Survival and ‘True’ Rehabilitation after Dialysis and Transplantation: a 7-Year Follow-up

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Summary
Serial follow-ups of processed and recorded semi-quantitative data (bone biopsies, nerve conduction velocity, glucose A−V, etc.) have been carried out in 152 chronic uraemic patients of which 39 underwent kidney transplantation. The comparative studies have been performed in order to evaluate the magnitude of survival/rehabilitation ratio due to dialysis and transplantation.

After a minimum of five years, the overall survival rate is better on dialysis. The most important determining factors seem to be: type of donor in transplantation and the nature of renal lesions and residual $C_{cr}$ in dialysis.

‘True’ or ‘effective’ rehabilitation has been documented only after transplantation. Dialysis does not reverse systemic uraemic changes and the rehabilitation in survivors may be ‘apparent’.

Dialysis may prevent systemic uraemia, provided that starting time of treatment is gauged earlier (residual $C_{cr} > 10$).

Introduction
Some aspects of the survival/rehabilitation ratio in kidney replacement programmes (dialysis and transplantation) for chronic uraemic patients have perhaps not been sufficiently investigated. They include:

(1) the comparative overall results of the two programmes in homogeneous groups,
(2) the influence on the survival rate of various factors including the nature of renal lesions and the method of treatment;
(3) the exact significance of the term rehabilitation which, when proper criteria of evaluation are employed, may be only ‘apparent’ and not ‘effective’.

These topics are discussed in the present paper.

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PATIENTS AND METHODS

From 1966 to 1974 152 cases of chronic renal failure have been included in our kidney replacement programme. Of these, 67 had glomerulonephritis; 43 pyelonephritis; 19 polycystic kidneys and 23 vascular nephrosclerosis. Whilst 113 cases have been treated by dialysis, only 39 have also been transplanted. Coil and Cordis dialysers were employed with a variable dialysis rhythm, according to necessity (Bonomini, 1974). Transplants were carried out from living (25 cases) or cadaver donors (14 cases). In all cases serial clinical and laboratory investigations were carried out at programmed times (3–6–12 months; 1–2–3–4–5 years). They included:

(1) **Routine biochemistry**: plasma BUN, creatinine, electrolytes, haematocrit, etc.
(2) **Erythropoiesis studies**: $^{59}$Fe, $^{51}$Cr, transferrin, reticulocytes, sternal marrow puncture.
(3) **Blood-pressure studies**: plasma renin concentration, serum aldosterone, $^{22}$Na, cardiac index.
(4) **Nerve conduction velocity**: peroneal and median nerves.
(5) **Iliac crest percutaneous bone biopsies**: using a trephine of 5 mm. internal diameter, calcium balance and $^{47}$Ca turnover.
(6) **Metabolic studies**: glucose (peripheral uptake, oral tolerance curves); lipids (triglycerides, NEFA, phospholipid and cholesterol); serum aminograms.

Computer recording of all dialysis and transplantation data was made using a Digital PDP 11/40 specifically devoted to dialysis checks.

RESULTS

Table I refers to the survival rate curves. Cumulative results confirm the more favourable effect of dialysis (especially at home) as compared with transplantation. At the fifth year, 59.5% of the dialysed patients are still alive, compared with 38.5% of the transplanted group.

It has been found that the dialysis survival rate is influenced by several factors among which the nature of renal lesions and the dialysis starting-time are of most importance.

The fifth year survival rate, according to the nature of renal lesions, has been found as follows: 93% in polycystic kidney; 82% in pyelonephritis; 62.1% in glomerulonephritis and 29.4% in vascular nephrosclerosis.

Bilateral nephrectomy and short daily dialysis have been shown to enhance the poor dialysis survival rate in malignant hypertension due to vascular nephrosclerosis. The correlation between nature of renal lesions and transplantation is not similarly clear: however, our material is too limited to allow definite conclusions on this point.
TABLE I. Survival Rates in Regular Dialysis (143 Patients) and after Kidney Transplantation (39 Patients)

<table>
<thead>
<tr>
<th></th>
<th>0–1 yr</th>
<th>1–2 yr</th>
<th>2–3 yr</th>
<th>3–4 yr</th>
<th>4–5 yr</th>
<th>5–6 yr</th>
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<tbody>
<tr>
<td>Dialysis</td>
<td></td>
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<tr>
<td>Residual C_{cr} &lt; 10</td>
<td>107 (100%)</td>
<td>88 (82.3%)</td>
<td>80 (74.8%)</td>
<td>66 (61.7%)</td>
<td>56 (52.5%)</td>
<td>45 (42.1%)</td>
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<tr>
<td>Residual C_{cr} &gt; 10</td>
<td>36 (100%)</td>
<td>34 (94.5%)</td>
<td>32 (88.9%)</td>
<td>30 (83.4%)</td>
<td>29 (80.6%)</td>
<td>27 (75.0%)</td>
</tr>
<tr>
<td>Transplantation</td>
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<tr>
<td>Living donors</td>
<td>25 (100%)</td>
<td>20 (80.0%)</td>
<td>18 (72.0%)</td>
<td>16 (64.0%)</td>
<td>12 (48.0%)</td>
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<tr>
<td>Cadaver donors</td>
<td>14 (100%)</td>
<td>8 (57.2%)</td>
<td>5 (35.8%)</td>
<td>4 (28.6%)</td>
<td>3 (21.5%)</td>
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</table>

In addition to the quality of life, the rehabilitation of the patients (for both dialysis and transplantation) has also been evaluated on the basis of the results of the following semiquantitative parameters:

1. nerve conduction velocity;
2. glucose A–V difference;
3. serum aminograms;
4. bone biopsy osteodystrophy;
5. serum transferrin.

All these results were consistently correlated with clinical data.

Figure 1. Rehabilitation as ‘able to work’ in regular dialysis (D) and in transplantation (T) programmes.

Figure 1 refers to the results of rehabilitation of the patients who were subjectively evaluated only as ‘able to work’. Approximately the same percentage of cases dialysed or transplanted return to work in the first one to two years while the fifth year percentage was higher in transplantation (88.7%) than in the dialysis group (57.4%). Figure 2 refers to the average ‘effective’ rehabilitation of the patients. The effectiveness was based on the disappearance of the alterations of all the parameters previously outlined. Discrepancies between dialysis and transplantation are so remarkable that further comment would be superfluous.
Figure 2. 'Effective' rehabilitation in regular dialysis (D) and in transplantation (T) programmes.

DISCUSSION

The invaluable merit of dialysis and transplantation in prolonging life in most chronic uraemic patients otherwise destined to die is well established, as is confirmed by EDTA annual reports (Gurland et al., 1973). Some aspects, however, seem to be worthwhile mentioning with regard to the survival/rehabilitation ratio which may be achieved by the two programmes.

In terms of pure survival, long-term studies (Table I) seem to confirm that dialysis gives better results (mainly by home dialysis, Gurland et al., 1973). However, when the results are evaluated not only as to 'survival' but also regarding 'rehabilitation', opinions are still controversial. This mostly concerns regular dialysis where the criteria used to indicate the rehabilitation of the patients are certainly equivocal. The most commonly used criteria — return to full employment (Bower et al., 1971); number of square meters-hours of dialysis per week (Babb et al., 1971); physical, clinical, dietary and socio-psychological factors (De Palma et al., 1972) — are subjective or hypothetical and concern the social and professional activity of the patients. Unfortunately exact comprehension of the often subclinical uraemic state is not always considered.

Judging rehabilitation only as 'return to work' may be misleading. The capacity to work may not have a direct relationship with the degree of uraemia. In other words, rehabilitation by dialysis in terms of capacity to work may be only apparent.

When a proper follow-up of multiple processed and recorded semi-quantitative data is carried out in a large population of uraemics on dialysis and after transplantation, and the effective rehabilitation of patients is measured in terms of their improvement, the differences between the two programmes are so remarkable that further comment may be unnecessary (Figure 2). This occurs despite a so-called 'reasonable quality of life' of the patients on RDT.
‘Effective’ or ‘true’ rehabilitation (disappearance of clinical and subclinical changes) cannot, in fact, be obtained by dialysis at present. Dialysis may be an acceptable method for preventing most of the systemic changes of uraemia provided that the starting time of treatment is properly gauged earlier (Bonomini, 1974). In successful transplantation a complete rehabilitation from systemic uraemia occurs in a matter of several months. In our experience, bone lesions, as evidenced by serial bone biopsies, seem to be the last change to disappear. Despite drug-dependency, therefore, transplanted patients have a quality of life more similar to normal than do cellophane-dependent patients on RDT.

References

Open Discussion
H C BURCK (GFR) I wonder whether you can really compare these two groups? Did you calculate whether there was still a difference, if you took the same Ccr at the start?
BONOMINI Yes, we did.
F P BRUNNER (Basle) What level of creatinine clearance do you suggest we should start at dialysing? Are you suggesting that we should start dialysing when creatinine clearance is still above 20ml/min?
BONOMINI Obviously not. One does what one can. One can treat patients with 0 ml/min, 2 ml/min, 3 ml/min, but my opinion is that starting time is critical. Better results are achieved with an earlier start, generally speaking. Only one patient has received dialysis with a Ccr of 21 ml/min. The majority have residual creatinine clearances from 10–15 ml/min.
V ANDREUCCI (Italy) I don’t think that you can compare a group of patients with a creatinine clearance of more than 10 ml/min with a group of patients with less than 10 ml/min. First of all, most of your patients below 10 ml/min of creatinine clearance are between 0 and 5 ml/min. Patients with a creatinine clearance of 0–2 ml/min have more complications of uraemia. Perhaps it could be better to compare patients with creatinine clearances below five and above five.
BONOMINI Perhaps you are right, but we have not found significant differences in sub-clinical uraemic changes in patients with 0 or 2, 3 or 5 ml/min of residual creatinine clearance.

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