FUNCTION OF A RENAL AUTOGRRAFT AFTER EXTRIPATION OF THE OTHER KIDNEY

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Previously [3] we have summarized studies of kidneys which have been preserved and then autografted into dogs in which the remaining kidney was undisturbed. The value of the diuresis, and the amounts of urea and creatinine excreted, and the ability to respond to a water and milk load by an enhanced diuresis was less in such kidneys than it was in the intact kidney of the same animal, and less too than in kidneys (of other dogs) which had been transplanted but not preserved.

In the present work we have experimented on eight dogs by transplanting one kidney into the neck, and then after various time-intervals removing the remaining kidney, and studying the function of the transplant.

METHOD

For the investigation we used dogs from experiments made by A. G. Lapchinskii [1]. The kidneys were preserved at a temperature of 2-4°.

Before and after removal of the kidneys from dogs we studied the following indices: diuresis, excretion of urea and creatinine, specific gravity of the urine, and response to a water and milk load. In the plasma we determined the residual nitrogen, urea, creatinine, and alkali reserve. From the endogenous creatinine we calculated the filtration and tubular reabsorption rates.

There is considerable evidence transplanted preserved kidneys can maintain life after removal of the others. Various lengths of life in such dogs have been claimed, and varied from one to six years [5, 6].

Extended survival of dogs supplied only with transplanted preserved kidneys was first observed in the experiments of A. G. Lapchinskii [1]. One such dog survived for two years seven months, another for 2½ years, and the others for shorter times.

RESULTS

The most striking feature of the transplanted preserved kidneys after the others have been removed is the rapidity and extent of the alteration of function.

Spontaneous diuresis increased many times in the first 3-7 days, and sometimes as early as the first day (Table 1). Subsequently diuresis varied according to nutrition, temperature and many other variables. In some of the dogs, after 3-15 days, a polyuria developed and lasted for various times. During this period, 50-100 ml per hour was passed spontaneously, many times more than was excreted from the two kidneys (one in situ and the other preserved and transplanted) before the former had been extirpated.

The concentration of urea and creatinine, and the amount of these substances excreted per hour by the preserved transplanted kidneys increased sharply during the spontaneous diuresis on the first day after extirpation. This effect was observed in all the eight dogs studied. For example, in Meduza the concentration of urea in the urine of the transplanted kidney on the second day after extirpation of the kidney in situ was 1747.4 mg%, and was 12.4 times more than was found in the urine of the other kidney before extirpation, while the urea excreted per hour was 244.63 mg, i.e., twice as much as had been excreted on the day before by both kidneys, one transplanted and the other.
in situ. On this day, the concentration of creatinine in the urine of the preserved transplanted kidney was 67.57 mg%, which was five times more than in the urine of this kidney before extirpation of the other, and was actually slightly greater than the concentration of creatinine in the urine of the in situ kidney before its extirpation.

On this day during spontaneous diuresis in one hour 9.45 mg of creatinine was excreted from the preserved kidney of Medusa, i.e., 1.3 times more than from both kidneys on the day before extirpation.

Subsequently the concentration of urea and creatinine in the urine of the single remaining transplanted preserved kidney varied over wide limits according to the extent of the diuresis, the diet, and many other factors.

When one kidney remained in situ, a water and milk load was excreted chiefly through it. Of the fluid which had been drunk, 40-60% was excreted through this kidney in three hours and 3-15% through the transplanted organ.

TABLE 1. Spontaneous Diuresis before and after Removal of the Untransplanted Kidneys (in ml per hour)

<table>
<thead>
<tr>
<th>Weight of dog (in kg)</th>
<th>Before extirpation</th>
<th>At various times after extirpation (in ml per hour)</th>
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<tbody>
<tr>
<td></td>
<td>Time in hours for which the transplanted kidney had been preserved</td>
<td>1st</td>
</tr>
<tr>
<td>Kukla, 12</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Kuma, 21</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Pesnya, 14.5</td>
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<td>25</td>
</tr>
<tr>
<td>Meduza, 8</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Strekoza, 13.8</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Ingo, 11</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Malysh, 9</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Johnny, 12.5</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

After removal of the undisturbed kidney, in most dogs the ability of the transplanted organ to respond to the milk and water load gradually increased. In Strekoza, before extirpation of the undisturbed kidney 6.3-7.3% of the milk and water load was excreted by the transplanted kidney in three hours, while 40-50% was excreted through the other. Ten days after removal of the intact kidney, 21.08% of the milk and water load was excreted through the preserved organ, after 25 days 31.6%, and after one month 40.8% was excreted in this way. However, in certain cases the ability to increase diuresis after a milk and water load increased sharply even in the first 7-10 days after extirpation (dogs Ingo and Johnny). The filtration per minute of the transplanted preserved kidneys increased 5-10 times during the first 1-2 days after extirpation. Subsequently this index varied over wide limits, but in many experiments the filtration volume from the single transplanted kidney was greater than the total previous filtration for both organs.