

COMPENSATORY HYPERTROPHY OF THE TRANSPLANTED REINNERVATED KIDNEY

A. A. Lebedev

Department of Pharmacology (Head — Professor G. M. Shpuga), Ivanovo Medical Institute

(Presented by Active Member AMN SSSR V. V. Parin)

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The compensatory hypertrophy of the autotransplanted kidney has been studied by several workers [1, 3-6, 8], who have concluded that such a kidney, although a totally denervated organ, can maintain the animal alive for a

long period after removal of the intact kidney. In our previous investigations [3,4], we have shown that the function of the autotransplanted, reinnervated kidney approximates to the function of the intact kidney, whereas the excretory activity of the kidney transplanted without restoration of its nerve supply is diminished.

In order to determine the reserve capacity of the transplanted, reinnervated kidney, we decided to study its function after removal of the intact kidney. At the same time, this investigation provided data relating to the pattern of development of compensatory hypertrophy.

EXPERIMENTAL METHOD

The investigation was carried out on three dogs in which a kidney was autotransplanted into the neck by means of an anastomosis between the renal vessels and the carotid artery and external jugular vein. The transplanted kidney was reinnervated at the time of the grafting by making an anastomosis between the central end of the vagus nerve and the renal nerves. The ureteric orifice of the transplanted, reinnervated kidney was brought out onto the skin of the chest, and the ureteric orifice of the intact kidney onto the skin of the abdomen. The function of both kidneys was studied 4-6 months after grafting. The intact left kidney was then removed; the function of the transplanted, reinnervated kidney was investigated 4 or 5 times a month for 3-6 months.

The kidney function of the dogs was studied by the inulin method. A 2% solution of inulin was given by continuous intravenous drop. The inulin concentration in the plasma and urine was determined by the resorcin method. Filtration was estimated by the inulin clearance index: $C_{in} = \frac{p}{u} \cdot D$, where

C_{in} is the inulin clearance index (in ml/min); u is the concentration of inulin in the urine (in mg %); p is the concentration of inulin in the plasma (in mg %); and D is the diuresis (in ml/min). In all cases, the filtration values obtained were estimated in terms of 1 m² of body surface. The

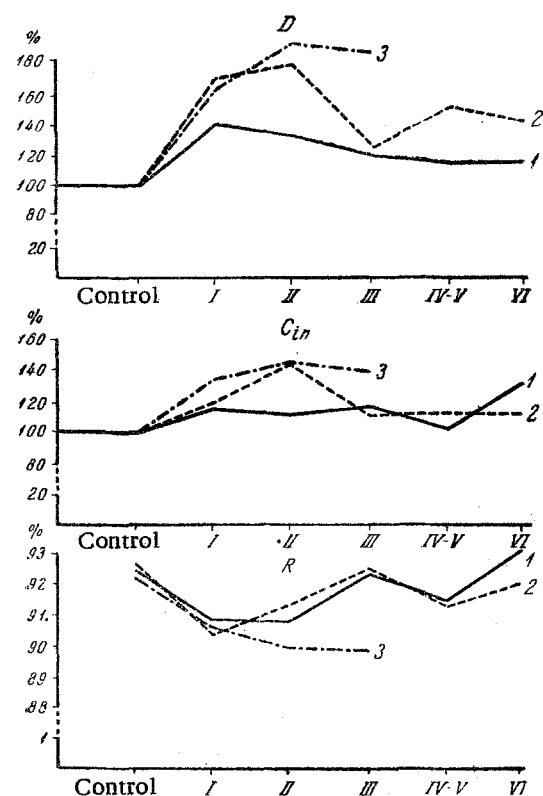


Fig. 1. Function of the right, transplanted reinnervated kidney in dogs after bilateral nephrectomy (mean values). D) Diuresis; C_{in}) inulin clearance index; R%) reabsorption of water. 1) The dog Pal'ma; 2) the dog Tuz; 3) the dog Druzhok. I-VI) Months after removal of the left kidney.

water reabsorption was calculated as a percentage of the filtration value: $R\% = \frac{C_{in} - D}{C_{in}} \cdot 100$.

EXPERIMENTAL RESULTS

The function of the transplanted, reinnervated kidney in all the experimental dogs 4-6 months after transplantation showed no significant difference from the function of the intact kidney. After removal of the intact kidney, the diuresis of the transplanted kidney rose considerably (Fig. 1). The greatest increase in diuresis was observed during the first and second months after nephrectomy. In the dogs Pal'ma and Tuz, the diuresis fell again at the 4th to 6th month, although it remained somewhat higher than the initial figure.

After removal of the left kidney the filtration in the remaining kidney was also increased (see Fig. 1), but the degree of the increase in filtration was much less than the degree of increase in the diuresis. The maximal filtration in the dog Pal'ma amounted to 116%, and in the dogs Tuz and Druzhok, 140% of the control filtration value. The maximal value of the diuresis in these experiments was 138% in the dog Pal'ma, 176% in Tuz, and 186% of the control diuresis in the dog Druzhok.

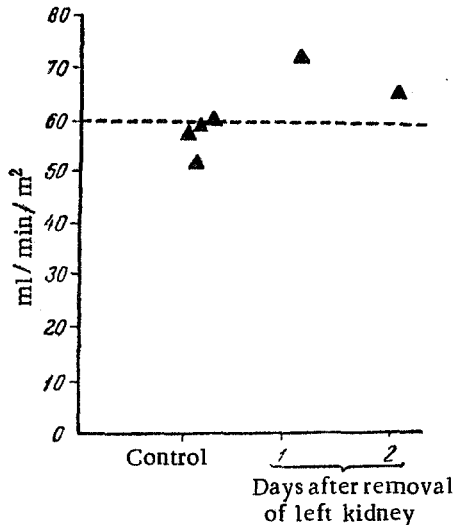


Fig. 2. Filtration in the right, transplanted reinnervated kidney in the dog Pal'ma.

It will be clear from Fig. 1 that during the first 2 months the water reabsorption was diminished in all the dogs. During the following months the reabsorption of water increased in the dogs Pal'ma and Tuz, and at the end of the observation it approximated to the control reabsorption values. No late observations could be made on the dog Druzhok, for it died accidentally at the end of the 4th month after nephrectomy.

Hence, after removal of the intact left kidney, the diuresis in the transplanted reinnervated kidney rose considerably, the filtration increased, and the reabsorption of water diminished. These changes were most marked in the course of the first 2-3 months after removal of the intact kidney. In the succeeding months the indices of the diuresis, filtration, and water reabsorption began to approximate the level of their values in the control experiments.

This pattern of change of function in the process of compensatory hypertrophy belongs not only to the transplanted, reinnervated kidney, but also to the intact kidney. Maluf [7], for instance, observed a progressive increase in the filtration and blood flow in the intact kidney for 2 months after removal of the other intact kidney. V. I. Fedenkov [2] observed a progressive increase in the diuresis and filtration and a decrease in the reabsorption of water in the residual intact kidney in the course of 3 months

after removal of the second, intact kidney. During the 4th month the diuresis and filtration diminished while the reabsorption increased. Results obtained in our laboratory show that during the first 2 months after removal of the intact kidney, the diuresis from the transplanted, denervated kidney progressively increased, but in the later stages the diuresis began to diminish again.

Experiments of particular interest were carried out during the first and second days after removal of the intact kidney. Obviously, at this time, the grafted, reinnervated kidney must take over the function of the removed kidney, although it has not had time to develop compensatory hypertrophy. It is clear from Fig. 2 that in the dog Pal'ma, in the first two days after removal of the left kidney, the values of the diuresis and filtration were much higher than in the control experiments, while the reabsorption of water was appreciably decreased.

During the first two days after removal of the left kidney, it is evident that the maximal utilization of the regulatory capacity of the transplanted, reinnervated kidney was taking place. These experiments demonstrated the functional integrity of the transplanted, reinnervated kidney, and its ability to modify its function rapidly.

Throughout the period of investigation, the dogs Tuz and Pal'ma remained fit and did not lose weight. The residual nitrogen of the blood in these dogs 6 months after nephrectomy was within normal limits (Tuz, 32.8 mg%; Pal'ma, 34 mg%). Ten months after nephrectomy, the dogs were sacrificed. The weight of the transplanted reinnervated kidney in all three experimental dogs was about 150% of the weight of the intact kidney, indicating the development of compensatory hypertrophy of the organ.

Hence, the transplanted, reinnervated kidney is able to undergo compensatory hypertrophy after removal of the intact kidney, and can support the animal's life for a long period of time. The pattern of the changes in diuresis, filtration, and water reabsorption in the transplanted, reinnervated kidney in the course of compensatory hypertrophy has much in common with the pattern of compensatory hypertrophy not only in the intact kidney, but also in the transplanted, denervated kidney [7].

SUMMARY

Experiments were performed on 3 dogs. As established, the reinnervated kidney transplanted on the neck was capable of compensatory hypertrophy after removal of intact kidney and long-time maintenance of the life of the organism.

Dynamics of diuresis, filtration, and water reabsorption in transplanted reinnervated kidney during the process of compensatory hypertrophy is similar to that of compensatory hypertrophy not only of intact, but also of transplanted denervated kidney.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
