Why do patients known to renal services still undergo urgent dialysis initiation? A cross-sectional survey

Jackie Buck1, Richard Baker2, Ann-Marie Cannaby3, Sarah Nicholson1, Jean Peters4 and Graham Warwick1

1John Walls Renal Unit, 2Department of Health Sciences, University of Leicester, Leicester General Hospital, Gwendolen Road, Leicester LE5 4PW 3Corporate Division, University Hospital, Clifford Bridge Road, Coventry, CV2 2DX 4School of Health and Related Research, University of Sheffield, Regent Court, 30 Regent Street, Sheffield S1 4DA, UK

Abstract

Background. Unplanned, urgent initiation of renal replacement therapy (RRT) is associated with poorer outcomes than planned initiation. However, in many services worldwide, substantial numbers of patients still do not begin treatment electively. The aim of this study was to identify numbers of and possible risk factors for, patients starting unplanned RRT despite being known to renal services for ≥4 months.

Methods. A retrospective survey of electronic and medical records was conducted of patients starting RRT in a large regional UK renal network in 2003. Data extracted included information on demographic, biochemical and treatment factors. Patients were classified as known acute (starting dialysis urgently yet known to renal services ≥4 months) or elective (starting RRT in a planned manner with a fistula or peritoneal dialysis catheter). Urgent dialysis was defined as starting either with a haemodialysis catheter or as an inpatient. Logistic regression was used to identify factors predicting an urgent dialysis start.

Results. Data from 109 of the 126 eligible patients were included; 60 elective, 49 known acute. Reasons for presenting as known acute were illness (21), service (24) and patient related (17). More than one reason was identified for 11 patients. The known acute group had more severe anaemia and lower glomerular filtration rates. Fewer known acute patients had attended dedicated predialysis clinics (90% increased odds of known acute start for non-attendance, \(P = 0.001\)) and patient dialysis information sessions (\(P = 0.020\)). Dialysis counselling had begun sooner in elective patients (\(P = 0.003\)). Odds of an urgent dialysis start increased by 4% with each year of age (\(P = 0.024\)).

Conclusions. Early dialysis education and predialysis clinic attendance were associated with greater likelihood of elective dialysis initiation. Further studies are required to determine the cost effectiveness of these interventions, but services that initiate RRT urgently in a high proportion of patients should consider improving predialysis clinic attendance and early dialysis education.

Keywords: care pathway; predialysis; urgent dialysis

Introduction

Chronic kidney disease and established renal failure are growing global public health concerns [1]. In the UK, ~38 000 adults are receiving renal replacement therapy (RRT) for established renal disease (ERD) [2]. In addition ~140 000 people are under the care of renal services with less severe chronic kidney disease [3]. Government initiatives in the UK and in other countries are directed towards early detection of chronic kidney disease. During the pre-ERD phases of chronic kidney disease, clinical care is focused on delaying the progression of kidney failure, dealing with complications (e.g. cardiovascular risk, anaemia, bone disease) and, crucially, preparing patients for a smooth transition to dialysis or transplantation.

Timing of referral is often thought to be critical, as patients referred to renal services earlier have greater opportunities to access education programmes, take part in clinical decisions regarding dialysis and transplantation, and start the RRT of their choice via an established vascular or peritoneal access route or by pre-emptive transplant [4–6]. Exactly how far in advance patients should be referred in order to ensure the best outcomes has never been well established. Many studies have used 3 or 4 months as a cut-off when examining the effects of late referral though whether this is adequate remains uncertain [7,8] with one study suggesting patients should be referred at least 24 months prior to RRT initiation [9] and another...
suggesting greatest benefits if patients are referred 36 months in advance [10].

Inadequate preparation is associated with starting dialysis using a temporary catheter, which in itself is associated with increased morbidity and mortality [11]. Several studies have reported that a proportion of patients, who have been known to the renal services for some time before starting dialysis, still have urgent dialysis initiation through temporary vascular access [2,7,12]. However, very few studies have examined in detail the possible reasons for unplanned urgent dialysis initiation. Chesser and Baker [12] found that the majority of patients in their study who fell into that category had been failed by the renal services in some way, while Marron et al. [13] discovered that pre-dialysis education was significant in determining whether patients who had education had an elective or an unplanned dialysis start.

We undertook a study with the aim of investigating why a proportion of patients in a large regional UK nephrology centre started RRT urgently when they had been known to the renal services for at least 4 months beforehand.

**Methods**

**Setting and subjects**

The study population consisted of all those patients who had started RRT in 2003 in the East Midlands Renal Network and had been known to the renal services for at least 4 months prior to starting RRT. The East Midlands Renal Network covers a large urban and rural area in the middle and east of England and at the time of the study served a population of \(~1.8–2.0\) million people. The network is based on a hub and spoke model with a main nephrology centre and, at the time of the study, four satellite dialysis units. Leicester city and the surrounding urban area has a population of \(~440000\) and has a diverse ethnic mix with approximately half of its population being of South Asian origin. This level of diversity is not seen across the whole network population of nearly 2 million.

Patients are seen in general nephrology clinics before being transferred to dedicated predialysis clinics. Timing of transfer to predialysis clinics, timing of predialysis clinic follow-up appointments and other aspects of care are all at the discretion of each nephrologist. Dedicated patient education in the network takes two forms: a patient information day and home visits by a renal nurse specialist from the home care team. Patients are given free choice of RRT unless there are clear medical or social contraindications to a particular form of RRT.

Data were collected retrospectively from medical records of eligible patients who were dead and those living patients who gave consent to record review. Patients were categorized by dialysis start according to the following definitions: Elective—commenced RRT electively as outpatients using either an arteriovenous fistula or graft, peritoneal dialysis catheter or by pre-emptive transplantation. Known acute—patients known to renal services for \(>4\) months who commenced dialysis using a haemodialysis catheter (cuffed or uncuffed) or who required emergency admission to start dialysis. Unknown acute—patients starting dialysis within 4 months of referral to nephrology services (these patients were subsequently excluded from the main analysis).

**Independent variables**

We extracted data from the records about demographic, laboratory, care pathway and treatment factors. These included age at start of RRT, sex, ethnicity, socio-economic status, location (main centre vs satellite clinic), diabetes (yes/no), comorbidity, predialysis or other clinic attendance, attendance at a patient information day, length of time known to the renal services, length of time since first documented discussion of RRT, length of time since first visit by the home care team nurse to discuss RRT options, length of time between referral for access creation and starting on RRT, estimated glomerular filtration rate (eGFR) at time of referral to nephrology services, eGFR, biochemical variables and haemoglobin concentrations at the start of RRT, use of phosphate binders and erythropoietic stimulating agents (ESA). Where possible data were also collected about the mode of RRT on which the patient had intended to start, the mode of RRT which patients actually started and the number of appointments with nephrology physicians in the 12 months preceding RRT.

Socio-economic status was defined using the Index of Multiple Deprivation 2004, a measure of deprivation at the small area level linked to post codes [14]. Estimated GFR was calculated using the modified five variable MDRD formula available from www.renal.org.uk. Diabetes was defined as the presence of either type 1 or type 2 diabetes whether a cause of chronic kidney disease or not. We also recorded the percentages of patients with phosphate \(>1.7\) mmol/1 who were not prescribed a phosphate binder or haemoglobin \(<10\) g/dl who were not prescribed ESA.

**Dependent variables**

The aim of this study was to identify risk factors contributing to starting dialysis acutely. Elective, known acute or unknown acute status was independently assigned by a consultant nephrologist (G.W.) prior to the study and corroborated by the researcher (J.B.) during data collection. Unknown acute patients were subsequently excluded from further analysis. Therefore, status (elective/known acute) was the binary dependent variable used in the analyses.

To supplement the analysis of individual factors potentially explaining the type of RRT initiation, three broad categories of factors (service, illness and patient related) were chosen to summarize many discrete elements that could have contributed to whether or not patients had an acute dialysis start. Each known acute patient was assigned to one or more of these categories based on the record reviewers’ assessment of the information contained in the medical records. Any doubt regarding the correct assignment of a particular case was resolved by discussion within the research team.

**Statistical analysis**

There were three stages of analysis: (i) univariate, used to examine and describe the distribution of the variables,
(ii) bivariate, in the form of t-tests, Mann–Whitney and chi-square tests as appropriate, used to compare data from patients who started RRT electively with those that started urgently and (iii) backwards stepwise logistic regression, to identify factors predicting urgent dialysis start. In total 16 variables were entered into the logistic regression model, with selection based on statistical significance and clinical interest. These were age at start of RRT, sex, ethnicity, social deprivation rank, number of years the patient had been known to the renal services, number of years since the first discussion of RRT, attendance at predialysis clinic, attendance at a patient information day, albumin, urea, creatinine, phosphate, haemoglobin and estimated GFR just prior to the start of RRT, whether or not phosphate binders were appropriately prescribed and whether or not ESA were appropriately prescribed.

All data were analysed using SPSS v12. Permission to carry out this study was granted from the Leicestershire Research Ethics Committee and relevant NHS Research and Development departments prior to approaching patients either by letter or in person for consent to allow collection of data for this study.

Results

One hundred and sixty-five patients started RRT in the East Midlands Renal Network in 2003 total of 39 (24%) had been known to the renal services for less than 4 months (unknown acute) and were excluded from further analysis. Of the remaining patients, 71 (43%) had an elective RRT initiation whilst 55 (33%) had an acute dialysis start and therefore comprised the known acute group. Consent to data collection was not received from 17 surviving patients, leaving a total study population of 109.

Patient characteristics are shown in Table 1. The mean age of the cohort was 63 years, 39% were female, 22% were of non-Caucasian ethnic origin and 59% had at least one co-morbidity, with 30% having diabetes. Forty-five percent had received the bulk of their predialysis nephrological care in one of the satellite units. Patients who had known acute RRT initiation were compared with those who had an elective RRT start, and no statistically significant differences were found between the groups in any of the demographic variables (Table 1).

Service related factors were judged to have contributed to urgent dialysis initiation in approximately half of all known acute patients (24/49). The particular factors varied from patient to patient, but were mostly related to late or lack of referral for access creation and time spent waiting for access creation. Illness related reasons were found in 21 patients and included more rapid decline of kidney function than anticipated, or precipitation of the start of RRT through intercurrent illness. Patient related reasons were generally that patients missed appointments or cancelled access operations (17 patients).

The median eGFR at the time of first referral to a nephrologist was 26 ml/min/1.73 m² in the elective group and 23 ml/min/1.73 m² in the known acute group. With a median decline of 4 ml/min/1.73 m²/year in the elective and 6 ml/min/1.73 m²/year in the known acute group, there was no statistical difference in the rate of decline in eGFR between referral and starting on RRT (P = 0.087). At the start of RRT, known acute patients had statistically significant lower concentrations of serum albumin and haemoglobin than elective patients (Table 2). This group also had lower eGFRs and higher serum creatinine, urea and phosphate concentrations compared with the elective group. More known acute patients had high phosphate levels and had not been prescribed phosphate binders than patients in the elective group (35% vs 18%, respectively).

Table 1. Demographic description of the population under study

<table>
<thead>
<tr>
<th></th>
<th>Elective (n = 60)</th>
<th>Known acute (n = 49)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59 (27–83)</td>
<td>66 (17–89)</td>
<td>0.132</td>
</tr>
<tr>
<td>(median and range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (% female)</td>
<td>35</td>
<td>43</td>
<td>0.434</td>
</tr>
<tr>
<td>Non-Caucasian (%)</td>
<td>18</td>
<td>26</td>
<td>0.357</td>
</tr>
<tr>
<td>Satellite unit (%)</td>
<td>47</td>
<td>43</td>
<td>0.846</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>28</td>
<td>33</td>
<td>0.678</td>
</tr>
<tr>
<td>≥1 Comorbidities (%)</td>
<td>60</td>
<td>57</td>
<td>0.846</td>
</tr>
</tbody>
</table>

Categorical data tested using chi-square tests, continuous data tested using Mann–Whitney tests.

Table 2. Mean laboratory values at the start of RRT

<table>
<thead>
<tr>
<th></th>
<th>Elective (n = 60)</th>
<th>Known urgent (n = 49)</th>
<th>P-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Albumin (g/l)</td>
<td>38.3</td>
<td>36.2</td>
<td>0.021</td>
<td>0.32</td>
</tr>
<tr>
<td>Bicarbonate (mmol/l)</td>
<td>21.5</td>
<td>20.4</td>
<td>0.188</td>
<td>−0.58</td>
</tr>
<tr>
<td>Calcium (mmol/l)</td>
<td>2.4</td>
<td>2.3</td>
<td>0.186</td>
<td>−0.03</td>
</tr>
<tr>
<td>Creatinine (µmol/l)</td>
<td>709</td>
<td>813</td>
<td>0.036</td>
<td>−2.01</td>
</tr>
<tr>
<td>eGFR (ml/min/1.73 m²)</td>
<td>7.5</td>
<td>6.2</td>
<td>0.003</td>
<td>0.47</td>
</tr>
<tr>
<td>Haemoglobin (g/dl)</td>
<td>10.5</td>
<td>9.6</td>
<td>0.005</td>
<td>0.26</td>
</tr>
<tr>
<td>Phosphate (mmol/l)</td>
<td>1.9</td>
<td>2.2</td>
<td>0.008</td>
<td>−0.58</td>
</tr>
<tr>
<td>Potassium (mmol/l)</td>
<td>4.7</td>
<td>4.7</td>
<td>0.792</td>
<td>−0.29</td>
</tr>
<tr>
<td>Urea (mmol/l)</td>
<td>32.9</td>
<td>38.4</td>
<td>0.003</td>
<td>−9.07</td>
</tr>
</tbody>
</table>

Groups compared by t-tests. 95% CI are differences between KA and E groups.
P = 0.047). Similar proportions of patients in both groups had not been prescribed ESA despite anaemia <10 g/dl.

Patients had been known for a median length of time of 3 years with no statistical difference in the length of time between elective and known acute patients. All but four patients, two in each group, had been known to the renal services for at least 1 year. Just over half of the sample had attended a patient information day during the predialysis phase, though more patients who had elective initiation had attended than known acute patients (Table 3). More elective patients had also been seen in a dedicated predialysis clinic (as opposed to routine follow-up in a general nephrology clinic). Additionally, discussions regarding RRT had occurred earlier in the elective group as had the first home care team visit to discuss RRT options. Patients in the elective group had been referred earlier for vascular or peritoneal access creation. All of these differences were statistically significant (Table 3). Although known acute patients had fewer consultations with renal clinicians in the year prior to RRT initiation, this difference was not statistically significant.

Of the 47 patients who planned to start peritoneal dialysis, 36 (77%) did so with the remainder commencing haemodialysis. Fifty-six percent (23/41) of patients who had planned to start on haemodialysis did so without definitive access or as emergencies. Only four patients, two in each group, changed their minds regarding RRT modality when counselling and preparations were underway.

In the logistic regression, factors which were shown to predict known acute dialysis start were age, phosphate level and attendance at a predialysis clinic (all P < 0.05) (Table 4). The eGFR at the start of RRT was of borderline significance (P = 0.052). Factors that were not predictive were sex, ethnicity, social deprivation, number of years patients had been known to the renal services, number of years since the first discussion of RRT, attendance at a patient information day, albumin, urea, creatinine, haemoglobin and prescription of phosphate binders or ESA.

### Table 4. Multivariable logistic regression analysis of predictors of known acute presentation (n = 90a)

<table>
<thead>
<tr>
<th>Odds ratio</th>
<th>P-value</th>
<th>95% CI</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-year age increase</td>
<td>1.039</td>
<td>0.024</td>
<td>1.005</td>
<td>1.074</td>
</tr>
<tr>
<td>1 mmol/l phosphate increase</td>
<td>2.791</td>
<td>0.030</td>
<td>1.107</td>
<td>7.040</td>
</tr>
<tr>
<td>1 ml/min/1.73 m² decrease in eGFR</td>
<td>0.762</td>
<td>0.052</td>
<td>0.579</td>
<td>1.002</td>
</tr>
<tr>
<td>Attendance at predialysis clinic</td>
<td>0.111</td>
<td>0.001</td>
<td>0.029</td>
<td>0.429</td>
</tr>
</tbody>
</table>

aNineteen excluded because of missing data.

### Discussion

This study has shown that substantial numbers of patients in the East Midlands Renal Network have urgent dialysis initiation despite being known to the renal services for >4 months. There is considerable evidence in the literature that, even if not widely recognized, this is not just a local problem. In the UK, the 2005 Renal Registry reported that for patients known to the renal services for at least a year, definitive access was only present in 50% at dialysis initiation. Similar results have been reported in Canada, and to a lesser extent, in the USA [15].

For some patients this was probably an unavoidable consequence of an unexpectedly rapid decline in renal function. However, in almost half of our patients (24/49) who had an urgent RRT initiation, the service was judged to be at least in some part responsible, and our results point to a number of factors which may contribute to urgent RRT initiation; namely delayed initial discussions about RRT, later referral for RRT counselling by specialist nurses and later referral for access creation. This finding builds on that of Chesser and Baker [12] who found that delays within the renal service accounted for the majority of temporary catheters inserted in patients already known to the renal services, although they could not adequately
determine where and why such delays had occurred. We have shown that there are a number of practical measures that could be taken to help reduce known acute admissions.

Importantly, our study did not find differences in some of the acknowledged barriers to service access and provision [16], such as sex, ethnic background and presence of comorbidities or social status. These findings are consistent with findings of a study of equity of access to dialysis facilities in Wales where ethnic background and socioeconomic status were not found to be factors in provision of services [17]. However, older age was associated with urgent dialysis start, with the odds of a known acute start increasing by 4% per year of age in our sample. Whether this is due to more intercurrent illness, or whether it is a consequence of age discrimination within our system, is beyond the scope of this study. It does, however, highlight a need for further research, as with an increasingly ageing population greater efforts may be needed to tailor interventions to reduce the risk of acute dialysis start in older people.

Patients who started RRT urgently in our study population were ‘sicker’ than those who had an elective initiation as judged by anaemia, lower serum albumin and lower eGFR. In some cases this may be a consequence of intercurrent illness. Lower serum albumin at the start of RRT has been associated with poorer survival on dialysis [5]. Higher eGFR was associated with a 24% decrease in the odds of having an urgent start for every 1 ml/min increase in eGFR at the start of RRT. Elevated phosphate levels were also found to be associated with acute dialysis start with a 280% increase in the odds of an urgent dialysis start for every 1 mmol/l increase in phosphate. Known acute patients started dialysis with lower haemoglobin concentrations than elective patients, although equal proportions of patients in both groups had been prescribed ESA. However, we do not have data on dosage or duration of ESA treatment. Though it is clear that patients who had an urgent start were sicker, the reasons for this cannot be fully understood from this study, and it is difficult to ascribe cause and effect. Is it that patients who were sicker had declined more rapidly, or is it that patients who should have ideally started dialysis earlier did not do so due to lack of access or adequate preparation? If the latter is the case then this research suggests that dialysis preparations should start sooner than it does for many patients, though trials such as the IDEAL Study [18] are required to fully understand the optimum time for dialysis initiation.

Patients in our study had been known to the service for 3 years on average, but the length of time patients had been known to the renal services was not a significant factor explaining planned initiation of RRT. In contrast, Stehman-Breen et al. [6] found that patients who had been told about their renal disease at least a year before starting dialysis were more likely to start dialysis with a permanent access than those whose renal disease had been diagnosed less than a year before.

The most striking risk factor that predicted known acute dialysis was attendance at a dedicated predialysis clinic, with patients who did not attend a predialysis clinic having a 90% increase in the odds of having an urgent, known acute, dialysis initiation. Other studies have demonstrated the potential of a multidisciplinary approach delivered via dedicated predialysis clinics in terms of better biochemical parameters at the start of dialysis, fewer hospitalisations to initiate RRT and increased survival post-RRT initiation [19–22]. Our study suggests that predialysis clinics may also offer a means to reduce the proportion of patients who have unplanned RRT initiation via a temporary catheter. In contrast to studies that have highlighted the benefits of multi-disciplinary team input in predialysis clinics vs standard nephrological care alone, [19–21] our clinics are staffed by nephrologists and dieticians with nursing input in the community. Our finding that patients benefit from predialysis clinic attendance suggests that it is the regularity of predialysis monitoring, the longer consultations and the focus on dialysis preparation that appear to be effective in our system. Given the obvious benefits of predialysis clinic, further research is needed to understand the barriers to predialysis clinic referral and attendance. Our results suggest that patients who had planned for peritoneal dialysis or transplantation were more likely to have an elective start compared to those planned for haemodialysis. This probably reflects deficiencies in the timing of referral and creation of arteriovenous fistula.

Several qualifications about the study should be noted. The sample size was relatively small, data on 17 patients who withheld consent were not available and data collection was retrospective. However, although the data reflect the practice, resources and patient population in one large regional nephrology service in the UK, other data from the UK and North America suggests this is not just a local problem [2,15]. Therefore, we believe the findings have implications for services elsewhere.

One of the markers of good practice outlined in UK Renal National Service Framework [23] for patients with advanced kidney disease is that they are referred to a renal team within 1 year of the anticipated start of dialysis. However, our research shows this simply does not appear to be enough time to adequately prepare patients for a smooth transition onto RRT, particularly if haemodialysis is chosen. These results add to the debate surrounding the definition of late referral, which is often described in the literature as 3 or 4 months. A recent survey in Canada showed that the majority of practitioners thought 4–12 months were adequate, yet over a third said for optimal preparation, at least 13 months were required [24]. Based on our results, we suggest extending the definition of late referral to at least 12 months.

Further research is needed to understand the process by which people access RRT and the reasons why some present late for urgent dialysis initiation. We are
currently undertaking a qualitative study to further explore the experience of patients in order to better understand the changes needed to ensure the smooth transition onto RRT that all patients deserve.

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Conflict of interest statement. None declared.

References


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