Experimental Transplantation of the Head
—Two Headed Dog—

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Experimental transplantation of the head in dogs was originally performed by Demikhov of U.S.S.R.

From the practical standpoint, the value of head transplantation may be ambiguous. However, it has its significance in two major aspects, namely in the fundamental studies of organ homotransplantation and neurophysiology.

(1) In the transplanted head, it was considered that not only the continuity of the circulation of the blood system is maintained, but also the lymphatic system and the nervous system are in a state of being intact. Therefore survival of the transplanted head depends upon the immunological reaction of the host and donor, taking for granted that the circulatory, the lymphatic and the nervous system are functioning normally. Thus, immunological phenomena in organ homotransplantation is observed with the minimum influence of the lymphatic and the nervous system, and various studies, especially of the effects of immuno-inhibitory drugs on the host-and-donor may be conducted more thoroughly.

(2) In the two headed dog, since the blood supply of the head of the host and the donor originate from the circulatory system of the host, the role of humoral factors in neurophysiological phenomena, such as sleep, appetite or emotion could be studied.

The authors performed a series of experimental transplantation of the head of a small dog (donor) to the neck of a full grown dog (host). Operation was carried out according to the modified Demikhov's method.

The host dog was anesthetized with intravenous injection of nembutal and the common carotid artery and the external jugular vein were exposed and severed. The vessel-suturing apparatuses were applied to the proximal ends of the artery and the vein.

The donor dog was anesthetized with endotracheal intubation and circular incision through the fifth intercostal space was made. The esophagus was dissected at the level of the diaphragm, the thoracic aorta and the superior caval vein were severed and the vessel-suturing apparatuses were
applied to the proximal end of the descending aorta and the distal end of the superior caval vein.

As illustrated in the fig. 1, the common carotid artery and the external jugular vein of the host were anastomosed with the thoracic aorta and the superior caval vein of the donor respectively; the heart and the lungs of the donor were completely extirpated and the esophagus of the donor was sutured in the form of an external fistula.

The difference between the technique of the authors and of Demikhov is that the authors anastomosed the external jugular vein of the host with the superior caval vein of the donor, whereas Demikhov anastomosed the former with the inferior caval vein suturing the right atrium. (Fig. 2)

Four successful transplantation were achieved. The transplanted head was found to be normal in behavior and appearance in the sense that it

<table>
<thead>
<tr>
<th>Number</th>
<th>Survival period (days)</th>
<th>Causes of death</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>one</td>
<td>Operative blood loss of the host</td>
</tr>
<tr>
<td>2</td>
<td>two</td>
<td>Circulatory disturbance leading to edema</td>
</tr>
<tr>
<td>3</td>
<td>five</td>
<td>Insufficient fixation of the transplanted head leading to edema</td>
</tr>
<tr>
<td>4</td>
<td>six</td>
<td>Tearing and &quot;giving-away&quot; of the fixation wire</td>
</tr>
</tbody>
</table>
Fig. 3.

Fig. 4. EEG on the 5th postoperative day
exhibited barking movement, biting the finger of the examiner or the ear of the host and drinking milk (Fig. 3). EEG examination showed a normal record in both the host and the donor (Fig. 4).

Their survival time and the causes of death are shown in the table. According to the authors’ experiences, they are of the opinion that the following points are of importance in the operative procedure.

1) The selection of dogs should be made in such a manner that the vessels to be sutured are approximately equal in size.

2) Anastomosis of the superior caval vein of the donor with the external jugular vein of the host should be done prior to the anastomosis of arterial vessels. If the order of the procedure is reversed, it leads to congestion of the transplanted head.

3) Fixation of the transplanted head is important as to prolong the survival time. It is not sufficient to fix the transplanted head to the muscles or ligaments of the neck of the host only; in addition to these, it is necessary to fix the head with wire to the spinal process of any cervical vertebra or transverse process of the first cervical vertebra.

Reference

1) V. P. Demikhov: Peresadka juiznenno-vajunuikh organov v eksperimente (Experimental transplantation of the essential organs for living)