Original Article

Outcome of renal replacement therapy in the very elderly

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Abstract

Background. In a retrospective case-note and computer database analysis we assessed the outcome of very elderly patients (≥ 75 years old) with end-stage renal disease (ESRD) on renal replacement therapy (RRT).

Methods. Fifty-eight individuals aged 75 or over (group 1) commenced RRT between 1 January 1991 and 31 December 1995. Comparisons were made with other patients commencing RRT who were divided into two groups: group 2 (201 individuals 65–74 years old) and group 3 (379 patients <65 years old). All subjects were followed up until the point of assessment (30 June 1998), the time of death, or withdrawal from dialysis. Survival rates in the three groups were compared using Kaplan–Meier method. The number of hospital admissions, length of in-patient stay, and complications rate on RRT were assessed for group 1.

Results. One-year survival rates in groups 1, 2 and 3 were 53.5, 72.6, and 90.6% respectively and the 5-year survival rates were 2.4, 18.8, and 61.4% respectively. The very elderly spent 20% of their time in hospital, 46% had two co-morbid factors at the outset, and 26% developed multiple complications while on RRT. Withdrawal from dialysis remained the most common cause of death in this group of individuals (38%), followed by cardiovascular causes (24%) and infections (22%).

Conclusion. Very elderly ESRD patients on RRT have a very poor outcome and, since they are the largest growing group of RRT patients, this has important implications for future health policies.

Keywords: end-stage renal disease; outcome; renal replacement therapy; survival; very elderly

Introduction

The proportion of elderly people is rising throughout the world and this is reflected in the number of elderly patients with end-stage renal disease (ESRD) [1]. The first report of the UK National Renal Registry (based on nine centres) shows that 43% of all new patients with ESRD in 1997 were ≥ 64 years old and 15% were ≥ 75 years old [2]. This increase in the proportion of elderly dialysis patients has also been noted in the US [3] and Canada [4]. Prior to 1980, the majority of elderly ESRD patients over the age of 60 were denied dialysis, often because primary care and general physicians failed to refer to nephrology departments because of reservations about prognosis and quality of life on dialysis and a lack of resources [5]. During the last decade the number of patients starting renal replacement therapy (RRT) has increased for all ages but the increase for patients over the age of 74 has been particularly dramatic with a 4.3-fold rise in the US, where in 1996 approximately one-third of all ESRD patients on RRT were over 65 years of age [3]. The reasons for this increase are multiple, including an increase in the number of treatment facilities, technical progress leading to improved tolerance of dialysis sessions, and development of peritoneal dialysis programmes [6]. RRT in the very elderly raises important ethical and medical issues and physicians differ in their views on this controversial subject. We report the results of a study of the outcome of very elderly patients aged 75 years or over, who commenced RRT at a single centre from 1 January 1991 to 31 December 1995.

Subjects and methods

A retrospective case-note and computer database analysis of all individuals aged 75 years and over, commencing RRT at the Leicester General Hospital between 1 January 1991 and 31 December 1995 was performed. Data on survival of all patients starting RRT in this time was also collected for comparisons of survival. The hospital provides adult nephrology services to approximately 2 million people in Leicestershire and the surrounding counties. 638 individuals (400 males, 238 females) commenced RRT in the study period. RRT was defined as any form of dialysis (peritoneal dialysis or haemodialysis) or renal transplantation. The main study group (group 1) included all individuals aged 75 years

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or over (58 patients, 44 males and 14 females) at the time of starting RRT. The other patients starting dialysis in the same time period were divided into two groups on the basis of age: group 2 included all individuals in the 65–74-year age group (201 patients, 126 males and 75 females), and group 3 comprised all individuals below the age of 65 (379 patients, 230 males and 149 females). The patients were followed up until the time of death or withdrawal from dialysis, or until the point of assessment (June 30, 1998). Two patients in group 3 were lost to follow up. Two patients moved to other regions but their survival details were obtained by communication with the renal units of those regions. Six patients were referred from surrounding counties and their outcome measures were assessed from the day they started RRT in our renal unit.

Patients were given a choice of the type of dialysis in the absence of absolute medical contraindications to one modality of treatment. However, the department has a strong reliance on peritoneal dialysis with more than 50% of all new patients commencing this form of therapy [2]. Haemodialysis was performed generally three times a week. A few patients had twice-weekly dialysis for short periods if residual function was maintained early in the course of RRT. The dialysis prescription was adjusted to achieve a target urea reduction ratio (URR) taking into other factors such as fluid balance and cardiovascular stability. The target URR increased from 50 to 65% over the period of this study. Peritoneal dialysis was performed mainly using standard dextrose solutions. Towards the latter part of the study period, a few patients used glucose polymer solution for overnight exchanges. Patients were treated with erythropoietin to maintain haemoglobin 10–12 g/dl. Some patients received more erythropoietin in the pre-dialysis phase than in the latter part of the study period.

The main outcome measures used to determine how the very elderly (>75 years old) fare on RRT were: (i) survival (length of survival on RRT); (ii) hospitalizations (number and length of inpatient stays); (iii) complications on RRT.

Data was also collected on the pattern of initial presentation (i.e. whether the individual presented initially as an emergency admission or was admitted electively from outpatients to start RRT; the presence of any co-morbid illness at the start of RRT (diabetes mellitus, ischaemic heart disease, peripheral vascular disease, hypertension, hyperlipidaemia, chronic obstructive airways disease and malignant disease); the aetiology of ESRD; the modalities of dialysis used; and the causes of death. Survival and mortality rates were obtained in all the three age groups. Survival analysis was performed by obtaining survival probabilities and constructing a life table using the Kaplan–Meier method. Survival probabilities for the three age groups were compared using the log rank test. The statistical package used for performing these calculations was SPSS 7.5, 1996, Inc. [7].

Results

Demographic data

The main study group (group 1) consisted of 58 patients accounting for 9.1% of all patients starting dialysis in the study period. The mean age in group 1 was 78.7 ± 3.1 (SD) years (range 75–88), for group 2 was 68.8 ± 2.7 years (65–74), and for group 3 was 47.1 ± 12.8 (range 14–64). Overall, 504 patients (79%) were Caucasian, 108 (17%) were Indo-Asian, and 25

(4%) were Afro-Carribeans. However, in group 1 ($\geqslant 75$ year olds), the vast majority of patients (96%) were Caucasian with only three (4%) of Indo-Asian origin, reflecting the younger age of the Asian population in Leicester.

Baseline clinical data

The causes of end-stage renal failure in group 1 are listed in Table 1. Of the 13 patients with obstructive uropathy, eight had prostatic hyperplasia, four had renal stones, and one had ureteric fibrosis. The patients with glomerulonephritis included single cases of focal segmental glomerulonephritis, crescentic glomerulonephritis, Wegener's granulomatosis, mesangiocapillary glomerulonephritis type 1, and IgA nephropathy with crescents.

The majority of 75-year-olds (93%, 54/58), had one or more co-morbid factors present at the time of starting RRT. Two or more co-morbid factors were present in at least 46%. Hypertension and ischaemic heart disease were the commonest co-morbid factors.

Diabetes was present in seven (12%) and three patients (5%) had some form of malignancy at the outset (Table 2). Of the 58 patients, 37 (64%) presented as emergency admissions initially, with the rest being elective or planned admissions. CAPD was the predominant mode of dialysis in 30 (52%) patients and hospital haemodialysis in 28 of 58 patients (48%). Only one patient underwent renal transplantation.

Survival analysis

At the point of assessment, only 5% (3/58) of individuals were alive in group 1 as against 22% (45/201)

Table 1. Aetiology of renal failure in the very elderly

Aetiology	No. of patients (%)
Renovascular disease	16 (28)
Obstructive uropathy	13 (23)
Glomerulonephritis	5 (9)
Chronic pyelonephritis	3 (5)
Diabetes mellitus	4 (3)
Myeloma kidney	5 (3)
Waldenström's disease	1 (2)
ESRD of unknown cause	16 (28)

Table 2. Co-morbid factors at start of RRT

Co-morbid Illness	Number of patients (%)
Ischaemic heart disease	31 (53)
Hypertension	30 (52)
Diabetes mellitus	7 (12)
Peripheral vascular disease	10 (17)
Malignant disease*	3 (5)
Chronic airways disease	2 (3)
Other	4 (7)

*Malignancies: bladder carcinoma, basal cell carcinoma, chronic myeloid leukaemia.

Table 3. Survival analysis in all age groups*

Group	1 year survival (n; %)	Alive at point of assessment (n; %)	5 year survival (n; %)	Median survival (months)	95% CI for median survival
⩾75 years (n=58)	31; 53.5	3; 5.2	1; 2.4	16	8–24
65–74 years (n=201)	146; 72.6	45; 22.4	37; 18.8	29	24–34
<65 years (n=377)	341; 90.6	242; 64.2	231; 61.4	86	70–102

*P value for difference in mean survival between groups 1 and 2 <0.001; *P value for difference in mean survival between groups 1 and 3 <0.001.

in group 2 and 64% (242/379) in group 3. Table 3 shows the survival data in the three groups in further detail. The Kaplan–Meier curves for the three groups are shown in Figure 1. The life expectancy compared to the general population and the percentage reductions in life expectancy in different age groups are given in Table 4.

The cause of death was due to withdrawal of dialysis in 38% (Table 5). Of the 12 patients who died of infectious causes, six had peritonitis, two had pneumo-
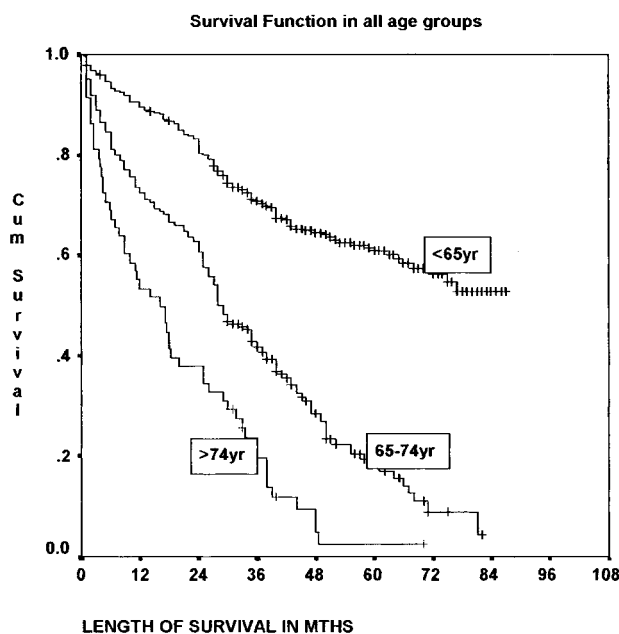
nia, two had septicaemia, including one with staphylococcal endocarditis, and two patients had colitis (one with *Clostridium difficile*). One patient had aspiration pneumonia following motor neurone disease. The cardiovascular causes included pulmonary oedema as a terminal event in seven cases, one severe right-heart failure and pulmonary artery hypertension, one myocardial infarction, one complete heart block, and major arterial emboli in two cases (mesenteric and lower limb). Early deaths occurred due to complications of renal failure or other co-morbid conditions; later deaths were commonly due to withdrawal of therapy (Figure 2).

Hospitalizations, complications and associated medical problems

Data for the number and duration of hospital admissions are shown in Table 6. These data were used to
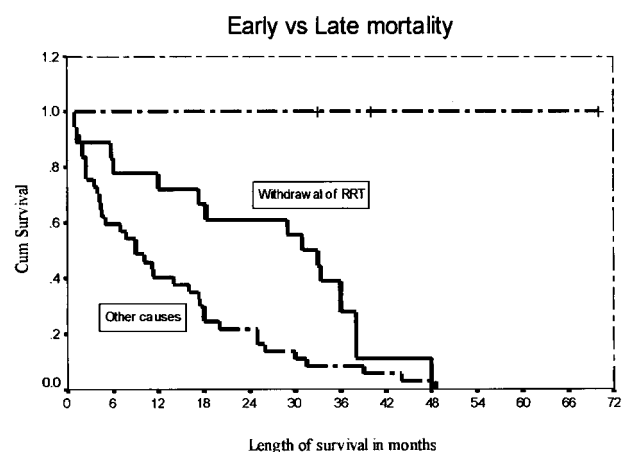

Fig. 1. Kaplan–Meier survival plots in the three age groups.

Table 4. Average life expectancy in years for all ESRD patients (1995)* compared with the UK population

Age (years)	UK population		ESRD patients in Leicester		% Reduction in life expectancy	
	Male	Female	Male	Female	Male	Female
50	25.7	30.4	7.1	7.3	72.3	75.9
65	3.7	17.4	2.3	2.4	83.2	86.2
75	8.1	10.4	1.3	1.3	83.9	87.5

*Provisional figures, Demographic Statistics, Eurostat 1997. Source, Central Statistics Office, UK.

Table 5. Causes of death in ⩾75-year-olds

Causes of death	No. of patients (%)
Withdrawal of dialysis	21 (38)
Infection	12 (22)
Cardiovascular	13 (24)
Malignancy	4 (7)
Cerebrovascular event	3 (5)
COAD	1 (2)
Motor neurone disease	1 (2)

Fig. 2. Timing of death from withdrawal of therapy compared with other causes.

calculate the number of admissions and total length of hospitalization per year of RRT. On average, the very elderly spent approximately one-fifth of their time as in-patients while on RRT. Predictably, there was an association between the number of admissions and the number of co-morbid factors present at start of RRT (data not shown).

Significant numbers of complications (Table 7), either related to or independent of dialysis, were recorded. Five patients with peritonitis had multiple episodes. Of the patients with septicaemia, one had methicillin-resistant staphylococcal septicaemia. The problems related to arteriovenous fistulae (AVF) and temporary vascular catheters included arterial steal syndrome, haematoma over the fistula in two, excessive bleeding following temporary dialysis catheter insertion in two, and four patients requiring a re-establishment of the fistula at some stage. Of the 11 patients requiring surgery while on RRT, five were related to dialysis and included three patients requiring surgery for hernia, one requiring ligation of the inferior epigastric artery, and one requiring surgery for a hydrocele. Two of these patients required more than one operation. Of the remaining six patients requiring surgery unrelated to RRT, one had a femorotibial graft with toe amputation, one a permanent pace-maker, one a nephrectomy for uncontrollable bleeding

following renal biopsy, one a laparotomy, one a haemorrhoidectomy and one a repair for a vesical fistula. The seven patients who had a gastrointestinal bleed included one with angiodysplasia of the colon and one secondary to haemorrhoids. The others were due to peptic ulcers.

Discussion

Several countries have reported an increase in the proportion of elderly patients starting RRT [2–4]. The proportion of the very elderly patients aged over 75 years was 9% of all patients accepted for RRT in our study—a lower percentage than that of 15% recorded in the UK Renal Registry for 1997 [2], suggesting this is an expanding population. The small percentage of non-Caucasians (Indo-Asians and Afro-Caribbean) among the very elderly may be explained by three factors: an overall decreased life span in these ethnic groups due to a greater prevalence of diabetes mellitus and cardiovascular risk factors [8]; a decreased awareness of and limited access to nephrology services; and a relatively young age compared to the white population in the UK [9]. The very elderly were often admitted as emergency admissions (64%), an important

Table 6. Outcome measures in ⩾75-year-olds

Measure	Median	Range	95% CI for median	Mean	Standard error
Inpatient days	42.0	3–158	31.5–49.0	43.6	5.0
Number of admissions	3.0	0–12	3.0–4.5	3.9	0.4
% Time on RRT as inpatient	9.1	0.3–92.1	8.3–20.8	9.7	3.6
Inpatient days per year of survival	33.4	0.9–336.4	30.2–76.0	71.9	13.1

Table 7. Complications and associated medical problems in ⩾75-year-old patients on RRT

Related to dialysis		Not directly related to dialysis	
Complication	No. of patients (%)	Complication	No. of patients (%)
Peritonitis	15/39 (38)	GI bleed	7/58 (12)
Catheter block or infection	14/42 (33)	Malignancy	8/58 (13.7)*
Septicaemia	3/58 (5)	Stroke	4/58 (6.8)
Hernias	8/58 (13)	Motor neurone disease	1/58 (1.7)
Fluid balance problems on CAPD	9/42 (21.4)	Deep vein thrombosis	1/58
Requiring surgical intervention	5/58 (8.6)	Requiring surgery	6/58 (10)
Hydrocele	2/58 (3.4)		
Problems related to AV fistula	9/24 (37)		
Multiple complications	15/58 (25.8)		

*Three patients had a malignancy at start of RRT; five patients developed malignancy later.

predictor of poorer outcome on RRT in many studies [10–13].

The major causes of ESRD in the very elderly population were renovascular disease (27.6%) and obstructive uropathy (22.6%). These results differ from previous UK studies, which studied <75-year-old populations but are similar to data from the USA [14,15]. An important finding in our patients was a low frequency of diabetes mellitus as a cause of ESRD in the very elderly. This may reflect selection bias with relatively few patients with diabetes mellitus surviving to this advanced age.

The modality of RRT used in our very elderly ESRD population was equally distributed between hospital haemodialysis and CAPD, an observation similar to that of other workers [16]. The proportion of very elderly patients treated by peritoneal dialysis (52%) is similar to the percentage of new patients of all ages starting renal replacement therapy in our department [2]. The department has a long history of high usage of CAPD probably reflecting a number of local factors including a large geographical area, physician and nurse preference and resources for haemodialysis. Only one of 58 patients was referred for renal transplantation. This low frequency is similar to the other parts of the world where only 5% of people over 65 years are transplanted. None of our patients was on home haemodialysis.

Data from some Scandinavian countries suggest a better prognosis than that of our patients. This may be a result of more readily available resources as compared to the UK especially in Norway, where more than 55% of ESRD patients over 65 years of age are transplanted [17]. A large majority of our very elderly ESRD population had associated co-morbid factors at the time of selection for RRT, with approximately one-half having two chronic co-morbid factors. Later in the course of RRT this proportion increased further. Those with four or more co-morbid factors at the outset were the ones most likely to have the maximum number of hospital admissions. This problem has been encountered in other studies [18]. Approximately one-third of our study population on RRT developed infections, either peritonitis or catheter related, a problem not uncommon in this age group [19,20].

Another important feature of this group of patients is that 'withdrawal of dialysis' is the most common cause of death accounting for 38% of deaths. These data clearly show that early deaths are due to either a complication of ESRD, RRT, or associated non-renal co-morbidity (Table 7). Those who die later do so mainly because of withdrawal from dialysis (which in turn can be prompted by medical, social, or a multitude of causes). Figure 2 shows these data in a Kaplan–Meier survival plot format.

Many nephrologists now offer a trial of dialysis to elderly patients or those with significant co-morbidity to assess quality of life and functional status once dialysis is established and uraemic symptoms are controlled. Often the decision to withdraw dialysis is very difficult for patient, family and the multidisciplinary team but this is an issue that most physicians will encounter frequently while treating ESRD in this age group [21]. Withdrawal of dialysis often occurs after weeks or months of decline or following a serious intercurrent event (e.g. major cerebrovascular event). Other important causes of death are infection and cardiovascular disease, which together accounted for 45% of deaths. As expected, the very elderly with ESRD die early as compared to other age groups. However, the percentage decrease in life expectancy due to ESRD over the age of 75 years is more than in younger individuals (Table 3).

It is likely that the very elderly ESRD patients on RRT may just represent the tip of an iceberg with the many elderly patients with ESRD either not referred or not accepted for RRT. Does this imply indirectly that the very elderly with ESRD who are taken up for RRT are the ones with less co-morbidity, and if all very elderly ESRD patients were selected the prognosis would be much worse? In the UK, there are a number of barriers, which may prevent elderly patients receiving treatment for ESRF. There may be failure to diagnose ESRD in the community (clinically or as a result of reluctance to do blood tests), failure to refer to the nephrologist by general practitioners or other physicians (either because of ageist beliefs or lack of knowledge about nephrology services), withholding of treatment by nephrologists or refusal of treatment by patients. Further studies are needed in this context.

Conflicting reports have previously been given regarding the outcome of the very elderly on RRT. Some studies have shown that most nephrologists do not consider age to be a barrier to dialysis [22,23] while others take an opposing view [24]. In conclusion, the high number of hospital admissions and in-patient days, increased number of co-morbid factors, high proportion of complications related or unrelated to RRT and the poor survival suggest that the outcome of RRT in this population is rather poor. These data raise important questions, which have clinical, ethical, legal and financial implications for health policies throughout the world. For every very elderly individual with ESRD, the physician needs to ask whether RRT should be started and what should be its aim or end-point. Is it going to improve the survival or quality of life of the patient and would a trial of dialysis be worthwhile? Does the patient understand the implications of this therapy and what are his or her wishes? Has the patient signed an informed consent or an advanced directive regarding the withdrawal of RRT in the future? All these issues need to be addressed for every very elderly individual with ESRD since there may be a wide disparity between chronological and biological ages of any individual. Therefore, the decision needs to be individualized for every patient recognizing that the aim of RRT is to enable the older individual to live with dignity and independence and with an acceptable quality of life.

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