The changing face of end stage renal disease in a UK renal unit

BRYAN WILLIAMS, BSc, MRCP, Registrar in Nephrology, Leicester General Hospital
PAUL BURTON, BSc, MRCP, MRC Training Fellow, Leicester Royal Infirmary
JOHN FEEHALLY, DM, MRCP, Consultant Nephrologist, Leicester General Hospital
JOHN WALLS, FRCP, Clinical Director, Department of Nephrology, Leicester General Hospital

The development of dialysis therapy and renal transplantation for the treatment of end stage renal failure has been one of the major advances in modern medicine in the past 30 years. Despite the proven efficacy of this therapy, different priorities have been adopted worldwide when allocating health care resources for end stage renal failure treatment. The United Kingdom (UK) has been regularly criticised for providing relatively poor dialysis facilities and, in particular, for its negative selection of older patients and patients with multisystem disease, including diabetes mellitus [1–6]. This criticism was not without justification; from the 1960s to the early 1980s the services for treating end stage renal failure in the UK fell well behind those of most Western nations in terms of the number of renal units, the number of patients accepted for dialysis per year and the stock of patients on treatment [2,7–10]. This discrepancy in performance lay with the strategy for the provision of renal replacement therapy in the UK [2]. Unlike the USA and elsewhere in Europe with up to 4 dialysis units per million population and the majority of patients being treated in hospital based units, the UK had only 1 unit per million population and the majority of patients were treated by home haemodialysis.

The introduction of continuous ambulatory peritoneal dialysis (CAPD) by Popovich et al. in 1976 [11] offered an effective alternative to home haemodialysis, and its widespread deployment improved the provision of dialysis therapy in the UK during the 1980s. Following the introduction of CAPD at Leicester, the new patient acceptance rate increased from 20 new patients per million population per year in the 1970s to more than 60 new patients by the mid-1980s, a rate equal to leading European counterparts. This study analyses the impact of the change in treatment rate on the social, demographic and medical composition of the patient population accepted for renal replacement therapy at Leicester throughout that period.

Method

This renal unit serves approximately 1.2 million people, 0.8 million residing within Leicestershire and 0.4 million in outlying counties. It is a mixed urban and rural community with a high immigrant population, principally Asian, representing 25% of the population of the City of Leicester and 12% of the overall catchment. The unit opened in July 1974 when the first patient was commenced on maintenance haemodialysis. The first renal transplant was performed in March 1975. The CAPD programme started in 1979 and became fully established in 1980.

The case notes and nursing records of 389 patients accepted for maintenance dialysis during an 11 year period from July 1974 to August 1985 were analysed for the group’s social, demographic and medical characteristics (Table 1).

The 11-year study period was divided into two equal and consecutive time intervals, the cut-off point coinciding with the turn of the decade.

Year Group 1 (Yr Gp 1): 124 patients accepted for dialysis between July 1974 and December 1979.
Year Group 2 (Yr Gp 2): 265 patients accepted for dialysis between January 1980 and August 1985.

Simple descriptive statistics were used. Mean values ± standard deviations of the mean are given. The statistical significance of the differences between the two year groups for each individual factor was ascertained using chi-squared analysis for categorised variables and analysis of variance for quantitative variables. Survival curves were constructed using the method of Kaplan and Meier [12] and were compared using an exponential scores test [13].

Results

Demographic breakdown

The study population consisted of 95% white persons, 12% Asians and 3% other ethnic groups, with a mean age of 44.5 years (range 9–75 years) at the time of acceptance; 61% of patients were male and 62% resided within Leicestershire.

The new patient acceptance rate

In Yr Gp 1, despite some variation, the acceptance rate was approximately 20 new patients per million population per year throughout. During the second period
Table 1. The demographic, social and medical factors analysed for each patient accepted for renal replacement therapy.

| Age        | I.Q.                          |
|------------|-------------------------------|
| Sex        | History of psychiatric illness|
| Marital status | English literacy              |
| Siblings  | Primary aetiology of renal disease |
| Family support | Presence of coexistent morbid disease |
| Employment | Mobility                      |
| Racial origin | Residence in Leicester        |

There was a steady increase to 65 new patients per million by the end of the study ($p < 0.0001$; Fig. 1).

**Age at acceptance**

The mean age of patients commencing dialysis has increased from $38.2 \pm 14.03$ years (range 9.3–63.2 years) in period 1 to $47.7 \pm 15.25$ years (range 7.9–74.9 years) in period 2 ($p < 0.0001$).

**The primary aetiology of renal disease**

The distribution of the principal causes of end stage renal failure is shown in Table 2. ‘Unknown’ refers to patients presenting with end stage renal disease in whom the diagnosis is unclear and radiological studies reveal small kidneys with no diagnostic features. Patients classified as ‘poor prognosis’ include those with systemic lupus erythematosus, Wegener’s granulomatosis, polyarteritis, amyloidosis and multiple myelomatosis. Diabetic nephropathy has been analysed as a separate entity.

Comparing the two year groups, an increased percentage of patients with diabetic nephropathy has been dialysed (1.6–8.5%; $p < 0.05$) and a greater percentage of patients from the poor prognosis group (2.3–7.3%; $p < 0.05$). The expanded heterogeneity of the dialysis population has meant that the dominant categories of renal disease, ie chronic glomerulonephritis, chronic pyelonephritis, polycystic kidney disease and hypertensive nephrosclerosis, have fallen as a proportion of the total dialysis population.

**Associated morbidity**

The presence of coexistent pathology, often unrelated to the primary aetiology of renal disease, influences referral and selection patterns. The percentage of patients with coexisting morbidity accepted for dialysis has increased ($p < 0.05$) (Fig. 2). Chronic obstructive pulmonary disease, ischaemic heart disease, connective tissue diseases and diabetes mellitus are now much more common in patients commencing dialysis therapy. Interestingly, uncontrolled hypertension (diastolic blood pressure equal to or greater than 105 mm Hg) is less common at presentation.

**Mode of treatment on commencing maintenance dialysis**

The functional capacity of the renal service in the 1970s was restricted to the limited haemodialysis facilities. CAPD was introduced in Leicester in 1979 and was rapidly deployed to become the commonest therapy for patients commencing dialysis. A comparison of year groups 1 and 2 emphasises the magnitude of this change (Fig. 3). Whilst 97% of patients were treated with haemodialysis in Yr Gp 1, this had fallen to 44% ($p < 0.001$) in the second year group.

**Acceptance of patients from outlying counties**

For patients living on the periphery of the catchment area the maximum distance to the dialysis unit is 75 miles. In Yr Gp 1, 69.8% of patients accepted for treatment lived in Leicestershire and 30.2% in the catchment area outside. This had changed to 59.2% and 40.8% by Yr Gp 2 ($p < 0.05$).

**Patient survival**

Mortality was analysed using Kaplan–Meier survival curves (Fig. 4). Despite the increased acceptance of older patients in greater numbers from the disadvantaged...
categories, the difference in patient survival between the two groups was small ($p < 0.13$).

**Discussion**

The increased new patient acceptance for dialysis of previously disadvantaged renal failure patients represents a significant change in the management of end stage renal disease in the UK during the 1980s. This was born out of a need for change and was achieved through the evolution of CAPD [14,15]. The popularity of CAPD as an alternative maintenance dialysis therapy has been the single most important factor accounting for the dramatic rise in the Leicester acceptance rate. This is emphasised by the three-fold increase in the acceptance rate without expansion of the hospital haemodialysis facilities. The same is true for several other units throughout the UK [16-18]. Nationally, CAPD is now the most popular mode of therapy for patients commencing dialysis, and at the end of 1986 41% of all dialysis patients in the UK were using CAPD [14] in contrast to only 10% worldwide [19]. This relative popularity of CAPD relates principally to the simplicity of the technique resulting in early patient independence and low capital costs. In other countries better provision of haemodialysis facilities reduced the urgency to adopt a new technique and the widespread use of CAPD in the UK is viewed with a mixture of interest and scepticism [20-23]. Is the UK improving its acceptance rate by offering a ‘second class treatment’ [24] to second class patients? For patients considered unsuitable for home haemodialysis, exploring the potential of CAPD is infinitely more desirable than the alternative — no treatment at all.

For the nephrologist the debate demands a more critical appraisal. Early reports suggested that CAPD compared unfavourably with haemodialysis, resulting in higher patient morbidity and mortality [25-28]. Two considerations put these early ‘poor’ results into perspective. First, haemodialysis had enjoyed the relative luxury of 25 years development. The learning curve of CAPD was perhaps condensed into as many months and the early results reflected inadequate experience [29]. Second, CAPD allowed for the treatment of older, higher risk patients, and therefore any comparison of different

**Fig. 2.** The percentage of patients with coexistent morbid disease at acceptance for renal replacement therapy; a comparison of year groups 1 and 2.

**Fig. 3.** The change in the mode of treatment for patients commencing dialysis. CAPD: 3% in year group 1 increasing to 66% by year group 2, $p < 0.001$.

**Fig. 4.** Observed survival curves for year groups 1 and 2.
dialysis techniques needs the elimination of distorting influences imposed by selection bias. Recent data, correcting for selection bias, suggest that CAPD is as effective at preserving life as haemodialysis and is not associated with a significant increase in patient morbidity [16,30,31]. These data are supported by the results of this study which shows that, despite the preferential use of CAPD to treat high risk patients, there was no major difference in patient survival.

The most notable beneficiaries of the more liberal acceptance policy have been older patients and those with multisystem disease. Before 1980 the relatively poor performance of the UK in providing long-term dialysis was due to the virtual exclusion of patients over the age of 55 years [1,32]. This discrimination was not based on clinical evidence that this group of patients would adapt badly to chronic dialysis [33]. On the contrary, in other countries similar patients were treated, surviving and leading a full life [34-39]. The discriminating factor was limited availability of hospital haemodialysis facilities which forced most units to adopt an arbitrary age limit for accepting new patients [40]. This study shows that this discrimination has now been removed, with a significant rise in the mean age and an expansion of the age range. In general, elderly patients either adapt well to CAPD and become fully rehabilitated or, in a small minority, die soon after commencing treatment [41]. Such a ‘therapeutic trial’ is justified because no single factor accurately predicts a successful outcome [40] and the low cost of failed CAPD therapy is more than compensated by the successful rehabilitation of a majority of older patients. Once established on therapy, the survival of patients over the age of 65 years on chronic dialysis parallels that of their non-uraemic counterparts [39]. To date there is no evidence to suggest an increased failure rate of CAPD in the elderly when compared with younger patients. Inevitably, however, as the proportion of elderly patients on dialysis programmes increases, greater numbers will outlive their peritoneal dialysis and require transfer to haemodialysis. Unlike younger patients, a majority of the elderly will not adapt to home haemodialysis and will require permanent in-centre haemodialysis. There is justifiable concern that such developments would restrict the availability of the hospital haemodialysis facilities needed to train younger patients for home dialysis.

Patients allotted to the poor prognosis group rarely received dialysis before 1980. Their increased acceptance for treatment in this decade reflects improvements in therapy and prognosis of some of the underlying diseases and the better availability of dialysis services. Patients with diabetes mellitus are amongst those who suffered most from the shortage of facilities. The ideal treatment for the diabetic with end stage renal failure remains undecided [42]. In Britain CAPD is overwhelmingly the most popular, contrasting sharply with the rest of Europe where a majority of patients are still treated with in-centre haemodialysis [43]. The ideal treatment rate is equally controversial as the mortality from diabetic nephropathy in the UK is unknown [44]. One estimate suggests that it is unlikely to be less than 500 patients per year and more probably 750 [45], equivalent to an annual acceptance rate of 15 new diabetics per million population. A recent survey of renal units in the UK calculated that, for the whole of the UK in 1985, a minimum of 580 patients (10 per every million population) were approaching the need for maintenance dialysis [46]. This study shows a sharp rise in the number of diabetics accepted in recent years, reflecting a national trend but with considerable inter-regional variation [44], and the number is still low in relation to that in many other countries [47]. Even in the health regions with the highest acceptance rates there may be many diabetics who would benefit from treatment but are probably not receiving it.

Increasing the treatment rate has resulted in a significant increase in the coexistent morbidity of the dialysis population. In our experience the fear that these patients would become increasingly dependent and soon occupy the limited in-centre haemodialysis facilities has not been substantiated. However, a 7 year prospective multicentre study indicates that whilst morbidity, as reflected in hospital admission, was almost identical for haemodialysis and CAPD patients (HD 12.8 days/patient years of treatment; CAPD 14.6 days), within the CAPD group, temporary (less than 2 months) changes to haemodialysis amounted to 8 days per patient years of treatment. Taken in conjunction with a failure rate of 10% per annum for permanent CAPD, the haemodialysis back-up required for a large CAPD programme of about 100 patients was estimated at one or two stations, with 6 to 8 back-up beds necessary for admission [31]. An expansion of hospital-based haemodialysis facilities is therefore necessary (1) because of the greater number of patients accepted for renal replacement therapy, (2) to provide back-up facilities for temporary and permanent transfers from CAPD, and (3) because, as more elderly and infirm patients are accepted for treatment, the demands on in-centre facilities will increase.

Much of this increased capacity could be provided by satellite renal units, with the additional advantage to the patient of reduced travel between home and unit. In 1987 such a unit opened in Lincolnshire to provide support facilities for the expansion of the renal replacement programme described in this study.

The increased referral of patients from all parts of the catchment area is another major factor which has influenced the change. Few patients are denied treatment once referred to renal units within the UK [34,41], and much of the negative selection for dialysis occurs before the nephrologist has a chance to evaluate the patient [5].

Acknowledgements

We thank all members of the medical, surgical, and especially the nursing staff, who enabled the Leicester renal replacement programme to develop as described, and also the Trent Regional Health Authority, without whose support and encouragement these results could not have been achieved.

Presented in part at the Xth International Congress of Nephrology, London, July 1987.
References

1. Wing, A. J., Brunner, F. P. and Brynger, H. (1977) Combined report on regular dialysis and transplantation in Europe. Proceedings of the European Dialysis and Transplant Association of the European Renal Association, 15, 4-76.

2. Wing, A. J. (1983) Why don’t the British treat more patients with kidney failure? British Medical Journal, 287, 1157-8.

3. Berlyne, G. M. (1982) Over 50 and uraemic = death. Nephron, 31, 109-99.

4. Royal College of Physicians Medical Services Study Group (1981) Deaths from chronic renal failure under the age of 50. British Medical Journal, 283, 283-6.

5. Chalhah, S., Wing, A. J., Baur, R. et al. (1984) Negative selection of patients for dialysis. British Medical Journal, 286, 1119-22.

6. Kjellstrand, C. M. and Logan, G. M. (1987) Racial, sexual and age inequalities in chronic dialysis. Nephron, 45, 257-63.

7. Cameron, J. S. (1983) The management of diabetic renal failure in the United Kingdom. Diabetic Nephropathy, 2, 1-2.

8. Wing, A. J., Broyer, M., Brunner, F. P. et al. (1983) Combined report on regular dialysis and transplantation in Europe. Proceedings of the European Dialysis and Transplant Association of the European Renal Association, 20, 2-75.

9. Laing, W. (1978) Chronic renal failure, a priority in health? London: Office of Health Economics.

10. Vollmer, W. M., Wahl, P. W. and Blagg, C. R. (1983) Survival with dialysis and transplantation in patients with end stage renal disease. New England Journal of Medicine, 308, 1553-8.

11. Popovich, R. P., Moncrief, J. W., Decker, J. F. and Bomar, J. B. (1976) The definition of a novel portable wearable equilibrium peritoneal dialysis technique (abstract). Abstracts of the American Society for Artificial Internal Organs, 5, 64.

12. Kaplan, E. L. and Meier, P. (1958) Nonparametric estimation from incomplete observations. Journal of the American Statistical Association, 53, 457-81.

13. Mantel, N. (1966) Evaluation of survival data and two new rank order statistics arising in its consideration. Cancer Chemotherapy Reports, 50, 163-70.

14. Gokal, R. (1987) Continuous ambulatory peritoneal dialysis — 10 years on. Quarterly Journal of Medicine, 242, 465-72.

15. Morgan, A. G. and Burden, R. P. (1986) Effect of continuous ambulatory peritoneal dialysis on a British renal unit. British Medical Journal, 293, 935-7.

16. Gokal, R., King, J., Bogle, S. et al. (1997) Outcome in patients on continuous ambulatory peritoneal dialysis and haemodialysis: 4-year analysis of a prospective multicentre study. Lancet, ii, 1105-9.

17. Registry of European Dialysis and Transplant Association. Report presented at EDTA/ERA meeting, Budapest, 1986.

18. Heaton, A., Rodger, R. S., Sellers, L. et al. (1986) Continuous ambulatory peritoneal dialysis after the honeymoon: review of experience in Newcastle 1979-84. British Medical Journal, 293, 938-41.

19. Gokal, R. (1986) World wide experience, cost effectiveness and future of CAPD — its role in renal replacement therapy. In Continuous peritoneal dialysis (ed. R. Gokal), pp 349-69. Edinburgh: Churchill Livingstone.

20. Friedman, E. A. (1981) Rushed judgement in uraemia therapy. Artificial Organs, 5, 97-8.

21. Comty, C. M. (1982) Is CAPD the panacea for chronic renal failure? American Journal of Kidney Diseases, 2, 386-9.

22. Rubin, J., Barnes, T., Burns, P. et al. (1983) Comparison of home haemodialysis to continuous ambulatory peritoneal dialysis. Kidney International, 23, 51-6.

23. Coles, G. A. (1985) Is peritoneal dialysis a good long term treatment? British Medical Journal, 290, 1164-6.

24. Shalhdon, S. (1986) Is CAPD a second class treatment? In Frontiers in peritoneal dialysis (ed. J. F. Maher and J. F. Winchester), pp 304-6. New York: Field Rich.

25. Jacobs, C., Broyer, M., Brunner, F. B. et al. (1981) Combined report on regular dialysis and transplantation in Europe, 1980. Proceedings of the European Dialysis and Transplant Association, 18, 2-58.

26. Broyer, M., Brunner, F. P., Brynger, H. et al. (1982) Combined report on regular dialysis and transplantation in Europe, 1981. Proceedings of the European Dialysis and Transplant Association, 19, 2-59.

27. Kramer, P., Broyer, M., Brunner, F. P. et al. (1983) Combined report on regular dialysis and transplantation in Europe, 1982. Proceedings of the European Dialysis and Transplant Association, 19, 4-59.

28. Fragola, J. A., Grube, S., Von Bock, L. and Bourlec, E. (1983) Multicentre study of physical activity and employment status of CAPD patients in the United States. Proceedings of the European Dialysis and Transplant Association, 20, 243-7.

29. Gokal, R. and Marsh, F. P. (1984) Survey of CAPD in the United Kingdom 1982. Peritoneal Dialysis Bulletin, 4, 240-3.

30. Burton, P. R. and Walls, J. (1987) Selection-adjusted comparison of life-expectancy of patients on continuous ambulatory peritoneal dialysis, haemodialysis and renal transplantation. Lancet, i, 1115-9.

31. Gokal, R., Jakubowski, G., Hunt, L. et al. (1986) Multi-centre outcome of CAPD and haemodialysis patients. Nephrology, Dialysis, and Transplantation, 1, 111.

32. Broyer, H., Brunner, F. P., Chantler, C. et al. (1980) Combined report on dialysis and transplantation in Europe. 1979. Proceedings of the European Dialysis and Transplant Association, 17, 2-86.

33. Wing, A. J. and Selwood, N. H. (1982) Achievements and problems in the treatment of end stage renal failure. In Advances in nephrology (ed. N. F. Jones and D. K. Peters), pp103-19. Edinburgh: Churchill Livingstone.

34. Taube, D. H., Winders, E. A., Oggs, C. S. et al. (1983) Successful treatment of middle aged and elderly patients with end stage renal disease. British Medical Journal, 286, 2018-20.

35. Jacobs, C., Diaio, A., Balas, E. A. et al. (1984) Maintenance haemodialysis treatment in patients aged over 60 years: demographic profile, clinical aspects and outcome. Proceedings of the European Dialysis and Transplant Association, 21, 477-89.

36. Mion, C., Oules, R. and Canaud, P. (1984) Maintenance dialysis in the elderly: a review of 15 years experience in Languedoc and Roussillon. Proceedings of the European Dialysis and Transplant Association, 22, 490-509.

37. Schaefer, K., Asmus, G., Quellhorst, E. et al. (1984) Optimum dialysis treatment for patients over 60 years with primary renal disease: survival data and clinical results from 242 patients treated by either haemodialysis or haemofiltration. Proceedings of the European Dialysis and Transplant Association, 21, 510-17.

38. Westlie, L., Umen, A., Nestrud, S. and Kjellstrand, C. M. (1984) Mortality, morbidity and life satisfaction in the very old dialysis patients. Transactions of the American Society for Artificial Internal Organs, 30, 21-9.

39. Rotellka, E., Lubela, R. A., Rotella, C. et al. (1985) Must patients over 65 be haemodialysed? Nephron, 41, 152-6.

40. Tapon, J. S., Rodger, R. S. C., Mants, H. et al. (1987) Renal replacement therapy in patients aged over 60 years. Postgraduate Medical Journal, 63, 1071-7.

41. Nicholls, A. J., Waldey, S., Platt, M. M. et al. (1984) Impact of CAPD on treatment of renal failure in patients aged over 60 years. British Medical Journal, 288, 18-19.

42. Legrain, M. G. (1983) Diabetics with end stage renal disease: the ‘best buy’. Diabetic Nephropathy, 2, 1-3.

43. Jacobs, C., Brunner, F. P., Brynger, H. et al. (1984) The first five thousand diabetics treated by dialysis and transplantation in Europe. Diabetic Nephropathy, 2, 261-2.

44. Cameron, J. S. (1986) Treatment of end stage renal failure due to diabetes mellitus in the United Kingdom, 1975-84. Lancet, ii, 962-6.

45. Poller, J. H., Elford, J., Goldblatt, P. and Adelstein, A. M. (1983) Diabetes mortality; new light on an underestimated health problem. Diabetologia, 24, 336-41.

46. Joint working party on renal failure of the British Diabetic Association, the Renal Association and the Research Unit of the Royal College of Physicians (1988) Renal failure in diabetics in the UK: deficient provision of care in 1983. Diabetic Medicine, 5, 79-84.

47. Renhi, D., Retig, R. A. and Wing, A. J. (1985) Limited resources and treatment of end-stage renal failure in Britain and the United States. Quarterly Journal of Medicine, 56, 321-36.