## CONTROVERSIAS

# *End-stage renal failure in diabetic nephropathy: CAPD vs other approaches*

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### Background

Diabetic nephropathy — the mixed micro- and macrovasculopathy culminating in intercapillary glomerulosclerosis and nephrosclerosis — is now the most prevalent cause of End-Stage Renal Disease (ESRD) in the United States [1]. Throughout Europe, Japan and South America, a progressively increasing proportion of new uremic patients begun on renal replacement therapy — ranging from 12 to 28 % depending on the country — are diagnosed as having diabetic nephropathy [2]. Selecting dialytic therapy or a kidney transplant as treatment for ESRD in a specific diabetic patient is an exercise in application of bias by physician and patient. Emphasized in the present remarks is the overriding necessity, no matter which option — dialytic therapy or a kidney transplant — is chosen, for comprehensive care by a team of communicating, skilled, collaborating health professionals if the effort to rehabilitate a uremic diabetic patient is to succeed.

Differences in the course and clinical expression of renal involvement in insulin-dependent diabetes (Type 1) and non-insulin-dependent diabetes (Type 2) are the subject of multiple ongoing investigations [3, 4]. Recent recognition of the high prevalence of proteinuria and azotemia in carefully followed Type 2 individuals has removed the former distinction of Type 2 diabetes as a disorder which only rarely results in diabetic nephropathy. While there is no question that Type 1 and Type 2 diabetes differ in genetic predisposition and racial expression, almost every other aspect of the two disorders — in terms of characterization of renal manifestations —is subject to near-term redefinition. Most literature reports of treatment for ESRD in diabetes fail to separate patients by diabetes type. For example, confusing terms like "insulin requiring" are employed to explain a physician's decision to treat an individual thought to have *resistant* Type 2 diabetes with insulin. Furthermore, with the exception of carefully studied small series of patients from individual centers, the majority of registry reports detailing outcome in large numbers of ESRD patients who have diabetes have not segregated results by diabetes type. Accordingly and reluctantly, the present remarks will not attempt to sort out distinctions between the two types of diabetes as expressed in renal disorders.

### Co-morbid risk factors

Clinical expression of renal disease in a diabetic individual, starting with a nephrotic syndrome, through advanced renal insufficiency, induces more stress than in a nondiabetic person with equivalent renal malfunction because of the impact of usuall symptomatic, concurrent extrarenal disease (Table I). For example, in preparation for maintenance hemodialysis, creation of a vascular access which in a nondiabetic patient is relatively minor surgery, may, in a diabetic patient induce major morbidity from infection or deranged glucose regulation. Cardiac decompensation, stroke, and the risk of limb amputation hang as a dark cloud over the head of all long-term diabetic patients manifesting renal insufficiency. During initial nephrologic evaluation, therefore, an inventory of coincident extrarenal

**Table I.** Co-morbid risk factors in diabetic patients evaluated for uremia therapy

1. Cystopathy. Cystomètrogram, urine culture, residual volume.
2. Heart disease. Electrocardiogram, exercise stress test, coronary angiography.
3. Gastrointestinal disease. Gastroparesis, obstipation, diarrhea. Abdominal radiography.
4. Respiratory disease. Vital capacity.
5. Preservation of vision. Visual acuity, fluorescein angiography.
6. Bone consequences of uremia. Metabolic radiographic bone survey, plasma aluminum level, bone scan.
7. Limb preservation. Podiatric assessment, Doppler flow studies of limb perfusion.
8. Dental assessment.
9. Social worker and nurse educator's assessment of potential for self-care.

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vascular disease — especially ophthalmic, cardiovascular, cerebrovascular and in the extremities — should be conducted to construct an appropriate treatment regimen for all illness afflicting the entire patient.

Prior to deciding whether to recommend dialytic therapy or a kidney transplant, we request consultations with an ophthalmologist and podiatrist who are familiar with management of diabetic patients in renal failure. Before a kidney transplant is scheduled, the urgency of need for laser photocoagulation and/or vitreous surgery is weighed to preserve ambulatory vision. In a similar effort, cardiac evaluation, even in asymptomatic patients, including coronary angiography, is performed prior to transplantation to detect those patients who might benefit from a prophylactic coronary artery angioplasty or bypass surgery. More than 95 % of diabetic individuals who begin maintenance dialysis or receive a renal allograft, in our experience, have been treated for retinopathy by laser photocoagulation and/or vitrectomy. Scheduling visits with a podiatrist as a component of routine care in diabetic patients on dialysis or after a renal transplant will sharply reduce the chance of lower limb amputations, a complication noted in about 20 % of uremic diabetics who do not receive podiatric care.

Among diabetic azotemic patients referred to our service, the presence and morbid impact of autonomic neuropathy — especially gastropathy and cystopathy — has been frequently overlooked. Visceral autonomic neuropathy, a ubiquitous complication of diabetes after a decade, may confound every aspect of management of the nephrotic, azotemic or uremic diabetic by: 1) inconsistently retarding timely food digestion (gastroparesis) thereby pre-empting carefull glucose regulation, 2) inducing functional urinary obstruction simulating renal transplant rejection (cystopathy), and 3) interfering with normalization of blood pressure by inducing orthostatic hypotension limiting ambulation.

Diabetic cystopathy, though highly prevalent, is infrequently misdiagnosed. Unrecognized cystopathy may simulate worsening diabetic nephropathy and is sometimes misdiagnosed as renal allograft rejection in diabetic kidney transplant recipients. We evaluated bladder function in 22 diabetic patients who developed renal failure including 14 men and 8 women of mean age 38 years (19 with type I diabetes and 3 with type II diabetes).

Cystopathy had not been previously diagnosed in any patient. Testing included an air cystogram, and maximal pressure, and capacity measurements. Cystopathy was detected in 8 patients (36 %) manifested as detrusor paralysis 1 patient; severe malfunction in 5 patients (24 %); and mild impairment in 1 patient. Other studies using urodynamic techniques for objective neurologic evaluations, have detected cystopathy in 26 % to 87 % of long-duration diabetic persons.

Gastroparesis, thought to be an expression of autonomic neuropathy can be detected in one-quarter to one-half of azotemic diabetic persons during their first nephrologic evaluation. Clues to the presence of gastroparesis include: 1) patient complaints of abdominal fullness and vomiting of undigested food hours after a meal, 2) erratic metabolic control of the plasma glucose level due to an inability to link insulin doses with the timing of food ingestion, and 3) unexplained intermittent severe hypoglycemia in the midst of inadequately regulated hyperglycemia. Confirmation of the diagnosis of gastroparesis is afforded by abdominal radiography demonstration a distended stomach containing a large air bubble. Symptomatic improvement can be attained in about one-half of patients by increasing the frequency and reducing the size of meals and administering metoclopramide 5 to 20 mg 30 minutes pre-meal and at night.

Alternating obstipation and explosive nighttime diarrhea often coexists with gastroparesis. More than half of diabetic patients evaluated by us for renal insufficiency report embarrassing, clothes-soiling diarrhea as a life-compromising complication. While both constipation and diarrhea are attributed to autonomic neuropathy, neither is well understood or treated satisfactorily. The diarrhea is often mortifying, uncontrollable and likely to imprison the patient who fears its occurrence outside of the safety perimeter of a proximal home bathroom.

Treatment is empiric and consists of cathartics for obstipation with as much as 120 ml of castor oil being required in difficult cases. In our diabetic referrals, about half of those reporting diarrhea respond to a psyllium seed dietary supplement (Metamucil or generic equivalent) taken one to three times daly.

## Comparison of options in uremia therapy

Until about five years ago, treatment for the uremic diabetic patient was mainly limited to maintenance hemodialysis or peritoneal dialysis due to the belief that following a kidney transplant, both patient and graft survival were unacceptably low and rehabilitation was unobtainable [6]. Throughout the 1980s, however, trials begun at the University of Minnesota, and subsequently confirmed and extended elsewhere, documented progressively improving results of living donor and cadaver renal donor renal transplants in diabetic recipients [7]. Consensus thinking has altered to the point that kidney transplantation is now the first-choice among options for managing diabetics with failed kidneys.

## Peritoneal dialysis

In Canada, Great Britain and Italy, diabetic patients with ESRD are increasingly treated by long-term peritoneal dialysis. In the United States, continuous ambulatory peritoneal dialysis (CAPD) now accounts for abour 16 % of all dialysis and probably is employed in about one-quarter of newly treated diabetic patients. CAPD has expanded rapidly because it offers advantages of rapid training, reduced cardiovascular stress and avoidance of heparin[8]. CAPD, like hemodialysis, can be performed as a self-care regimen by properly instructed patients.

While home hemodialysis requires three to sixteen weeks of training, motivated patients, including strongly motivated blind diabetic individuals, are able to learn to perform CAPD at home within 10 to 15 days. Legrain et al. who view home hemodialysis as the preferred dialytic therapy for diabetics (75 % survival at three years in 67 patients younger than 50 years) propose CAPD should as "a first choice treatment"[9]. Welecting uremia therapy for a specific patient is an individual-specific undertaking in which patient the benefits of CAPD including freedom from a machine and electrical outlets and facility in travel are weighed against its disadvantages of unremitting attention to fluid exchange, constant risk of peritonitis, and disappearing exchange surface.

## Hemodialysis

Since 1978, it has been recognized that maintenance hemodialysis can sustain life for the majority of uremic diabetics for at least two years. In both Europe and the United States, over 90 % of uremic diabetic patients will know no other treatment than maintenance hemodialysis throughout the course of renal failure.

Multiple reports note that diabetic individuals experience greater morbidity than nondiabetic patients throughout the course of dialytic therapy starting with greater difficulty in creating a satisfactory vascular access and continuing with poor regulation of hypertension and volume overload. For many patients with peripheral vascular calcification and/or atherosclerosis, establishment of an access for hemodialysis may necessitate resort to prosthetic vascular grafts or insertion of metallic devices[10]. Survival of diabetic patients treated by maintenance hemodialysis is distinctly inferior to age and sex matched nondiabetic patients. Kjellstrand, Goetz, and Najarian plotted the half-time survival of diabetics on hemodialysis to be 3 years versus 7½ years for nondiabetic patients[11]. Our experience in Brooklyn leads us to believe that despite rigorous blood pressure reduction and extraction of excess total body water by ultrafiltration during hemodialysis, satisfactory rehabilitation of diabetic patients is rarely attained. Affirmation of the thesis that maintenance hemodialysis does not restore vigor to a uremic diabetic patient was provided in a comprehensive study conducted by Lowder et al. in 1986. Of 232 diabetic people on maintenance hemodialysis in Brooklyn, only seven individuals had resumed full-time employment while 64.9 % required assistance to accomplish everyday activities[12].

## Kidney transplantation

Our program of uremia therapy first offered kidney transplantation to diabetic patients fifteen years ago because of dissatisfaction with the dismal outcome of hemodialysis in this patient subset. Early results, others and our own, did not suggest great promise for kidney transplantation in diabetic recipients because of inordinate mortality and minimal rehabilitation. A typical report illustrating this point is a 1978 series of 49 diabetic patients treated by hemodialysis and transplantation in which two-year survival for dialysis patients was 74 % compared to only a 54 % two-year survival for 22 transplant recipients[13]. The degree of change in outcome over the past decade can be gauged from the series reported by Sutherland et al. who concluded that "Virtually every diabetic patient with renal failure referred to the University of Minnesota was accepted for transplantation, regardless of age, associated complications, or availability of a related donor. Kidney transplantation should be the treatment of choice for the uremic diabetic patient"[14]. Support for this view is provided in the recent report from the University of California at Los Angeles Transplant Registry which notes that in recipients of cadaver donor first kidney grafts: "the remarkable transition of diabetes as a high-risk factor to diabetes becoming no different from any other original disease with regard to both patient as well as graft survival rates"[15]. Our own experience indicated that patient survival at one and two years is equivalent in diabetic and nondiabetic recipients but kidney graft survival remains about 10 % lower in diabetics. There is, in our subjective appraisal, a striking superiority in rehabilitation in the diabetic individual given a functioning transplant as compared to dialytic therapy. Based on the repetitive observation that enhanced life quality is facilitated by a kidney transplant, therefore, we recommend a kidney transplant as favored treatment to newly evaluated diabetic persons with ESRD who are under the age of 60. More than half of diabetic kidney transplant recipients in most series live for three years: many survivors return to occupational, school and home responsibilities.

## Patient survival during treatment of ESRD

Retrospective comparisons of the fate of diabetic

patients treated for ESRD have not, as yet, been able to adjust risks in study groups for inequalities in age, race, diabetes type, severity of complications, and degree of metabolic control. Prospective studies of renal transplantation compared with peritoneal or hemodialysis have not been able to overcome the limitation imposed by patient and physician refusal to permit random assignment to one treatment over another. As a generalization, in all programs which have been recently reviewed, younger patients with fewer complications have been assigned to renal transplantation while the residual pool of older, sicker patients is treated by dialysis.

The critical reader, reflecting on the preceding comments about survival and rehabilitation in the uremic diabetic patient must keep in mind the reality that there have been no prospective, controlled, randomized studies of the effect of choice of therapy for ESRD of any etiology on survival. Furthermore, until the past five years, few national composite data permitting analysis of survival by therapy *corrected for varying patient demographics and renal diagnosis or comorbid conditions* were available in the United States. Extensive survival data from the excellent European Dialysis and Transplant Association (EDTA) Registry which have been repeatedly reported, most recently summarized by Brunner et al., demonstrate the singular effect of age on survival during treatment for ESRD "irrespective of treatment modality and of primary renal disease" [16]. At 10 and 15 years after startng treatment, 58 % and 52 % respectively of patients who were 10 to 14 years old when begun on ESRD therapy were alive, compared to 28 % and 16 % who were alive at 10 and 15 years of those who were 45 to 54 years old when commencing renal replacement therapy. A similar effect of increasing age was noted in recipients of living related donor kidney transplants. In the early 1980s, kidney recipient survival was 92 % at 5 years for patients younger than 15, 87 % for the 15 to 44 year old cohort and 72 % for those aged 45 or older. An unanticipated yet consistent finding in the EDTA analysis was the equivalent survival at 10 and 15 years on dissimilar modes of therapy in diverse regions of Europe despite the fact that the proportion of patients treated with each modality varied widely. Diabetes added a severe restriction on life anticipation, imparting a threefold rise in risk of dying compared with either chronic glomerulonephritis or polycystic kidney disease.

Similar findings were generated by another broad European analysis in which all patients starting CAPD or hemodialysis in seven large renal units in England between 1983-1985 were monitored prospectively over four years. Of a total of 610 new patients (median age 52 years, range 3-80 years) beginning CAPD and 329 patients (median age 48 years, range 5-77 years) begun on hemodialysis, patient survival estimates at 4 years were 74 % for hemodialysis and 62 % for CAPD [17]. CAPD patients spent a mean of 14.8 days per year in hospital compared with 12.4 days per year for hemodialysis patients. That the groups were not medically equivalent at the start of the study, is evidenced by the different proportions of diabetic patients on CAPD (16 %) and hemodialysis (7 %). Nevertheless, there was no clear advantage to one dialysis regimen over another.

There appears to be, in several reports, a survival advantage in treatment by home hemodialysis over that in center hemodialysis or CAPD. Care in interpretation of this conclusion is warranted, however, as it may be that more intelligent, healthier patients with superior social support systems are picked for home hemodialysis. Rubin et al., in a large single center experience in Mississippi, evaluated the outcome of 1,216 patients treated by dialysis between January 1, 1967 and June 15, 1986 [18]. There were 230 patients treated by CAPD, 150 by home hemodialysis and the remainder in a free-standing dialysis facility. Covariate analysis found that patient survival was not influenced by race, sex or marital status. As might have been anticipated, home hemodialysis patients had the best survival followed by those treated by center dialysis and CAPD which were equivalent in survival.

Rubin et al. remarked that "Only a randomized prospective trial will answer the question as to whether CAPD can maintain a patient at home as long as home hemodialysis". On the other side of the argument, contending that CAPD is equivalent to hemodialysis in terms of patient and technique survival, Maiorca et al. reported an 8 year experience at a single center in Italy which offered "all treatments" for ESRD [19]. Survival at 5 years — as in the EDTA report above — was equivalent for CAPD and hemodialysis patients but 98 % of those started on hemodialysis remained on hemodialysis while only 71 % of CAPD trated patient continued on CAPD ($p < 0.01$).

Sustaining the view that survival on the mainly utilized dialysis regimens is now equivalent, Burton and Walls determined life-expectancy using the Cox Proportional Hazards statistical methodology for unequal group analysis in 389 patients accepted for renal replacement therapy in Leicester between 1974 and 1985 [20]. There were no statistically significant differences between the relative risk of death for patients on CAPD (1.0), those on hemodialysis (1.30), and those who received a kidney transplant (1.09). CAPD, the authors concluded "is at least as effective as haemodialysis or transplantation in preserving life". It is fair to state that proof of the superiority of one ESRD treatment over another is lacking for both the total population of treated patients and the subset who have diabetic nephropathy.

## Rehabilitation

If caution is needed in interpreting results of comparative survival in various treatment options for ESRD, great canniness is mandatory in extracting "truths" from the *soft data* produced by sociologist attempting to quantify rehabilitation in uremia therapy. Without question, failure in rehabilitation stands as failure for the overall teatment protocol. Samuel B. Chayatte, Director of the Department of Rehabilitation Medicine at Emory University Shortly months before his death in 1978, after undergoing three years of maintenance hemodialysis for diabetic nephropathy, observed that: "Rehabilitation is medically and ethically a part of the management of the ESRD patient. The process has been shown to pay for itself in other catastrophic illness and should be economically sound for the ESRD patient" [21]. Variables which must be equilibrated in comparative studies of rehabilitation in renal replacement therapy include: 1) modifications in extra-familiar and intra-familiar social interactions [22-24], 2) changed employment and blocked advancement [25, 26], 3) time lost, unemployment or enforced early retirement [27, 28], 4) sexual interest and arousal and impotence [76, 77], and 5) mood changes, depression, and memory loss [31, 32].

Contrary to the absence of a superior modality in ESRD survival studies, reports of comparative measurements of rehabilitation have generally reached two main conclusions: 1) Participation in self-care regimens enhances self-image and improves life quality, and 2) A functioning renal transplant affords objective evidence of superior rehabilitation to that attained by either peritoneal dialysis or hemodialysis. Unfortunately, critical analysis of the investigational protocols from which these inferences were drawn uncovers consistent problems of bias in initial assignment to a specific treatment and, as a consequence, comparisons of groups which may not have been equivalent in age, race, proportion of diabetic individuals, or mean income. Statistical corrections using the Cox Proportional Hazards technique [33] and other methods, cannot fully compensate for the extent of the differences. As an illustration, the finding that rehabilitation is superior in kidney transplant recipients to that of CAPD or hemodialysis patients must be suspected of bias in studies in which when the mean age of the transplant patients is a decade younger than the CAPD or hemodialysis groups.

Clinicians must keep in mind the concern that unless treatment groups are studied concurrently, the effect of change in one treatment and not another may be missed. For example, comparisons of outcome in renal transplant recipients to that in patients treated by any dialysis method must allow for continuously improving survival of the transplant recipient over the past five years [34]. Diabetic kidney transplant recipients have benefitted from recent improvements in: 1) better understanding of immunogenetics of the HLA system; 2) the blood transfusion effect; and 3) introduction of cyclosporine, monoclonal antibody and other modifications of immunosuppression [35, 36].

Every study of rehabilitation in diabetic subjects treated for ESRD requires validation that treatment groups under comparison contain patients with equal and contemporaneous risk factors. One variable affecting the magnitude of rehabilitation attained in diabetic and nondiabetic ESRD patients is the progressive increase in age of newly treated patients. In the United States, for example, patients over the age of 69 years who comprised 27 % of all dialysis patients in 1979 [37] increased by 450 % between 1974 and 1981 [38], and — it is projected — will make up 60 % of all dialysis patients by the year 2010. An ageing ESRD population obviously will have a declining rate of employment and increasingly prevalent comorbid complications [39].

In a state-wide longitudinal prospective study of 979 ESRD patients in Minnesota the Karnofsky scoring system was employed to follow the course of patients begun on therapy [40]. The results were encouraging with initial Karnofsky scores showing that 50 % of all patients were able to care for themselves when starting treatment.

After two years of maintenance hemodialysis, a remarkable 78 % of patients maintained or improved their functional status. Those patients who received a kidney transplant, however, had higher initial Karnofsky scores than did those relegated to long-term dialysis. It may be inferred that in Minnesota, selection for a kidney transplant gleaned the most functional patients leaving a residual population of less functional patients. Thus, all subsequent comparisons of relative rehabilitation in transplant and dialysis groups patients which discerned a higher Karnofsky score for transplant recipients might be a consequence of selection bias rather than any salutary effect of the kidney transplant.

At variance with the favorable rehabilitation achieved for selected dialysis patients in Minnesota, the usual hemodialysis patient fares far less well. In a nationwide survey of maintenance hemodialysis patients, Gutman, Stead and Robinson measured functional assessment in 2,481 dialysis patients irrespective of location or type of dialysis [41]. Diabetic patients achieved very poor rehabilitation; only 23 % of diabetic patients (versus 60 % of nondiabetic patients) were capable of physical activity beyond caring for themselves. The dismal outlook for diabetic patients supported by hemodialysis was confirmed by Lowder et al.'s study of 232 uremic diabetic persons in fourteen hemodialysis facilities in Brooklyn [12]. Only 7 of 153 patients younger than age 65 were gainfully employed outside the home, and only 27 % of patients were able to attend to activities beyond self care.

Whether or not a patient with ESRD has diabetic nephropathy, life after a successful kidney transplant does not necessarily include full rehabilitation. Recalling that selection bias in assignment of treatment modality may inordinately effect treatment outcome, the study by Kutner, Brogan and Kutner is intriguing. These workers observed 97 ESRD patients at two 18-month follow-up intervals and determined that home hemodialysis patients had the highest quality of life and lowest hospitalization rates over time even though transplant recipients had higher employment and perceived health status [42]. Further to the point is a study of 16 men undergoing maintenance hemodialysis who were compared for degree of social disability through the use of the Ruesch Social Disability Rating Scale, with 16 men who received a kidney transplant in which no differences were noted in the degree of social disability [43]. Also disturbing to the thesis that renal transplantation is the ESRD modality most likely to effect full rehabilitation is the report of Johnson, McCauley and Copley who found no differences in subjective quality of life as judged by successful transplant recipients and stable hemodialysis patients [44].

From these and other investigations of rehabilitation in ESRD patients it may be inferred that irrespective of treatment modality, advanced age and diabetes adversely effect the probability of resumption of normal life activities. As was the case for patient survival, neither peritoneal dialysis nor hemodialysis has been shown to be a distinctly superior dialytic regimen. Both the EDTA Registry and several large American studies, have found that rehabilitation is approximately equivalent during treatment with dialysis or after a kidney transplant. It is true that in terms of permitting resumption of physical activity and return to gainful employment, renal transplantation is superior to hemodialysis or CAPD. On the other hand, successful renal transplant recipients continue to manifest social disability, depression, and subjective complaints at a rate equivalent to that of newly evaluated dialyis patients.

## Comorbid index for diabetic patients

As an aid to following the course of diabetic patients over the course of ESRD treatment we conduct periodic inventories of the type and severity of common co-morbid problems. To quantify our findings, a co-morbid index (Table II), has been prepared to assign a numeric value to each diabetic patients overall condition at various points in treatment. Comparison between treatments (hemodialysis versus CAPD versus renal transplantation) or subsets of patients managed differently is facilitated when the severity of illness has been documented as equivalent in the study groups under comparison.

**Table II.** Variables influencing morbidity in diabetic kidney transplant recipients the co-morbidity index

1. Persistent angina or myocardial infarction.
2. Other cardiovascular problems, hypertension, congestive heart failure, cardiomyopathy.
3. Respiratory disease.
4. Autonomic neuropathy (gastroparesis, obstipation, diarrhea, cystopathy, orthostatic hypotension.
5. Neurologic problems, cerebrovascular accident or stroke residual.
6. Musculoskeletal disorders, including all varieties of renal bone disease.
7. Infections including AIDS but excluding vascular access-site or peritonitis.
8. Hepatitis, hepatic insufficiency, enzymatic pancreatic insufficiency.
9. Hematologic problems other than anemia.
10. Spinals abnormalities, lower back problems or arthritis.
11. Vision impairment (minor to severe - decreased acuity to blindness) loss.
12. Limb amputation (minor to severe - finger to lower extremity).
13. Mental or emotional illness (neurosis, depression, psychosis).

To obtain a numerical Co-Morbidity Index for an individual patient, rate each variable from 0 to 3 (0 = absent, 1 = mild - of minor import to patient's life, 2 = moderate, 3 = severe). By proportional hazard analysis, the relative significance of each variable can be isolated from the other 12.

## Inferences

Control of hypertension and hyperglycemia are the main components of treatment intended to slow the course of diabetic nephropathy but dietary protein restriction may be beneficial. Once ESRD supervenes in a diabetic patient, survival and morbidity during the course of uremia therapy are governed by the number and severity of co-morbid disorders present, especially cardiovascular and cerebrovascular disease. To expedite management of the myriad micro- and macrovascular complications which accompany kidney failure in diabetic nephropathy, an inventory of co-morbid risk factores should be conducted. Strategic planning for a diabetic individual whose kidneys are failing requires a team approach and appreciation of the patient's family, social, and economic circumstances. Home hemodialysis, for example, is an unworkable option for a blind diabetic who lives alone.

Deciding upon a kidney transplant requires knowledge of the patient's family structure, including its willingness to participate by donating a kidney. Without a defined plan, the diabetic patient is often subjected to repetitive inconclusive studies which delay implementation of urgently required treatment (such as panretinal photocoagulation or arterial bypass surgery). Electing a "no treatment" option is rational for some patients for whom the concept of further life extension is unacceptable. Illustrating this point, a

blind diabetic patient who experiences multiple daily episodes of angina and explosive nocturnal diarrhea, and is about to undergo a second lower limb amputation may understandably reject his family's plea that he undertake maintenance dialysis. Because azotemic diabetic patients typically manifest transient depression, the rational decision to die must be distinguished from temporary despair over a current setback. Depressed diabetics on occasion respond to visits by rehabilitated dialisys patients or transplant recipients by reversing their decision to die. It is unwise to coerce a acceptance of dialysis or a kidney transplant, in a patient for whom life has minimal (or even negative) value.

We have found that diabetic patients forced into uremia therapy by family or the health care team are noncompliant to dietary and drug regimens expressing behaviour which culminates in passive suicide.

## Summary and conclusions

Maximizing rehabilitation in the azotemic patient with diabetic nephropathy requires that effort be devoted to recognition and management of co-morbid conditions. By tabulating the presence and severity of coincident extrarenal complications of diabetes, a comorbidity index can be quantified. Once ESRD has developed, treatment whether by dialysis or a kidney transplant should be individualized to the medical and family circumstances specific to the patient. Registry analysis by the EDTA and other large European studies indicates that at one, two, and five years of treatment for ESRD, survival is independent of treatment modality. Furthermore, although physical rehabilitation is greater in kidney transplant recipients than in uremic diabetic patients treated by CAPD or maintenance hemodialysis, the patient's subjective ranking of life quality is equivalent in all three modalities.

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