PART 8

Chairman:  E Malan
           Milano
           Italy
Mortality and Morbidity in Diabetic Patients Accepted for Renal Transplantation

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Uraemic patients with diabetes are usually excluded from dialysis and transplantation because of a general fear that their basic disease and its complications will make either dialysis or transplantation an exercise in futility. The fear is that the patient will be impossible to rehabilitate due to retinopathy, neuropathy, enteropathy, and vascular disease. Blagg and co-workers (Blagg et al, 1971) have presented rather pessimistic dialysis results in diabetic patients with, 8 patients out of 12 dead and no patient surviving two years of dialysis. Four of 10 dialysed diabetic patients reported from Europe died within a year (Drukker et al, 1970). Comty and Shapiro (1971) reported 20 patients with diabetes treated with dialysis up to 33 months with an overall mortality of 50 per cent. As in Blagg's series, myocardial infarction was the most frequent cause of death, and progressive retinopathy interfered with rehabilitation. The conclusion was that dialysis may offer a palliative form of therapy for diabetic patients although the clinical results are poor compared to non-diabetic patients.

At the University of Minnesota, 38 diabetic patients have been transplanted since 1966. The first series of 10 patients received both pancreas and kidney transplants and have been reported elsewhere* (Lillehei et al, 1970). Between June, 1969 and December, 1971, 28 diabetic patients have been accepted for transplantation of kidney alone and this report concerns the 25 patients that had juvenile onset diabetes.**

* Two of these 10 patients first received a kidney transplant only. After failure of the kidney graft, one due to arterial thrombosis and one due to chronic rejection, they received a double transplant (kidney and pancreas). These patients are not included in the series of patients reported in this paper.

** Three patients had adult onset diabetes not requiring insulin treatment. Two of these patients died after nephrectomy-splenectomy, one of abscess formation followed by sepsisemia and the other of pulmonary embolus. One patient received a cadaver kidney and is doing well two years after transplantation. These patients are not included in this paper.
Table I. Summary of diabetic patients accepted
June, 1969 - December, 1971

(Observation Time: May, 1972)
25 patients - 10 dead
  6 women - 1 dead
  19 men - 9 dead
4 died on dialysis after nephrectomy-splenectomy before transplant
16 received related kidneys, 5 (31%) died
  5 received cadaver kidneys, 1 (20%) died

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
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<tbody>
<tr>
<td>Age, years:</td>
<td>34</td>
<td>23-48</td>
</tr>
<tr>
<td>Duration diabetes, years:</td>
<td>20</td>
<td>14-34</td>
</tr>
<tr>
<td>Duration kidney disease, years:</td>
<td>3</td>
<td>1/2-5</td>
</tr>
</tbody>
</table>

All juvenile onset insulin dependent; all severely hypertensive
requiring medication
7/25 reported repeated episodes of ketoacidosis
13/25 reported repeated episodes of hypoglycemia
All end-stage kidney disease, 18 typical K-W renal disease, 7
unspecified nephrocirrhosis

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>Creatinine first dialysis</td>
<td>15.1</td>
<td>7.8-23.6</td>
</tr>
<tr>
<td>BUN first dialysis</td>
<td>107</td>
<td>40-173</td>
</tr>
</tbody>
</table>

PATIENTS AND METHODS
The salient features of the patients are outlined in Table I. No stringent
criteria for acceptance were applied but each case was considered individually. During the period, only four diabetic patients were denied transplantation, two because of old age (55 and 63 years) and two because of overwhelming complications of diabetes other than kidney disease.

Once accepted, the patient was started on haemodialysis. Haemodialysis
was performed 2-3 times weekly for 6-8 hours using EX-03 or Alwall-Gambro
11 layer artificial kidneys. Dialysis was carried out with a standard dialysate containing 2.6 mMk and 200 mg/100 ml glucose. Approximately half of
the patients had ordinary Scribner shunts, the other half had fistulae. During
the preoperative dialyses, the patient was transfused to a hematocrit of at
least 30%. Albumin was given in cases of hypoalbuminemia, and over-
hydration was corrected. The organisation of this sequence of dialyses and
operation has been previously described (Kjellstrand et al, 1972). The
number of dialyses and days until nephrectomy-splenectomy and transplantation or pretransplant death are given in Table II. Before or during haemo-
dialysis but before nephrectomy-splenectomy the patient underwent a routine
work-up procedure previously described (Kjellstrand et al, 1972). Included
Table II. Dialysis and time of nephrectomy/splenectomy, transplantation, or death

<table>
<thead>
<tr>
<th>Transplanted patients:</th>
<th>No dialyses day 1-BNS</th>
<th>BNS day</th>
<th>No dialyses BNS-Tx or death</th>
<th>Days BNS-Tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related recipients (16)</td>
<td>7 (2-16)</td>
<td>13 (5-35)</td>
<td>6 (3-12)</td>
<td>15 (8-25)</td>
</tr>
<tr>
<td>Cadaver recipients (5)</td>
<td>8 (4-15)</td>
<td>23 (8-37)</td>
<td>37 (8-46)</td>
<td>93 (27-150)</td>
</tr>
<tr>
<td>Patients dying after BNS before Tx:</td>
<td></td>
<td></td>
<td>Days BNS-Death</td>
<td></td>
</tr>
<tr>
<td>Pretransplant deaths (4)</td>
<td>8 (4-12)</td>
<td>23 (13-33)</td>
<td>17 (6-33)</td>
<td>50 (16-98)</td>
</tr>
</tbody>
</table>

Dialysis and time intervals, start dialysis – bilateral nephrectomy/splenectomy (BNS) – transplantation (Tx) or death. Day 1 = day of first dialysis. Values are means, range in parenthesis. Only first transplant included.

was voiding cystourethrogram, fundoscopy, and distant visual acuity testing (Snellen method) in all cases. Cystoscopy, cystometry, electromyography, and nerve conduction studies were performed in most cases. After 2-16 haemodialyses, bilateral nephrectomy and splenectomy were performed, and the patient was transplanted 2 weeks to 5 months later.

During transplantation, the kidney was placed in either iliac fossa, the renal artery being anastomosed end-to-side to the external iliac artery, the vein end-to-side to the external iliac vein. In all cases the donor ureter was implanted through ureteroneocystostomy into the recipient’s bladder (Simmons et al, 1972). After transplantation, routine immunosuppression with Imuran approximately 3 mg/kg and Prednisone at a starting dose of 1 mg/kg for related recipients, 2 mg/kg for cadaver recipients, slowly tapered to approximately 0.33 mg/kg was instituted. Cadaver recipients received 30 mg/kg, related recipients 20 mg/kg of ALG daily for 2 weeks (Simmons et al, 1972). Rejections, diagnosed by increase in creatinine and deterioration of renograms, were treated with local irradiation, increase in oral Prednisone, and 1 gram doses of methyl-prednisolone intravenously (Simmons et al, 1972). Four of the 25 patients died after nephrectomy-splenectomy before transplantation; the remaining 21 patients received 23 kidneys. Donors were parents in three cases, siblings in 13 cases, child in one case, and cadaver in six cases. One patient received two cadaver kidneys and is well. One patient received two kidneys from two sisters and died after the second transplant. Two patients, both recipients of cadaver kidneys, underwent a two-week period of acute tubular necrosis after transplantation. In both kidneys function returned and both kidneys now function normally (Kjellstrand et al, 1971). Of the 23 renal transplants, five were performed in 1969, four in 1970, nine in the first half of 1971, and five in the latter half of 1971. The minimum observation period is five months, the maximum 36 months. Follow-up studies include weekly or monthly
creatinine, BUN, blood pressure, and repeated urine cultures. Eye examinations, similar to the pretransplant examination, are performed at intervals of several months. Renal biopsies, studied by routine light microscopy and immunofluorescence microscopy, and electromyography are performed yearly. As a standard to compare the mortality and morbidity in the diabetic group, we have chosen our patient material of 104 non-diabetic patients (80 transplanted) age 15-45 (the 'ideal' age group) accepted and treated during the same time (June, 1969 - December, 1971) (non-diabetic patients). For evaluation of renal function, blood pressure, chronic rejection and urinary tract infections, a group of 21 non-diabetic patients matched for age, sex, time of transplant, source of kidney (cadaver or related) was selected (non-diabetic control).

RESULTS AND DISCUSSION

Survival

Of the 25 patients, 10 have died. Four of these patients died before transplantation after nephrectomy and splenectomy. Mortality after nephrectomy-splenectomy is thus 16 per cent in the diabetic patients which should be compared to 3 per cent in our group of non-diabetic patients age 15-45 operated upon during the same time. Six patients of the 21 who have been transplanted died (Table III). One of 5 (20%) cadaver recipients died as compared to 7 of 32 (22%) non-diabetic patients. Five of 16 or 31% of the related recipients died versus 2 out of 48 or 4% in the non-diabetic patients. The causes of death are outlined in Table III. Actuarial survival curves (Merrell & Shulman, 1980).

Table III. Cause of death

<table>
<thead>
<tr>
<th>After nephrectomy-splenectomy (NS), before transplantation (4/25 = 16%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Subphrenic abscess - septicemia 39 days after NS</td>
</tr>
<tr>
<td>2. Myocardial infarct 16 days</td>
</tr>
<tr>
<td>3. Fluid overload - cardiac arrest 98 days</td>
</tr>
<tr>
<td>4. Fluid overload - cardiac arrest (stomach wall haematoma) 46 days</td>
</tr>
</tbody>
</table>

After transplantation

Cadaver (1/5 = 20%)

1. Neurogenic bladder - uraemia, chronic rejection 8 months after transplant

Related (5/16 = 31%)

1. Herpes oesophagitis-encephalitis, 1 month
2. CMV - septicemia, 2 months
3. Pneumonia - myocardial infarct, 3 months
4. Aspiration pneumonia, chronic rejection, 18 months
5. Myocardial infarct, 2 years

CMV = cytomegalovirus
1955) were prepared for the diabetic patients both including and excluding pretransplantation deaths (Figure 1). For comparison, a similar curve was prepared for non-diabetic patients age 15-45 transplanted during the same time (Figure 1). The cumulated two-year survival for related recipients is 58% for diabetic and 95% for non-diabetic patients, and for cadaver recipients, 80% and 72% respectively not including dialysis deaths.

The causes of death were grouped in four main categories and again the diabetic and non-diabetic patients were compared (Table IV). As can be seen from Table IV, the causes of death are no different in the diabetic when compared to the non-diabetic patient, but death is more frequent in the diabetic. Infections are three times more common and myocardial infarct and dialysis related deaths eight times more common in the diabetic patient.

The diabetic patient is more prone to infectious problems even without immunosuppression, and premature cardiac arteriosclerosis is also a common finding in the diabetic patient. To see if myocardial infarcts could have been foreseen, all ECG’s in the diabetic patients done before acceptance were reviewed. Of the ECG’s, seven were within normal limits, two showed evidence of previous myocardial infarction, two showed a conduction defect, and 14 showed a combination of left ventricular hypertrophy and non-specific ST changes. Two patients died of myocardial infarcts, one 3 weeks after
Table IV. Causes of death

<table>
<thead>
<tr>
<th></th>
<th>Total deaths</th>
<th>% of patients dying</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diabetics</td>
<td>Non-diabetics</td>
</tr>
<tr>
<td>Infections</td>
<td>5/10</td>
<td>7/12</td>
</tr>
<tr>
<td>Myocardial infarct</td>
<td>2/10</td>
<td>1/12</td>
</tr>
<tr>
<td>Dialysis related</td>
<td>2/10</td>
<td>1/12</td>
</tr>
<tr>
<td>Other</td>
<td>1/10</td>
<td>3/12</td>
</tr>
</tbody>
</table>

Total deaths is deaths in category (infections, infarcts, etc) over total deaths in group (10 diabetics, 12 non-diabetics). Per cent of patients dying is per cent of all patients in the group (25 diabetics, 104 non-diabetics), i.e., 5 of 25 (20%) of all diabetic patients died of infections.

nephrectomy-splenectomy before transplantation. This patient had an ECG showing previous myocardial infarction. One patient died two years after transplantation. His ECG had shown left ventricular hypertrophy and non-specific ST changes. One patient died of pneumonia complicated by a myocardial infarct. Her pre-acceptance ECG had been interpreted as being within normal limits. One patient who showed previous myocardial infarction underwent a prolonged period of pre-transplant dialysis (5 months) and is doing well one year after transplant. Three patients reported episodes of chest pain related to exercise before transplantation. None had myocardial problems during dialysis or after transplantation. Consequently, in our small series ECG changes or a history of chest pain are of no prognostic importance.

The age of the patient seemed to influence the death rate. Eleven (three women) of the 25 patients were below the mean age of 34. Two of these patients died, 14 patients were 34 years or older; of these patients, 7 or 50 per cent are now dead.

Loss of kidney

The 21 transplanted patients received 23 kidneys. Of these kidneys, 14 are still functioning at present. Six losses of kidneys were due to death of the patient. Two of these patients also showed evidence of chronic rejection (Table III). One patient lost a kidney from a brother donor six months after transplantation from chronic rejection and is presently being dialysed awaiting retransplantation. One patient lost a cadaver kidney from distal ureteral necrosis one month after transplantation. The patient was retransplanted with a cadaver kidney six months later and is doing well one year after the second transplant. One patient lost a kidney from a sister from renal arterial thrombosis. The patient had had an endarterectomy during transplantation because of severe arteriosclerosis. However, the arterial thrombosis occurred during ALG administration with a batch of ALG that caused several

350
arterial thromboses even in non-diabetic patients. The patient was retransplanted one month later and died from pneumonia and myocardial infarction two months after receiving the second transplant. Of 17 related kidneys, 7 or 41% were lost; of cadaver kidneys, 2 of 6 or 33% have been lost. Actuarial curves of kidney survival are shown in Figure 2 where the results are compared to those of the 80 non-diabetic patients transplanted during the same time. The cadaver results are essentially identical in the two groups, 66% versus 68% functioning at two years, but of the related kidneys only 50% of the diabetic patients have functioning kidneys as compared to 84% 2 1/2 year kidney survival in the non-diabetic group.

The good success of cadaver transplantation is in disagreement with a previous report (Greifer, 1971) by the Kidney Foundation who found only two 6-month survivals in nine diabetic patients receiving cadaver kidneys. One reason for our good results could be that our cadaver recipients die on dialysis while waiting for a transplant, thus the 'best' patients are 'selected' for transplantation by long-term dialysis. Of the four patients who died while on dialysis, only one had a related donor. The other three were future cadaver recipients. Two of the patients died clearly dialysis related deaths due to overhydration, pulmonary oedema, and cardiac arrest; however, one of these was the patient with a related donor ready for transplantation. One patient died from myocardial infarct while asleep at home 16 days after nephrectomy-splenectomy. Another developed a subphrenic
abscess and septicemia after nephrectomy-splenectomy. It is also clear from Table II that the waiting period in the patients who died pretransplantation was not excessive. The time between nephrectomy-splenectomy and death was a mean of 50 days with a range of 16–98 days. This should be compared to the related recipient in the same table who waited 15 days from nephrectomy-splenectomy to transplantation versus 93 days for the patient later transplanted with a cadaver kidney.

**Diabetic complications**

The visual acuity of our diabetic patient is shown in Figure 3. Approximately half of the patients had eyesight better than 20/100 when transplanted. The other half had grave decrease in visual acuity with eyesight less than 20/100. From the graph two things are obvious. First of all, little change occurs in visual acuity after transplantation. Secondly, most of the loss of eyesight occurred the year immediately before transplantation. We feel this is due to the addition of hypertensive retinopathy complicating end-stage Kimmelstiel-Wilson disease and the particular difficulties in the control of hypertension in the diabetic-uraemic patient. Present plans are to transplant the diabetic patient before uraemia is severe to see if better eye preservation then occurs. We now accept diabetic patients for transplantation with a creatinine between 7 and 8 mg/100 ml, approximately half of the previous creatinine at time of first dialysis (Table I).

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**Figure 3.** Visual acuity (Snellen method) before and after transplantation (broad vertical line). Each dot represents a visual acuity test, lines connect examinations in one patient. Most deterioration of visual acuity occurs the year before transplantation. After transplantation visual acuity tends to stabilise.
All patients had evidence of peripheral neuropathy on electromyography. Following transplantation, some of the electromyograms have shown evidence of improved nerve conduction and reinnervation; some have either been unchanged or shown slight deterioration. Clinical severe motor involvement with weakness and atrophy in the legs was present before acceptance in five patients. Two patients have improved; one of these was paraplegic before transplantation and improved to walking with a cane. Three patients remain unchanged; no patient is bedridden. In 16 cases there was no evidence of weakness and atrophy. None of these patients has deteriorated.

Six cases had evidence of autonomic neuropathy with severe gastroenteropathy before transplantation with large dilated stomachs, vomiting, regurgitation, and diarrhoea or constipation. All patients but one became asymptomatic. This patient died of uraemia and chronic rejection eight months following transplantation.

There were no signs of severe peripheral vascular disease before transplantation, and no patient had had any amputations. Due to infection of the big toe in one patient, it was amputated while the patient was on dialysis. This patient later died on dialysis from fluid overload, pulmonary oedema, and cardiac arrest. Due to repeated infections with osteitis, one little toe was amputated in two patients one year after transplantation. One patient presently has a necrotic lesion of the sole of the foot one year post-transplantation.

There have been no episodes of ketoacidosis post-transplantation. A few minor episodes of hypoglycemia have occurred but none have required hospitalisation nor glucagon. Generally, the patient's insulin requirement decreased with progressive renal failure and decreased even more after nephrectomy-splenectomy. The requirement rose dramatically following transplantation (Figure 4).

Serious infections have been more common in the diabetic than in the non-diabetic patient (Table IV). However, there has not been any increased incidence of minor infections. The incidence of urinary tract infections (15%) is the same in diabetics as in the non-diabetic control. Three out of 21 diabetic transplanted patients reported frequent urinary tract infections before transplantation. Two of these have had urinary tract infections requiring antibiotics after transplantation but so has one patient who had no previous urinary tract infections.

Operative and urological complications

The vascular anastomosis in the diabetic patient is more complicated to perform due to atheromatous involvement of the iliac vessels. Endarterectomy is frequently necessary. As mentioned before, this might have contributed to the loss of one kidney.
Urological problems are much more common in the diabetic patients. Four out of 21 patients or 19 per cent had urological problems after transplantation as compared to only one out of 80 (1.2%) in the non-diabetic patients. In two cases the urological problem in diabetic patients consisted of bladder dehiscence and wound dehiscence. Both of these healed after prolonged periods of conservative management and repeated operative interventions. One patient had a distal ureteral necrosis necessitating nephrectomy approximately one month after receiving a cadaver kidney. This same complication occurred in only one non-diabetic patient (Weil et al, 1971).

One patient developed a neurogenic bladder after transplantation necessitating indwelling catheter. This patient died six months following transplantation of uraemia due to repeated infections and also chronic rejection. This patient had some residual urine on voiding cystourethrogram done during pretransplant evaluation but so did seven other diabetic patients who had no problems after transplantation. Thirteen of the 21 diabetic patients who received transplants had normal voiding cystourethrograms. The pretransplant cystometrogram on the patient with a neurogenic bladder showed partial denervation; however, this was also present in two other patients who have had no post-transplant urological problems.

No primary wound infection occurred in the diabetic patients, and the only wound problems were those that occurred in connection with urological problems.

Renal function, biopsies and blood pressure

In order to study renal function and hypertension after transplantation, a control group of non-diabetic patients was selected. This control group was
matched for age, sex, source of transplant (relative or cadaver), and time of transplantation. The renal function post-transplantation and blood pressures are given in Table V. There is no difference in the mean or the range of creatinine or number of rejections nor does the blood pressure differ between the diabetic and the non-diabetic control. However, the diabetic patient requires more antihypertensive medications than the non-diabetic to remain normotensive. Hydrochlorothiazide 50 mg, hydralazine 25 mg, α-methyl DOPA 750 mg are the mean blood pressure medications per diabetic patient as compared to hydrochlorothiazide 50 mg and α-methyl DOPA 250 mg per non-diabetic control.

One patient in each group lost a kidney from chronic rejection (excluding dead patients). None of the patients who now have functioning kidneys show any clinical evidence of chronic rejection or progressive renal failure.

Table V. Renal function post-transplantation

<table>
<thead>
<tr>
<th></th>
<th>Diabetic</th>
<th>Non-diabetic control</th>
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<tbody>
<tr>
<td>Creatinine mg/100 ml</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>1.2</td>
<td>0.9-1.9</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>0.8-2.1</td>
</tr>
<tr>
<td>Number of rejections</td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>0.33</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>0-1</td>
</tr>
<tr>
<td>Blood pressure</td>
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<td></td>
<td>125/80</td>
<td>100/70-150/100</td>
</tr>
<tr>
<td></td>
<td>120/75</td>
<td>110/80-155/85</td>
</tr>
</tbody>
</table>

Eight 1-year biopsies and two 2-year biopsies were performed on the diabetic patients. These were interpreted by an independent pathology group as showing mild rejection. There was no evidence of diabetic nephropathy. However, the longest biopsies are only two years post-transplantation and as pointed out in Table I it has taken the diabetic a mean of 20 years from onset of diabetes to end-stage renal failure and a mean of 3 years from the detection of kidney disease to end-stage renal failure. However, even if the diabetic renal disease ultimately recurs, it may take 20 years for them to fail. Secondary complications of diabetes contributing to renal failure, hypertension, or urinary tract infections have not been a problem different from that in the non-diabetic patients.

Rehabilitation

The patients had 38 children before acceptance. Two men have fathered children that have been born after transplantation. One diabetic woman got pregnant two years after transplantation and was delivered through a cesarean section. Both mother and child are well and there are no congenital abnormalities of the child. Of the present 14 patients with functioning kidneys, nine are totally rehabilitated in that they are independent either managing houses or being wage earners. Four are partially rehabilitated requiring some support, and one patient is not rehabilitated at all.
The treatment of terminal uraemia in the diabetic patients poses a particular challenge and reward. Most of these patients are young and have children in the young age group. If their life could be prolonged 10 or 15 years we feel this would be a major medical triumph. Dialysis has been fraught with many problems (Blagg et al, 1971; Comty & Shapiro, 1971) and the survival results and poor results of rehabilitation seem to make this procedure questionable in the diabetic patient.

Regular dialysis per se seems to be stressful on the cardiovascular system and cardiac problems remain the leading cause of death in the dialysed patient (Parsons et al, 1971). The diabetic patient's already compromised cardiovascular system obviously tolerates this stress less well. The most common cause of death in the dialysed diabetic patient has been myocardial infarct. Seven of the eight deaths in Blagg's series (Blagg et al, 1971) and most of the deaths in Comty's series (Comty & Shapiro, 1971) were due to myocardial infarct.

Progressive retinopathy occurred commonly during dialysis of the diabetic patient and interfered with rehabilitation (Blagg et al, 1971). In our series of transplanted diabetics, the visual acuity tends to stabilise after transplantation. The same seems to hold true for neuropathy, both peripheral and autonomic (Blagg et al, 1971).

There is thus no doubt that the results of transplantation in the diabetic patients are better than those of dialysis but much worse than those of transplantation of the non-diabetic patient. Ten of our 25 patients or 40 per cent are dead as compared to 12 of 104 (12%) non-diabetic patients age 15-45 accepted for transplantation during the same time. Thus the death rate in the diabetic patient is 3-4 times that of the non-diabetic. Still, with approximately 60 and 80 per cent two-year survival after transplantation we feel it worthwhile to continue our programme. Hopefully as the transplanted patients now seem to be stable, this figure should improve as observation time increases for the more recently transplanted diabetics.

Women seem to do better than men, and the younger age group (< 34 years of age) does better. However, our material is quite small. Many fears of rehabilitation failures have not been borne out. Once transplantation is achieved, eyesight seems to stabilise and enteropathy and neuropathy improve. There has been no problem with management of the diabetes, and rehabilitation is satisfactory.

Unfortunately, we cannot point to any prognostic indicator as being particularly reliable. Absence or presence of myocardial injury before transplantation has not succeeded in foretelling later myocardial catastrophe. Neither have we any reliable indicators of later peripheral vascular problems. Dramatic improvements have occurred in the symptoms of peripheral neuropathy and enteropathy suggesting that many 'diabetic' complications are
indeed complications of uraemia. To differentiate them seems almost impossible with our present routine pretransplant work-up, a finding in agreement with that of Blagg and Comty. We thus cannot set up any specific acceptance criteria predicting success or failure but continue to use only general clinical impression trying to avoid those patients with severe multiple system involvement. This impression, however, is tempered with the knowledge that we cannot differentiate diabetic and uraemic complications.

**SUMMARY**

1. Twenty-five patients with end-stage diabetic renal disease were accepted for renal transplantation. Four died prior to transplantation after nephrectomy-splenectomy. Of 21 patients transplanted, 14 have well functioning kidneys, 6 died, 1 is on dialysis after rejection.
2. Eyesight stabilises following renal transplantation.
3. Diabetic-uraemic neuropathy, gastroenteropathy, and bladder dysfunction tend to improve following transplantation. The diabetic and uraemic components cannot be separated before transplantation.
4. Management of diabetes is not a problem following transplantation.
5. Technical dialysis problems, myocardial infarcts, urological and lethal infectious complications are increased in diabetics when compared to non-diabetic transplant recipients but minor infectious complications are not increased.
7. Diabetics are relatively good candidates for renal transplantation as compared with haemodialysis and diabetics should not be categorically excluded from the benefits of renal transplantation.

**REFERENCES**


357
OPEN DISCUSSION

V PARSONS (London): In view of the deterioration of retinal function in the final phases of the renal failure, would you now advise transplantation to take place perhaps as much as a year earlier than would be warranted on renal function alone?

KJELLSTRAND: I am glad you asked this question, because it is in keeping with our future policy to transplant earlier than renal function studies alone would warrant. We will no longer wait until the plasma creatinine rises above 15 mg/100 ml, but would transplant with creatinines of only 7-8 mg/100 ml, about one year earlier, to see if we can arrest the functional deterioration in the diabetic patient's eyes.