Mortality Abstract 480M-1

SINGLE LUNG TRANSPLANT FOR CHRONIC RESPIRATORY FAILURE

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Reference

Objective of This Abstract
To analyze comparative mortality in a small series of patients with severe restrictive lung disease treated by surgical transplant of a single lung.

Patients Studied
A series of 20 patients with end-stage pulmonary fibrosis treated at Toronto General and Mt Sinai Hospitals, Toronto, from November 1983 to August 1990 and treated surgically with single lung transplant. In the 16 patients who survived the perioperative period the median age was 51 years, with a range from 15 to 61; only three of the 16 were female. The diagnosis was idiopathic pulmonary fibrosis in 12 of these patients; the others were diagnosed (one case each) as pulmonary fibrosis, familial or due to chemotherapy, sarcoidosis, and eosinophilic granuloma. All patients had severely reduced exercise capacity, all required supplemental oxygen at rest, and all were estimated to have a potential survival that probably did not exceed 12 to 18 months. Preoperative lung function tests on the nine patients who survived one year or more revealed a vital capacity (Vc) of 43±9% of predicted, and a forced expiratory volume at 1 second (FEV1) of 50±9% of predicted. Candidates with similar severe restrictive lung disease were excluded from consideration for lung transplant if age exceeded 60 years, if other severe diseases were present, including liver impairment, if there was a history of cancer within 5 years, if right-heart failure was severe, if nutrition was poor, and if the patient was not ambulatory with good social support and motivation.

Follow-up
Age, sex, diagnosis, and FU data were given for each of the 20 patients in Table 1. Follow-up ranged from 1 month to nearly 6 years, with a mean of 2.2 years and a total of 34.5 patient-years of exposure.

Expected Mortality
Expected deaths for the table in this abstract have been calculated on an individual age/sex/duration-matched basis, from the 1975-79 Group Life Insurance Tables prepared by the Society of Actuaries. These tables were considered to be more appropriate than population life tables because of the degree of selection used in formation of the group of patients eligible for lung transplant. The small numbers of survivors account for the considerable random variation in aggregate expected mortality, q', by year of FU in Table 1A.

Results
There were four perioperative deaths, resulting in an acute mortality rate of 20%. The causes were listed as air embolism, septicemia, viral pneumonia, and poor donor selection plus sepsis. These deaths were excluded from long-term FU of the 16 perioperative survivors, detailed in Table 1A. Four deaths occurred in the first year, and only a single death thereafter. With such small numbers, Table 1A has been arranged to show the observed data for l, w, E, and d on an annual basis, but comparative mortality only for the first year and for the combined subsequent FU (durations 1-6 years). The observed mortality rates, the mortality ratios, and the excess death rates (EDRs) are all subject to very wide random variation because of the small size of the series, but they are of interest as a preliminary indication of what to anticipate for this new type of organ transplant. Excess mortality was extremely high in the first year: a mortality ratio of 5700%, and an EDR of 287 extra deaths per 1,000 per year. After the first year there was only a single death in 20.8 patient-years of exposure, yielding a mortality ratio of 735% and EDR of 42 per 1,000, both very crude estimates, but substantially lower than their respective estimates in the first year. The levels of excess mortality and the pattern by duration resemble these characteristics in patients, age 40-49, who have had a successful kidney transplant for end-stage renal disease (see various abstract tables in the 1976 and 1990 Medical Risks monographs). After the perioperative period for kidney transplant the mortality is highest in the first year, and EDR tends to diminish thereafter until it appears to stabilize. There has been a secular reduction in excess mortality in kidney transplant patients, and we may reasonably anticipate a similar reduction if lung transplant operations of this type are further developed and long-term management improves.

Comment
These data have been presented on the basis that skimpy data are better than no data, but readers are cautioned to keep in mind the quantitative uncertainty inherent in the very small exposure and numbers of deaths. Tests on patients surviving a year or more showed increase of VC to 69±10%, FEV1 to 79±15%, arterial oxygen saturation to 87±13 mm (nearly normal), a doubling of the single-breath diffusing capacity, and a significant increase in exercise capacity; supplemental oxygen at rest was no longer necessary. Prolongation of life in these
patients was clearly associated with an improvement in their quality of life. For further details as to the course in these patients and the long-term causes of death, the reader should consult the original article. The report was of interest to me not only for the uniqueness of the results, but also because such lung transplant represents another remarkable (and costly) technological advance in medicine.

Table 1A

Comparative Mortality after Single Lung Transplant for End-Stage Pulmonary Fibrosis, 1983-1990

<table>
<thead>
<tr>
<th>Interval</th>
<th>No. Alive</th>
<th>No. Withdrawn</th>
<th>Exposure</th>
<th>No. of Deaths</th>
<th>Mortality Ratio 100d/d'</th>
<th>Mean Ann. Mort. Rate/1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at Start</td>
<td>at Start</td>
<td>Pt.-Yrs. E</td>
<td>Obs. d</td>
<td>Exp.* d'</td>
<td>Obs. q</td>
</tr>
<tr>
<td>0-1 yr.</td>
<td>16</td>
<td>3</td>
<td>13.7**</td>
<td>4</td>
<td>0.070</td>
<td>292</td>
</tr>
<tr>
<td>1-2</td>
<td>9</td>
<td>1</td>
<td>9.0</td>
<td>1</td>
<td>0.050</td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td>7</td>
<td>3</td>
<td>5.7</td>
<td>0</td>
<td>0.040</td>
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<tr>
<td>3-4</td>
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<td>2</td>
<td>3.4</td>
<td>0</td>
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</tr>
<tr>
<td>4-5</td>
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<td>1</td>
<td>1.9</td>
<td>0</td>
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</tr>
<tr>
<td>5-6</td>
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<td>1</td>
<td>0.8</td>
<td>0</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>1-6</td>
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<td>8</td>
<td>20.8</td>
<td>1</td>
<td>0.136</td>
<td>735</td>
</tr>
</tbody>
</table>

* Basis of expected mortality: 1975-79 Group Life Insurance Tables (Soc. Act.)
† Individual cases (Table 1 of article) matched by attained age and sex
** E adjusted for assumed perioperative period of 3 weeks, excluding all deaths in that period