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Diabetes and renal disease: who does what?

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ABSTRACT – Care of patients with diabetes and chronic kidney disease (CKD) in the UK is divided between primary care, diabetologists and nephrology. In a retrospective analysis, we examined the distribution of care provision for patients with diabetes and CKD. Nephrology services see a minority of diabetic patients with CKD, but they see the majority of those with an estimated glomerular filtration rate (eGFR) of <30 ml/min. Of those followed in nephrology, 70% showed no evidence of progressive renal dysfunction. The nephrology cohort were significantly younger that those seen by primary care physicians or diabetologists. Half of the patients with diabetes and CKD seen in either the primary care and diabetology cohorts, with no nephrology input, had a rate of fall of eGFR of >5 ml/min/yr. This suggests that older age might deter referral to nephrology, which is based predominantly on CKD stage. This results in a significant proportion of patients with stable renal function being seen by nephrology, and in the under-referral of a large cohort of patients with progressive CKD.

KEY WORDS: Chronic kidney disease, CKD, diabetes, epidemiology, nephropathy.

Introduction

Classification of chronic kidney disease (CKD) on the basis of estimated glomerular filtration rate (eGFR) and automated reporting of eGFR have focused attention on the prevalence of chronic kidney disease (CKD).[1] This has been further complemented in the UK by changes in primary care working patterns. In April 2004, a new contract for general practice, the General Medical Services (GMS) contract, was introduced, in which a significant proportion of practice income is derived from performance against targets in a new Quality and Outcomes Framework (QOF). The intended consequences of the new contractual arrangements were to reward quality of care rather than number of registered patients, to improve data capture and care processes, and to improve patient outcomes and doctors' working conditions.[2] In 2006, in response to the heightened awareness of the increasing prevalence of renal disease, the revised QOF of the GMS contract added CKD to the previously identified domains of chronic disease. This revised QOF now requires general practitioners (GPs) to keep a renal register of patients with CKD who have eGFRs below 60 ml/min/1.73m^2. The rationale behind the alterations in the reporting of renal function, and that underlying the recognition of patients with CKD in general practice disease registers, is to enable the early identification of CKD. The introduction of the CKD domain into QOF has therefore changed the level of emphasis on CKD patient care by highlighting the requirement to see and care for early and moderate CKD predominantly within primary care.

The most common cause of renal failure in the western world is now diabetes mellitus, which accounts for 20–50% of all patients requiring renal replacement therapy.[3] Progression of diabetic nephropathy in the pre-dialysis phase from normoalbuminuria to overt proteinuria, as well as the provision of renal replacement therapy, is associated with increased medical care costs.[4] General practice QOF in the UK include not only CKD but also domains relating to diabetes, which, like the CKD QOF domains, reward primary care practices for completeness of processes and agreed clinical indicators. As a result, the majority of patients with the combination of diabetes and CKD are likely to be managed in primary care. Nevertheless, guidelines suggest that specialist care is appropriate for those patients with evidence of disease progression and the development of significant complications such as nephropathy.[5,6] As a result, the responsibility for the care of patients with diabetes and CKD in the UK is divided between primary care, diabetology and nephrology services. Specific guidelines have been published on how to manage the interface between these different healthcare settings in terms of patient referral.

At present, very little data exist on the caseload of each of these areas of healthcare in managing patients with both diabetes and CKD. In this manuscript, we describe the characteristics of patients followed up in each setting. In particular, we describe the age, CKD stage and proportion of patients with CKD and with progressive CKD in each care setting.

Methods

Data were collected from the records of the clinical biochemistry department serving the whole of the Aneurin Bevan NHS Health Board, which covers five primary healthcare Local Health Boards and a total population of 560,000 people.

Using the data for the year 2009, 6.5% of CKD patients were identified as having a diagnosis of diabetes mellitus, either by a positive glucose tolerance test or by having Haemoglobin A1c

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Table 1. Basic characteristics and distribution of patients with diabetes and CKD between primary care, diabetes and nephrology services.

	Primary care only (GP)	Diabetes (D)	Nephrology (N)	Statistically significant differences
Number of patients (%)	1,156 (42.6%)	970 (35.9%)	584 (21.5%)	p<0.0001
Average age (± SD)	77.4 ± 8.9[a]	75.9 ± 9.5	74.0 ± 10.7[b]	[a]p<0.0001 GP vs D [b]p<0.0001 N vs GP and N vs D
Average eGFR ml/min (± SD)	47.5 ± 9.1[c]	46.0 ± 9.6	35.3 ± 12.2[d]	[c]p=0.0003 GP vs D [d]p<0.0001 N vs GP and N vs D
Number of patients with eGFR <30 ml/min (%)	62 (5.4%)	76 (7.8%)	222[e] (38.1%)	[e]p<0.0001 N vs GP and N vs D
Average age of patients with eGFR <30 ml/min	82.6 ± 8.0[f]	78.2 ± 10.1	75.0 ± 10.9[g]	[f]p<0.0001 GP vs D [g]p<0.0001 N vs GP and N vs D
Average age of patients with eGFR ≥30 but <60 ml/min	77.1 ± 8.8[h]	75.8 ± 9.5[i]	73.4 ± 10.5	[h]p<0.001 GP vs <30 ml/min GP [i]p=0.04 D vs <30 ml/min D

CKD = chronic kidney disease; D = diabetes; eGFR = estimated glomerular filtration rate; GP = general practioner; N = nephrology; SD = standard deviation.

>48 mmol/mol. We were not able to differentiate between type I and type II diabetes, nor between diabetic nephropathy and non-diabetic CKD in diabetic patients. Following the initial screen, patients with a diagnosis of diabetes in 2009, a recorded eGFR of <60 ml/min, and follow-up biochemical data covering at least one year were included in the analysis. Patients were separated into those whose clinical care during 2009 was delivered by a primary care physician only, those seen additionally by a diabetologist and those seen by a nephrologist.

Using all available biochemical data between January 2009 and April 2012 (and at least 12 months of follow-up data), the rate of decline of renal function was calculated as change in eGFR ml/min/year. Patients were defined as 'progressors' if the rate of reduction in their eGFR was >3 ml/min/year, stable if the change in eGFR was between −3 ml/min/year and +3 ml/min/year and improving if their eGFR rose by >3 ml/min/year. Albumin:creatine ratio (ACR) results were collected from the nearest time point to the date of the reported eGFR in 2009 that was the trigger for inclusion of the patient in the analysis.

Statistical analysis was carried out by Students' t-test and the Chi-squared (χ^2) test as appropriate, and $p < 0.05$ deemed statistically significant.

Results

Identification of patients with CKD

From the initial screen of 26,759 CKD patients with a known diagnosis of diabetes in 2009, we identified 2,710 patients with an eGFR <60 ml/min and at least one year of biochemical follow-up data.

The proportion of the diabetic patients with CKD (DM-CKD) were seen only in primary care (42.7%) was significantly larger than that seen by a diabetologist (36.0%, $p < 0.0001$). An even smaller proportion of DM-CKD patients were seen in nephrology (21.6%, $p < 0.0001$).

Patients followed up in primary care only, were significantly older the patients who were also seen by a diabetologist or a nephrologist. Similarly, the patients who were seen by a nephrologist were significantly younger than those cared for in primary care alone or those who saw a diabetologist but no nephrologist.

The cohort followed up by nephrology had the lowest eGFR (Table 1). The nephrology cohort had a significantly higher proportion of patients with stage 4–5 CKD (eGFR <30 ml/min), and these patients were significantly younger than the patients with stage 4–5 CKD in both the primary care and diabetes cohorts.

Analysis of the progression of CKD

The change in the renal function of DM-CKD patients within each follow-up cohort is shown in Table 2. The proportion of patients with progressive DM-CKD was no different in those seen in primary care, diabetes or nephrology. The patients followed up in primary care with progressive DM-CKD were, however, significantly older than the progressors in the diabetes and nephrology cohorts. In both the primary care and diabetes cohorts, 97% of those with progressive DM-CKD had stage 3 CKD. In the nephrology cohort, almost a third of the patients with progressive DM-CKD had stage 4–5 CKD.

Patients with progressive DM-CKD were further sub-divided into mild, moderate and severe progressors on the basis of the rate of deterioration in eGFR with 'mild' defined as >3 but ≤5 ml/min/year, 'moderate' as >5 but ≤10, and 'severe' as >10 ml/min/year (Table 3). The smallest proportion of severe progressors was seen in the primary care cohort, although in absolute terms, the number of severe-progressor patients seen by primary carers alone was comparable that seen by nephrology. The severe progressors group in primary care were significantly older those followed up by diabetes or nephrology. The proportion of patients classified as severe progressors was no different between the diabetes and nephrology cohorts, and there was no difference in the ages of these two severe progressor groups.

Table 2. Characteristics and distribution of patients with diabetes and CKD according to rate of progression of their renal disease, and according to their eGFR, between primary care, diabetes and nephrology services.

	Primary care (GP)	Diabetes (D)	Nephrology (N)	Statistically significant differences
'Progressors' (%)	334 (29%)	331 (34%)	200 (34%)	p=0.23 (not significant)
Age	77.9 ± 8.1[a]	75.1 ± 10.1	73.8 ± 11.1	[a]p<0.0001 GP progressors vs D progressors and GP progressors vs N progressors
eGFR	50.5 ± 8.0[b]	49.4 ± 8.4[b]	38.5 ± 11.7[b,c]	[b]p<0.0001, progressors vs stable or improved patients within the same treatment cohort [c]p<0.0001 N progressors vs D or GP progressors
Progressors with eGFR ≥30 ml/min	325 (97%)	322 (97%)	142 (71%)	p<0.0001
Progressors with starting eGFR <30 ml/min	9 (3%)	9 (3%)	58 (29%)	p<0.0001
'Stable' (%)	716 (62%)	541 (56%)	338 (58%)	Not significant
Age	77.1 ± 9.1	76.0 ± 9.4	73.8 ± 10.5	Not significant
eGFR	47.1 ± 9.2	45.3 ± 9.6	33.7 ± 12.4	p<0.0001
'Improvers' (%)	106 (9%)	98 (10%)	46 (8%)	Not significant
Age	78.2 ± 9.6	78.4 ± 7.8	76.3 ± 10.3	Not significant
eGFR	40.7 ± 7.5[d]	38.9 ± 8.6[d]	32.3 ± 10.8	[d]p<0.0001 improvers vs stable or progressors within the same cohort

Patients were defined as progressors if the rate of reduction in their eGFR was >3 ml/min/year, stable if the change in their eGFR was between −3 ml/min/year and +3 ml/min/year, and improving if their eGFR rose by >3 ml/min/year.
CKD = chronic kidney disease; D = diabetes; eGFR = estimated glomerular filtration rate; GP = general practioner; N = nephrology.

Proteinuira and follow-up characteristics

The results of ACR for each of the patient cohorts are shown in Table 4. ACR was highest in the patient cohort followed up by nephrology, and significantly higher in the patient cohort followed up by diabetes than in those seen by primary care alone. The same pattern was also seen within the sub-group of patients with progressive renal disease; patients with progressive renal disease who were followed up by nephrology had the highest ACR, and those seen by diabetologists had a higher ACR than those in seen by primary carers alone.

Discussion

Changes in working practice have moved the emphasis of care for patients with diabetes and CKD away from specialist services towards primary care.[7] For most patients with the combination of CKD and diabetes, it is therefore appropriate for management to be coordinated within primary care, where the focus is on cardiovascular risk management. Nevertheless, patients with more advanced diabetes and associated complications, might benefit from joint care with specialist services. Patients with either advanced or progressive renal disease should ideally be under the care of nephrology specialist services. A smooth transition of patient care through the appropriate specialist services, requires an awareness of the significance of the markers of disease progression, which should trigger referral. In response to the perceived shift in focus for the care of diabetic patients, in this study we determined the distribution of care of patients with diabetes and CKD between primary care, diabetes and nephrology services, and sought to identify patient- and disease-associated characteristics of those followed up in each setting.

From this analysis it is clear, as would be expected, that the nephrology service sees only a minority of patients with the combination of diabetes and CKD. From the patient characteristics, it would seem that age, stage of CKD and quantitation of proteinuria are the driving forces for referral; the patients followed up by nephrologists are younger, have a lower eGFR and have the highest levels of proteinuria or albuminuria. However, nephrologists currently do see the majority of the patients with stage 4 or 5 CKD as well as diabetes. These data, therefore, suggest that the characteristics of the nephrology cohort reflect current referral guidelines that emphasise an absolute eGFR and CKD stage as the trigger for the referral of patients with CKD to a nephrologist.

A striking feature of the majority of the patients followed by nephrologists is that they have stable stage 3 CKD, with the stable (or improving) group of CKD patients representing roughly two-thirds of all the patients seen. It is unlikely that this high proportion of non-progressors relates to a difference in management, as a similar proportion of non-progressors was seen in the primary care and diabetic cohorts. This is, however, likely to reflect the relatively elderly population with the combination of diabetes and CKD in our study; it is known that in the elderly CKD may be a more important marker of cardiovascular risk than of risk of progression to end-stage renal disease.[8,9] Is this an appropriate use of resources? Might these patients be better served by having their cardiovascular risk managed by their primary care physician? The idea of an active programme of discharge of patients with significant renal impairment might be viewed as rash and might not be routine practice

Table 3. Distribution of patients with diabetes, CKD and progressive renal impairment (defined as a fall in eGFR of ≥3 ml/min/yr) according to the rate of progression (categorised as mild, moderate and severe) between primary care, diabetes and nephrology services.

	Primary care (GP)	Diabetes (D)	Nephrology (N)	Statistically significant differences
Mild (%) **>3 but ≤ 5 ml/min/year**	167 (50%)[a]	139 (42%)[a]	106 (53%)	[a]p<0.05 GP vs N and D vs N
Age	76.9 ± 7.9[b]	76.1 ± 8.5	74.6 ± 9.8	[b]p<0.05 GP vs N
eGFR	49.8 ± 8.8	48.5 ± 8.7	36.5 ± 11.7[c]	[c]p<0.001 N vs GP and N vs D
Moderate (%) **>5 but ≤10 ml/min/year**	148 (44%)	157 (47%)	73 (37%)[d]	[d]p<0.05 N vs GP and N vs D
Age	78.6 ± 8.1[e]	74.8 ± 11.0	74.3 ± 10.9	[e]p<0.001 GP vs D and GP vs N
eGFR	51.2 ± 7.1	49.7 ± 7.8	39.8 ± 11.1[f]	[f]p<0.001 N vs GP and N vs D
Severe % (n=) **>10 ml/min/year**	19 (6%)[g]	35 (11%)	21 (10%)	[g]p<0.05 GP vs N
Age	80.9 ± 7.9	72.8 ± 11.5[h]	67.8 ± 16.3[h]	[h]p<0.005 GP vs D and GP vs N
eGFR	51.2 ± 7.9	51.2 ± 9.2	44.0 ± 11.4[i]	[i]p<0.01 N vs GP and N vs D

CKD = chronic kidney disease; D = diabetes; eGFR = estimated glomerular filtration rate; GP = general practioner; N = nephrology.

Table 4. Analysis of albumin:creatinine ratio in patients with diabetes and CKD.

	Primary care (GP)	Diabetes (D)	Nephrology (N)	
Whole cohort	8.2 ± 16.4	14.5 ± 24.2[a]	27.8 ± 33.8[b]	[a]p<0.0001 D vs PC [b]p<0.0001 N vs GP and N vs D
Progressors eGFR ≥–3 ml/min/yr	11.0 ± 20.4*	17.4 ± 26.9[c]*	33.7 ± 33.9†[d]	[c]p<0.0001 D vs GP [d]p<0.0001 N vs D and N vs PC
Stable eGFR –3 to +3 ml/min/yr	6.7 ± 14.5	12.6 ± 21.9	24.5 ± 34.4	
Improved eGFR >3 ml/min/yr	9.2 ± 18.9	14.9 ± 25.5	18.2 ± 23.3	

Albumin:creatinine ratio: mg albumin per mmol creatinine.
*p < 0.01 progressors vs stable in GP and in D. †p < 0.001 for N progressors vs N stable and N improved.

within nephrology. We have previously examined the impact of a programme of active and aggressive discharge of patients with non-progressive CKD, supported by advice on monitoring and re-referral parameters.[7–10] In this context, we have shown that discharge of the appropriate CKD patients from secondary care was followed by adequate monitoring of renal function in primary care, and that this was safe for patients. We suggest, therefore, that repatriation of stable patients with diabetes and CKD should be considered in order to increase capacity within existing clinical resources.

Recent studies have highlighted that early decline in renal function in patients with diabetes is a predictor of the risk of end-stage renal disease, with the rate of progression for any individual being linear.[11] In the current study, it would appear that deterioration of renal function does not influence patterns of referral. From our data, the same proportion of patients classified as progressors was seen in each of the three follow-up groups (primary care, diabetes and nephrology). Therefore, although nephrology services see the majority of those with advanced renal disease (stages 4 and 5 CKD), only a third of progressors are followed up in the nephrology clinic. Roughly half of the patient group classified as progressors in the primary care and diabetes cohorts were classified as moderate or severe progressors, having a rate of deterioration in their eGFR of ≥5 ml/min/year.

A striking feature within the progressor cohort is that the age of the patients seen only by their primary care physicians is significantly older than those seen by a nephrologist. In addition, this disparity in age is exaggerated in those in which the rate of decline in renal function is greatest. This would suggest that age seemingly influences the decisions of primary care physicians. This may well be appropriate in that some elderly patients might not be suitable for long-term renal replacement therapy. Nevertheless, when patients, following suitable immersion and education, make a decision to have conservative management of end-stage renal disease (a decision that of itself needs interaction and discussion), active management of anaemia, of renal bone disease and of end-of-life care are an important part of the role of the nephrologist and the wider nephrology multidisciplinary team. Age therefore should not in itself be seen as a barrier to referral.

As in the patient cohort followed in primary care, there is a significant proportion of patients in the diabetes cohort who have progressive renal disease. A greater share of moderate progressors and an equivalent proportion of severe progressors are seen by diabetologists when compared to those seen by nephrologists. This

reflects the larger absolute number of patients in these two categories seen by diabetologists than are seen by nephrologists. Age does not seem to be a factor influencing decision making for those seeing a diabetologist as there their age does not differ from that of the progressor subgroup seen in nephrology. The key difference between the diabetes and nephrology patients (which also applies to the primary care cohort) relates to eGFR, which is higher in the diabetes cohort than in the nephrology cohort. This would suggest that for patients with diabetes, absolute eGFR or CKD stage seems to dictate referral patterns rather than rate of progression. Current guidelines,[6] although emphasising referral based on eGFR and CKD stage, also highlight deteriorating renal function as an important criteria that should prompt referral, but our data suggest that this does not influence decision making. Adoption of an approach in which rate of decline of renal function forms an important determinant of the decision to refer would, however, result in a large increase in new patient referrals to nephrology. In this study, in which half of the patients being followed up by either primary care or diabetology were classified as moderate or severe progressors, this would amount to a four-fold increase in the number of patients with moderate progression (≥5 but <10 ml/min/year) who would need to be accommodated within nephrology clinics, and roughly a doubling of patients with severe progression (≥10 ml/min/year).

Conclusion

We have demonstrated that using current guidelines based on referral according to CKD stage, the majority of patients with DM-CKD in nephrology clinics do not have progressive renal disease. Furthermore, there is a large cohort of patients who are not currently referred to nephrology but who have significant progressive renal impairment. At least in primary care, patient age seems to influence referral patterns.

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