TIMY—A Center-Oriented Transplant Information Management System


The increasing numbers of transplants performed at the University of Pittsburgh mandated the development of a computerized data storage and retrieval facility. The manual processing of data proved to be inefficient in meeting the daily departmental needs. Throughout the design the intention was to create a system for everyday clinical use as well as for scientific purposes. Highest priority was given to two distinct features, user friendliness and flexibility.

It was clear that tasks addressed to the system cannot depend on the available database structure and report facilities but that the database and reports have to be adjustable with reasonable time and efforts to the ever-changing needs of the clinical and scientific transplant team. The designers’ roles within the Transplant Department proved to be of great importance in meeting these requirements.

In this report we describe the development and design of our center-oriented computerized kidney transplant information management system (TIMY). A scoring system for equitable allocation of kidney transplant organs is an integral part. Similar systems are currently in use for the liver transplant program and to some extent for the heart transplant service.

System Design

Using the DATAEASE data base program (DATAEASE International, Trumbull, CT), TIMY was designed and implemented by using an IBM AT computer with a 30-megabyte hard disk. As a distinct feature, many of the data entry fields are choice fields, which helps to eliminate data entry errors. The precoding of choices allows a convenient export to statistical software packages.

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Fig 1. As a distinct feature, many of the data entry fields are choice fields, which helps to eliminate data entry errors. The precoding of choices allows a convenient export to statistical software packages.

The system design covers the candidacy, transplant, and follow-up phases. Data can be entered in the appropriate forms (Figs 2 to 4) with easy movement between the various patient records. In addition addresses and telephone numbers of referring physicians, patients, and their home dialysis centers are stored in specific files and used for printing the weekly candidate list.

Various established reports are available for clinical and research tasks. Included are comprehensive candidate listings, regular summary reviews, and statistics (Figs 5 and 6). Additional reports can be designed for impromptu informational requests by using the software query language, which does not require a programmer to initiate them.

The data base is available to the transplant coordinators via a laptop computer. Therefore

From the Department of Surgery, University of Pittsburgh.

Dr. Markus is the recipient of a research fellowship from the Deutsche Forschungsgemeinschaft.

Address reprint requests to B.H. Markus, M.D., Department of Surgery, School of Medicine, University of Pittsburgh, Falk Clinic, 3601 Fifth Ave, Pittsburgh, PA 15213.

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**Fig 2.** Every patient entered in the TIMY kidney transplant management system has a pertinent record with demographic data. Most of the data is entered in precoded choice fields, which minimizes data entry errors and greatly facilitates later analysis.

**Fig 3.** Form for candidate information. Additional forms exist for patient address, referring physician, and dialysis center.
data entry form covering the essential information related to the transplant event and the particular donor. For survival and status information additional forms are existing.

pertinent patient data can be reviewed from any telephone connection, which facilitates the coordinators work during nights and weekends. The dynamic nature of the data requires constant updating, so the coordinator can review any pertinent data changes since the last printing of the candidate list.

The system structure encompasses the data necessary for reporting to government agencies as well as to the UCLA and Collaborative Transplant Study (CTS) Kidney Transplant Registries. The electronic data transfer via diskettes or modem to the UCLA Kidney Transplant Registry and to the CTS study at
Doe, John
ID#: 999-99-9999
DATE REFERRED: 12/01/86
ABO: 0
AGE: 53.6
SEX: MALE
DOB: 01/01/34
HT: 173
WT: 77.9
CANDIDACY FOR GX: 1
STATUS: ACTIVE
URGENCY:
DIAG: Diabetic Nephropathy
DIALYSIS: Hemodialysis
PRA HIGH: 2.0
DATE: 01/01/87
PRA RECENT: 0.0
DATE: 04/07/87
TISSUE TYPING #: 77777
HLA TYPE: A 2, 3 B 7,62 DR 3,5
HAAB: Neg
HBsAg: Neg
HBsAb: Neg
HBcAb: Neg
CMV: Neg
INSURANCES: Blue Cross/Blue Shield
Nephrectomy: None
COMMENTS:
Patient had myocardial infarct in 10/85
ADDRESS: 22 Beechwood Ave, Pittsburgh, PA. 15219
PHONE HOME: (412) 999-9999
PAGER: (412) 999-9999
PHONE WORK: (412) 999-9999
TYPE: VOICE
RELATIVES: (412) 999-9999 - Susan - aunt
RELATIVES: (412) 999-9999 - Jack - sister
DIALYSIS CENTER: ABC
PHONE: (412) 999-9999
REFERRING MD: TES

ETC. ETC. ETC.

BLOOD GROUP A
BLOOD GROUP B
BLOOD GROUP AB

ETC. ETC. ETC.

CANDIDATE LIST STATISTICS
FOR ALL BLOOD GROUPS

<table>
<thead>
<tr>
<th>ACTIVE CANDIDATES</th>
<th>#</th>
<th>100.00 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOOD GROUP 0</td>
<td>57</td>
<td>47.9 %</td>
</tr>
<tr>
<td>BLOOD GROUP A</td>
<td>34</td>
<td>28.5 %</td>
</tr>
<tr>
<td>BLOOD GROUP B</td>
<td>20</td>
<td>16.8 %</td>
</tr>
<tr>
<td>BLOOD GROUP AB</td>
<td>8</td>
<td>6.7 %</td>
</tr>
</tbody>
</table>

Fig 5. Weekly candidate listings are printed with comprehensive candidate data for use by transplant coordinators, procurement agency, and tissue typing laboratory.
TIMY—TRANSPLANT INFORMATION SYSTEM

The University of Heidelberg, W Germany, is currently being implemented.

For scientific projects additional data entry forms can be easily developed and implemented into the system. Using the DTAASE query language, the researcher or clerical staff can design customized reports including basic statistics. Further analysis can be accomplished by exporting the data for use in different statistical software packages. This process is greatly facilitated through the use of precoded choice fields.

SCORING SYSTEM

To facilitate the allocation of the best-suited transplant candidate when a donor organ is offered, an integral, computerized scoring system was developed as an objective allocation method. The results do not mandate but augment the decision-making process of the surgeon. Currently, in Pittsburgh the Transplant Organ Procurement Foundation is running this scoring system for the kidney transplant program.

Various factors were thought to play an important role in the assessment of a suitable candidate. Of these, the five most significant are used in the scoring system: time of waiting, quality of HLA antigen match, presensitization state with panel reactive antibodies (PRA), medical urgency, and logistical factors. Because the donor and recipient should be of the same blood group with only rare exceptions, renal candidates are grouped as to whether their blood type is O, A, B, or AB. Candidates who weigh less than 27 kg or are 10 years or younger are listed separately. Sera from all candidates of the appropriate blood type and size are match against lymphocytes from the donor of the offered kidney. A negative crossmatch, connoting the absence of antidonor cytotoxic antibodies in the recipient serum, is a necessary condition for placement on the list of potential candidates.

The waiting score is determined as a rank order of waiting time that is established from the date of referral for consideration of transplantation. A maximum of ten points is awarded to the candidate waiting for the longest period, with fewer points given for shorter waits.

The quality of antigen match points is determined by the grade of histocompatibility at the HLA-A, -B, and -DR loci. Two points

Fig 6. The Oversight Committee, a community board established to review the transplant activities in Pittsburgh, receives every month a listing of the performed transplants, patient data, scoring results, and eventually overriding statements.
are given for each antigen matched, with a score of 12 being possible.

The present state of alloimmunization, as defined by the most recent PRA antibody level, is used for calculating the PRA score. One point is given for each 10% PRA value up to a maximum of ten points.

The medical urgency score is used in cases where dialysis is not a feasible option for the patient so that organ transplantation within a short period of time is essential. This is necessary, for example, in patients whose access sites for dialysis have been exhausted. A total of ten points can be assigned to such a patient.

A maximum logistics score of six points can be awarded for logistic factors based on the ease and rapidity with which the transplant could be performed. For example, if a kidney was offered near the end of its permissible storage time, logistic points might be given to a candidate whose proximity to the hospital and history of recent dialysis could permit prompt organ transplantation.

DISCUSSION

TIMY has proved to be very effective in our everyday clinical and scientific use. In comparison to previous data management systems available in our department, user friendliness and flexibility are greatly improved. This led to departmentwide acceptance of the system as a useful tool. The availability via telephone connection from a laptop computer is of great importance for the clinical transplant coordinators. The easy customization of reports proved to be very valuable to our clerical staff in accommodating the various requests from insurance companies and other agencies. The medical staff participating in research can design their data entry forms to compliment the existing system. The standard framework of the data base can be used and expanded to meet the particular study needs.

As stated earlier the result of the scoring system does not mandate but facilitates the selection of an appropriate candidate for this particular donor organ. Certainly additional medical circumstances like cytomegalovirus status of donor and recipient, size limitations, etc, have to be considered. When there is a deviation from the computerized scoring result, an explanation is documented. Scoring results and overriding explanations are routinely reported to community boards for review purposes (Fig 6). Since its introduction in 1986 this computerized scoring system has proved to be a very valuable tool in the transplant candidate selection process.

A similar scoring system is routinely used for candidate selection in our liver transplant program. A system for heart transplantation is currently under evaluation.

REFERENCES