Recovery Procedures of the Intermountain Organ Bank

D S RICKS, L E STEVENS, H KLINKMANN*, W J KOLFF, B K KASTAGIR and S CHRYSANTHAKOPOULOS
University of Utah College of Medicine, Salt Lake City, Utah, USA
*Visiting Professor from the Renal Unit of the University of Rostock, GDR

The Intermountain Organ Bank located at Salt Lake City, Utah in the western part of the United States of America, was organised in June of 1969 to augment the procurement efforts of the University of Utah Organ Transplantation Service. The primary objective of the organ bank is to salvage for transplantation as many as possible of the kidneys becoming available from non-living donors in the area. Other organs and tissues such as corneas, skin, nerve, temporal bones and glands can be salvaged by the organ bank at the request of any doctor needing these tissues.

The recovery effort of the organ bank involves making the most use of the four component aspects which were recognised to be essential: (1) identifying potential donors, (2) obtaining permission to remove and use organs and tissues, (3) efficient removal of organs and tissues and (4) placing as many donated kidneys as possible in closely matched recipients.

The central Utah area where the Intermountain Organ Bank operates has a population of 774,800 and involves the hospitals 50 miles to the north and south of Salt Lake City (Bureau of the Census, 1970). Twelve hospitals took active part in the organ recovery effort, but because of the differences in facilities, size, and personnel, a varied programme has been used (see Table II).

The criteria for acceptability of a kidney from a non-living donor are: (1) ages 5 to 65 years, (2) no septicaemia or significant urinary tract infection, (3) no malignancy except non-metastasising varieties, (4) adequate urine volume with no more than 4 hours of oliguria prior to the death of the donor, (5) a period of warm ischaemia less than 2 hours.

METHODS

Included are the methods which the organ bank is using to obtain a maximum kidney harvest. These methods are described under the four component aspects of the organ bank's effort:
I. IDENTIFYING POTENTIAL DONORS

Four procedures for obtaining notification concerning potential donors have been used by the organ bank.

A. Calls to Intensive Care Units and Emergency Rooms

In the first intensive effort to obtain donors, each hospital was telephoned on a close schedule. Larger hospitals were called daily, smaller hospitals three times a week. An attempt was made to vary the working shift being called and the responsible person contacted. Within two weeks, supervising nurses at most of the larger hospitals voiced their dissatisfaction with the inconvenience of this procedure and it was discontinued.

B. Visits to Intensive Care Units and Emergency Rooms

The Intermountain Organ Bank Coordinator visited the intensive care units and emergency rooms of the hospitals in the area. The visits involved a friendly reminder that the organ bank needed donors, and an investigation of a new case or a report on the outcome of a previous case. The effect of these visits has been encouraging because of the fine rapport which the organ bank has established with the hospital personnel and the calls which hospital personnel have made to the organ bank when a potential organ donor is sighted. Only one hospital administration has denied organ bank personnel free access to visit their intensive care unit and emergency room and they promised the organ bank Coordinator that permission would, in time, be granted.

C. Call Schedule to Hospitals

Four hospitals have allowed the establishment of a daily call schedule. The names of patients in critical condition, and recent critical admissions are given to the organ bank secretary when she calls an operator at the information desk of the hospital each morning. The critically ill patients are checked for medical acceptability and prognosis by a personal visit or a call to the resident on the case.

D. Other Sources

Other sources of notification include monitoring of news media and receiving calls from police or ambulance services. Since accident cases constitute about one-third of the potential donors, these sources of notification hold promise. The police department and ambulance services agreed to have their dispatchers call the organ bank when a good potential donor was found.

II. OBTAINING PERMISSION TO REMOVE ORGANS AND TISSUES

A. Requests for Donation of Next of Kin

Most donations have been obtained from the next of kin of a comatose patient at the time a hopeless prognosis is given by the attending physician. The attending physician normally makes the request for permission to transplant needed tissues, but occasionally he requests that someone from the organ
bank be in attendance to answer questions or make the request for permission. Few problems have developed while using this method, but the physician has occasionally been difficult to contact when a good opportunity to request permission presents itself, and permission to remove organs has been occasionally denied.

In order to obtain permission for kidney removal with greater frequency, a publicity programme was launched by the organ bank. The effort followed the passage of Utah's Gifts of Parts of the Body Act of 1969 (Utah State Legislature 1969). The Act resulted from a noteworthy co-operative effort between the several medical and legal groups of the State of Utah.

B. The Intermountain Organ Bank Donor Registry Campaign
The publicity effort was designed to register as many donors as possible and to educate the public so that a higher number of people would give permission when a relative was about to expire.

The main part of the publicity programme was an organ donor registration campaign backed by the largest local newspaper, the Salt Lake Tribune. Between January 1, 1970 and February 22, 1970, there were 26 articles mostly accompanied by photographs which were placed on the front page of the local news section of the paper. The articles discussed the need for organ donations and the procedure which would be used to make donations. There were testimonials by patients awaiting a transplant, recipients of transplants, and hospital administrators supporting the organ bank. Two transplants which occurred during the period received special coverage. The news articles were augmented by television on the 10:00 pm news broadcast describing the organ retrieval programme of the organ bank.

The campaign was culminated on February 22, 1970 with the distribution of donor registry cards, front page headlines and articles 'Help Save a Life'. Each person who mailed in the donor registry form received an organ donor card.

The publicity effort has continued at a less intense level in the mass media, but has increased in terms of requests from clubs and civic groups for speakers.

III. EFFICIENT REMOVAL OF ORGANS AND TISSUES

A. The Mobile Nephrectomy Team
Two approaches to the logistics of efficient removal of the kidneys have been studied. The first is a mobile nephrectomy team equipped to travel to the donor. A van is loaded with sterile instruments, gowns, caps, and kidney containers necessary to perform a nephrectomy. When a potential donor expires, the team moves to the operating room of the hospital where the donor has been a patient and performs the nephrectomy. After the kidneys have been removed, another surgeon removes non-renal tissues which he needs.
B. The Local Surgeon
The second approach we have used for removing kidneys is to utilise the services of a surgeon to remove the kidneys from donors in each distant hospital. With efficient transportation, this method of kidney removal would allow retrieval of kidneys from greater distances; arrangements are being made with doctors to remove kidneys in hospitals up to 560 miles away.

IV. PLACING AS MANY DONATED KIDNEYS AS POSSIBLE IN CLOSELY MATCHED RECIPIENTS

A. The Local Recipient Pool
The local recipient pool is maintained in three dialysis units: (1) The University of Utah Transplant Service, utilising four dialysis beds, (2) Salt Lake Veterans Administration Hospital Hemodialysis Unit, with eight dialysis beds, and (3) The University of Utah Home Dialysis Program, which trains the patients and families to perform dialysis in their homes (Reemstma et al, 1970). Due to the comparatively small recipient pool locally and the resultant difficulty of matching donors and recipients, it soon became apparent that sharing kidneys with other transplant centres would lead to better matching and utilisation.

B. The North American Network for Sharing Kidneys
The North American Network for Sharing Kidneys includes the majority of transplant centres in the United States and Canada, co-operating along the guidelines established December 11, 1969 in a joint meeting at Los Angeles, California.

Table I. Guidelines of the North American Sharing Network
December 11, 1969

1. Decisions will be made by telephone contact between the transplant teams of the prospective donor and recipient.
2. A recipient team need accept only those preferred organs which appear suitable to them.
3. Preservation may include the use of Dr Geoffry Collins isotonic solution. Instructions on the preparation and use of Collins Flushing Solution can be obtained from Dr Paul I. Terasaki at UCLA.
4. An expense covering fee of $500 is to be paid by the recipient to the transplanting (recipient) team, then transmitted to the donor team which incurred the expense.
5. Criteria for acceptability of donor kidney:
   a. As short a warm ischaemic interval as possible – preferably not to exceed 60 minutes.
   b. Donor age 4 – 65 years.
   c. Donor free from severe infection or malignancy.
   d. Good kidney function until demise of donor.
6. The centre acquiring a pair of kidneys from a non-living donor uses both kidneys if the donor-recipient match is B or better for both locally. However, if no match better than C is available locally, each centre agrees to share into the Network one of the pair acquired if a match B or better can be obtained.

7. Donor and recipient should match for ABO red cell antigens in each case.

8. Steps to be taken by each participating centre:
   a. Each potential recipient to be typed and registered with the typing laboratory at UCLA. When a recipient is no longer ready to accept a kidney, notification should be sent promptly to Dr Terasaki.
   b. A listing of the names, addresses and telephone numbers of the first three members of each transplant team to be contacted in case a matched kidney becomes available should be sent to the UCLA lab.

All centres register their recipients with Dr Terasaki at the UCLA Tissue Typing Laboratory where the phenotypes are stored in a computer (Mittal et al, 1969). Once a month an updated computer printout of all the recipients, (now over 500) indexed by phenotype, is sent to each of the co-operating centres. The prospective donors are typed locally using standard antisera* and matched with recipients listed on the computer printout. Priorities are given first to recipients in the locale, then in the region, and finally in the continental pool.

The transporting of kidneys between various centres in the network has been accomplished by standardised transport boxes which are assembled in Salt Lake City. They consist of a styrofoam and cardboard box which is filled with ice to maintain a constant temperature, a wide-mouth two-litre polypropylene jar wrapped in two polyethylene bags for sterility. A tissue typing bag and containers for shipping test tubes and other samples for lymphocyte suspensions and lymph nodes are included in each transport box. Information about each transplant involving a shared kidney, and follow-up data is being collected by the Salt Lake Center.

RESULTS

The organ bank continues to study new alternatives designed to improve recovery of kidneys for transplantation. Between July 1, 1969 and March 31, 1970, the organ bank evaluated 56 cases which involved acceptable donors who progressed to demise. From these cases, 12 transplants were performed. A breakdown of the hospitals and their participation in these cases is given in Table II.

* Supplied by the UCLA Typing Laboratory of Dr Paul Terasaki under auspices of the US Public Health Service
<table>
<thead>
<tr>
<th>Donor Hospital</th>
<th>Medically Cases which Progressed to Death</th>
<th>Number of these with Permission Given</th>
<th>Number Tissue Typed</th>
<th>Kidneys Removed</th>
<th>Kidneys Transplanted</th>
<th>Number of Beds</th>
<th>Distance from Organ Transplant Service miles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Salt Lake County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U of U</td>
<td>16</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>2</td>
<td>267</td>
<td>0</td>
</tr>
<tr>
<td>LDS</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>544</td>
<td>3½</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>153</td>
<td>12</td>
</tr>
<tr>
<td>Veterans Administration</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>546</td>
<td>1</td>
</tr>
<tr>
<td>Primary Childrens</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>135</td>
<td>3½</td>
</tr>
<tr>
<td>Holy Cross</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>379</td>
<td>2</td>
</tr>
<tr>
<td>St Marks</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>260</td>
<td>6</td>
</tr>
<tr>
<td><strong>In Davis County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So. Davis Community</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>74</td>
<td>14</td>
</tr>
<tr>
<td><strong>In Weber County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McKay-Dee</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>318</td>
<td>46</td>
</tr>
<tr>
<td>St Benedict's</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>188</td>
<td>48</td>
</tr>
<tr>
<td><strong>In Utah County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utah Valley</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>241</td>
<td>52</td>
</tr>
<tr>
<td>American Fork</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>85</td>
<td>37</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>56</strong></td>
<td><strong>31</strong></td>
<td><strong>27</strong></td>
<td><strong>38</strong></td>
<td><strong>12</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Hospital Calls to IOB</td>
<td>IOB Staff Called</td>
<td>Calls to ICU's &amp; ER's</td>
<td>Call Schedule to Hospitals</td>
<td>IOB Monitoring News</td>
<td>Police and Ambulance</td>
<td>Total</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------</td>
<td>------------------</td>
<td>-----------------------</td>
<td>-----------------------------</td>
<td>--------------------</td>
<td>----------------------</td>
<td>-------</td>
</tr>
<tr>
<td>No Donors Identified</td>
<td>50</td>
<td>12</td>
<td>2</td>
<td>159</td>
<td>24</td>
<td>3</td>
<td>250</td>
</tr>
<tr>
<td>Donors Judged Medically</td>
<td>32</td>
<td>12</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>56</td>
</tr>
<tr>
<td>Acceptable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Next-of-kin Giving Permission</td>
<td>20</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Donors Tissue Typed</td>
<td>15</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Kidneys Removed</td>
<td>24</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>Kidneys Transplanted</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

**Key**

- IOB — Intermountain Organ Bank
- ICU — Intensive Care Unit
- ER — Emergency Room
I. Identifying Potential Donors
The results of the various methods of identifying potential donors are given on Table III. Most of the cases identified on the call schedule were either medically unacceptable or the patient recovered.

A study of the total deaths occurring at all of the hospitals in the Salt Lake City area for January and February 1970 showed that the organ bank was notified in 100% of the respirator turn-off cases, 43% of the terminal patients, and 14% of the cases involving deaths which occurred suddenly and received resuscitation. In six potentially usable cases between July 1, 1969 and March 31, 1970, notification came to the organ bank too late for recovery of the kidneys.

II. Obtaining Permission
The organ donor registry has now registered 5,235 donors. The first kidney recovery made possible because of the registry was from a 45 year old victim of a heart attack on March 4, 1970. The second recovery occurred in a 57 year old man who died a few hours after open heart surgery. His wife presented the donor card when he died. Both kidneys and corneas were removed and one kidney and the corneas were transplanted.

The primary objective of the donor campaign has been accomplished. The secondary objective was to educate the public to the needs of the organ bank in such a way as to improve the frequency of permissions granted by the next of kin. Before January 1, 1970, permission was given 24 out of the 37 times it was requested with 65% success. Since January 1, the date that our publicity was launched, through April 30 only 12 out of 22 (55%) requests for permission to use organs for transplant were granted.

III. Efficient Removal of Organs and Tissues
The mobile nephrectomy team has proved effective up to distances of 15 miles from the transplant centre.

Having surgeons at the donor hospital remove kidneys has been quite effective in outlying areas. Six kidneys have been removed by surgeons at the largest outlying hospital, and four of the six had less than two hours of ischaemia.

IV. Placing as many Donated Kidneys as possible in Closely Matched Recipients
Ten kidneys which were otherwise acceptable were not used because no tissue match could be found or because no transportation could be obtained in the time available.

Six kidneys have been recovered locally and transplanted. Six kidneys have been retrieved locally and transported to out-of-state centres for transplantation. Five kidneys have been recovered in California and transported to our centre for transplantation.
DISCUSSION

Donor identification is particularly effective when a doctor or nurse in a local hospital calls the organ bank about a potential donor. All other procedures to seek out potential donors have been comparatively less productive. Frequent visits and reminders from the organ bank staff appear essential to successful tissue recovery.

Permission to remove and use organs and tissues is accomplished most easily before a terminal illness or accident occurs. However, it is doubtful that a majority of potential donors will carry donor cards so the request made of the next of kin at the time of the accident remains the primary method of gaining permission to remove and use organs and tissues. Evidently, a long-term education process for the public will be necessary to obtain a high frequency of permission for donations from the next of kin.

Organ recovery is performed most effectively by a mobile nephrectomy team at distances up to 15 miles. Over greater distances, a local surgeon in the donor's hospital can perform the nephrectomy more effectively.

The efficiency attained in placing closely matched kidneys appears to depend first upon the size of the recipient pool, and second upon the availability of transportation to the recipient. Time is an important consideration under present conditions and either extending the time a kidney can withstand ischaemia or establishing more efficient, faster transportation systems will reduce the problems caused by the lack of time.

CONCLUSION

The Intermountain Organ Bank has augmented the efforts of the University of Utah Organ Transplant Service in recovering kidneys. A maximum number of usable organs can be obtained by a programme designed to identify all potential donors, to obtain permission to remove and use organs and tissues in an optimum percentage, to remove tissues efficiently, and to maintain as large and accessible a recipient pool as possible.

ACKNOWLEDGEMENT

Supported in part by a US PHS Contract Number HMS-110-69-382 through the Kidney Disease Control Program to Dr Lawrence E. Stevens, MD.

REFERENCES