on the Rate of Formation of Phospholipids in the Liver

THE work described below was carried out in the Biochemistry Department, University of Liverpool, but in consequence of war it had to be abandoned early in 1940. As the results have not been reported elsewhere, it was considered to be of interest to record them.

Using radioactive phosphorus, Chaikoff[1] made an extensive study of phospholipid metabolism, in which he showed that choline caused an increase in the rate of phospholipid turnover in the livers of rats maintained on a 40 per cent fat diet. The maximal increase of 30–40 per cent over the controls was reached six hours after the administration of choline by stomach tube. He suggested that the stimulation of phospholipid turnover was the mechanism by which the choline exerted its lipotropic action. McHenry and Patterson[2] have since supported this suggestion. It occurred to us, however, that this rise in the turnover rate might merely be a mass action effect due to the temporary increase in the concentration of choline, a constituent of the lecithin of the liver phospholipids. If this were the case, it would be expected that the increased rate of turnover would be confined to the lecithin fraction. It would also be expected that the administration, under similar conditions, of ethanolamine, which is not lipotropic[3,4], would also cause a rise in the rate of phospholipid turnover, the increase in this case being confined to the cephalin fraction. As will be seen, this was, in fact, found to occur.

As a preliminary experiment, the relative rates of lecithin and cephalin formation in fed and fasted rats were compared. Five rats on stock diet were injected with radiophosphate in saline, killed six hours later and the organs extracted with ethanol and ether after pooling and grinding with sand. The extracted lipoids were dissolved in ether and fractionated in the usual way. Five rats fasted 22 hours before death were treated similarly. The radioactivity of the samples was measured on a Geiger counter and the specific activity calculated. The specific activity is defined as the percentage of injected radiophosphate which is present per mgm. of phosphorus in the particular phosphatide preparation.

TABLE 1

Tissue	Specific activity of fed rats: Lecithin	Cephalin	Specific activity of fasted rats: Lecithin	Cephalin
Liver	0·42	0·29	0·31	0·21
Kidney	0·31	0·16	0·15	0·10
Small intestine	0·18	0·12	0·13	0·07

It can be seen that though the specific activity of the lecithin is greater than that of the cephalin, the relative increase from the fasted to the fed rats is approximately the same.

The influence of choline on the rates of turnover of the phosphatide fractions in the liver was determined as follows: ten rats were maintained on a 40 per cent fat, 10 per cent albumin diet, and on the seventh day each received an injection of radiophosphate in saline. Five rats received the diet as usual, while the other five had, in addition, 50 mgm.

TABLE 2

Group	Specific activity: Lecithin	Cephalin
Control	0·36	0·24
Choline	0·44	0·26