Impairment of kidney function and reduced quality-of-life in older people: a cross-sectional study

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Abstract

Objective: to assess the association of kidney function with quality-of-life in community-dwelling older adults aged 75 years or more in the UK.
Design: cross-sectional study.
Setting: primary care; 12 UK general practices participating in a cluster trial of health screening.
Subjects: estimated glomerular filtration rate (eGFR, ml/min/1.73 m²) using the four-variable modified diet in renal disease equation was derived in 1,195 men and 1,772 women with available bloods, these were 92% of 3,211 study participants who consented to interviews and 73% of those invited into the original cluster trial of health screening.
Main outcome measures: interviews by trained fieldworker using the Sickness Impact Profile (home management, mobility, self-care, social interaction), and the Philadelphia Geriatric Morale Scale. Higher scores imply worse quality-of-life in a given domain.
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Results: in age- and co-morbidity-adjusted analyses there was an association of eGFR <45 and the highest scores (defined as ≥median) of mobility (men: odds ratio (OR) 2.91, 95% confidence interval (CI) 1.56–5.41; women: OR 1.73, 95% CI 1.02–2.94), home management (men: OR 1.49, 95% CI 1.09–2.04; women: OR 3.50, 95% CI 1.18–10.35), social interaction (men: OR 3.34, 95% CI 1.73–6.45; women: 2.64, 95% CI 1.61–4.33) when compared with those with eGFR ≥60 and who reported no problems. Men with eGFR <45 had low morale (OR 2.45, 95% CI 1.02–5.87) but this was not found for women (OR 1.40, 95% CI 0.65–3.04), whereas women (but not men) with eGFR <45 reported problems with body care (women: OR 1.68; 95% CI 1.25–2.27: men: OR 0.89, 95% CI 0.55–1.46).

Conclusions: an eGFR <45 is associated with poorer quality-of-life at older age. More research is needed to identify modifiable causes to improve quality-of-life in older people with such a degree of kidney function impairment.

Keywords: estimated glomerular filtration rate, general population, older age, quality-of-life, elderly

Introduction

Chronic kidney disease (CKD) is common and associated with cardiovascular and all-cause mortality [1] as well as progression to need for renal replacement therapy (RRT) [2]. Earlier stages of CKD are characterised by urinary abnormalities and/or decreased estimated glomerular filtration rate (eGFR) [3]. The prevalence of CKD is high in older people [4], but there remains uncertainty of its clinical significance. Policy measures, such as the Quality Outcomes Framework targets for CKD [5, 6], have been criticised therefore as being ‘bad medicine’ [7]. CKD is associated with cardiovascular and all-cause mortality at older age [4, 8], but the pathways that mediate these associations and other health consequences are poorly understood.

People receiving RRT have a high prevalence of depression with an associated risk of hospitalisation [9–17]. There are few data on the effects of CKD on other health outcomes in the general population. A recent study of hypertensive African-American CKD patients reported that one in four patients had quality-of-life (QOL) scores consistent with depressive affect, but there was no comparison with people without CKD of similar age and sex [18]. A population-based Australian study found an association of CKD with lower QOL; there was a stronger impairment of mental health in people <50 years with CKD as opposed to older people with CKD who had impairment of physical functioning when compared with those without CKD in the respective age groups [19].

The aim of our study was to assess the association between eGFR and QOL in an older community-dwelling population in the UK.

Methods

We used data from the Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community which is fully described elsewhere [20, 21]. Practices were randomised to ‘universal’ or ‘targeted’ assessment. In the ‘universal’ arm, all patients aged over 75 years were invited to an in-depth health assessment by the study nurse while in the ‘targeted’ arm only selected patients were invited. Through the MRC General Practice Research Framework 106 practices were recruited, selected to be representative of the joint tertiles of Jarman Scores [22] and standard mortality ratios for practice locations. People, unless in nursing homes or terminally ill, were invited to participate in the study, with inclusion of those in residential homes and sheltered accommodation. The present paper uses data from participants in the ‘universal’ arm of the study as a representative sample of community-dwelling older people. This arm had a 73.2% response rate for baseline assessment; non-responders were older and more likely to be female [21]. As part of the trial outcomes a QOL assessment was carried out in a random subsample of 24 practices stratified by intervention arm (12 practices in the ‘universal’ arm) [21]. There were 3,211 participants who underwent the baseline assessment and who had QOL data. Ethics committee approval was obtained for all practices.

In-depth assessment of health and QOL

In each practice, the health assessments were undertaken by study nurses using a standardised protocol. The assessments covered a wide range of self-reported and measured health problems, lifestyle factors (smoking, alcohol and physical activity) and anthropometry measurements. A non-fasting blood sample was taken.

Trained interviewers, independent of the practice, administered QOL interviews in the patient’s homes prior to the health assessment. The core interview included four dimensions from the UK version of the Sickness Impact Profile (SIP; home management, mobility, self-care, social interaction), and the Philadelphia Geriatric Morale Scale (PGMS), a 17-item measure specifically developed for use with older people. Information was also collected on availability of informal help, and pre-retirement main occupation of respondent and spouse. Social class was derived from job titles and brief job description using the 1991 classification of occupations (using the husband’s occupation for women if they were ever married) [23].
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Derivation of eGFR categories

Serum creatinine measurements were carried out in local laboratories. At the time (1995–99), the majority of laboratories used Jaffe-based methods. The simple modification of diet in renal disease equation was used to calculate eGFR in ml/min/1.73 m² [24]. For brevity this was expressed in units only. Among those in the ‘universal’ arm, there were 13,177 with derivable eGFR (86% of 15,336 trial participants), among those were 2,967 individuals with available QOL data (92% of 3,211 with QOL at baseline assessment in the ‘universal’ arm). Participants were divided into eGFR groups <45, 45–59, ≥60 with cut-offs chosen to correspond to previously published CKD stages.

Data analysis

For all QOL scores, the possible range was 0–100% with higher scores indicating lower QOL [25]. Fewer than 1% of the participants could not be assigned a score because they answered fewer than half the component items of any one scale and were excluded from the analysis. For SIP dimensions, affirmative responses to problem statements were weighted, summed and expressed as a percent of the maximum possible score for that domain [26]. The PGMS scores were calculated similarly but without weighting.

Score distributions were skewed and differed considerably between men and women, such that a comparison of a QOL relative to the total population median would capture somewhat different entities within men as opposed to similar comparisons within women. We have previously found that associations of CKD with baseline co-morbidity and with subsequent mortality differ by sex, with women having generally weaker associations [4, 8]. In order to arrive at internally consistent estimates for associations of CKD with QOL among men and among women, the QOL scores were categorised separately by sex into three groups: 0 (no problems), >0 but <median, and ≥median. Multinomial logistic regression analyses of QOL were carried out separately by sex, taking the no-problem group as the reference category. Robust standard errors were used to account for the clustering by practice.

All models were adjusted for age as a major confounder of the association of eGFR categories with QOL dimensions. Subsequent models examined the effect of other potential confounders identified from previous reports from the study [4]. The final model was adjusted for co-morbid illness (self-reported history of myocardial infarction, stroke or diabetes). Adjustment for other potential confounders (social class, Activities of Daily Living) was not possible because of small numbers in certain categories. We therefore carried out sensitivity analyses with a simpler QOL categorisation of having no problems (zero score in a given domain) compared with any problems (non-zero score). This enabled us to adjust the associations of eGFR categories with this binary QOL outcome for age, co-morbid illness, receiving regular help, living alone and socio-economic status. These factors were chosen because of known associations of these factors with eGFR [4] and with QOL at older age [27, 28]. Analyses were subsequently additionally adjusted for serum haemoglobin to investigate whether anaemia found in people with CKD explains some of the CKD-QOL associations. Missing data on individual variables (172 with no social class data; 12 with no data on receiving regular help; 4 with inconclusive data on living circumstances; 61 with missing data on haemoglobin) reduced the analysis sample to 1,586 women and 1,130 men (91% of those with eGFR and QOL data). Data analysis was carried out with Stata version 11.

Results

The median age of men and women was 79.8 (IQR 76.8–83.4) years and 80.5 (IQR 77.3–84.2) years, respectively. There were fewer men (40.3%) than women. The data analysed here are comparable with the entire trial in terms of age and sex, and when compared with the subset of participants who had available data on CKD with regards to the distribution of eGFR. The distributions of QOL scores appeared different between men and women and changed with age (Table 1). Median scores of mobility, body care, home management, social interaction and morale were slightly higher in women when compared with men at all ages. Median QOL scores also increased with increasing age in both men and women.

Both men and women who had previously suffered a stroke or myocardial infarction, those with diabetes, those with the lowest quintile of haemoglobin and those with past manual occupations (or with husbands with past manual occupations) had poorer QOL in all dimensions that were assessed. More women (n = 1,048, 60% of 1,766 with QOL data) than men were living alone (n = 300, 25% of total 1,192 men with QOL data). Both women and men who were living alone had poorer morale and social interaction scores than those not living alone. Both men (n = 318, 27%) and women (n = 550, 31%) who needed regular help at home had poorer QOL scores on all dimensions.

Across decreasing categories of eGFR there was a trend of poorer mobility in men, with an age- and co-morbidity-adjusted odds ratio (OR) of 2.68 (95% confidence interval (CI): 1.39–5.18) for men with eGFR <45 when compared with eGFR ≥60 for scores <median, and an OR 2.91 (1.56–5.41) for scores ≥median (Figure 1). In other words, men who had an eGFR <45 had a 2.91-fold increase in odds of reporting worse than average mobility scores when compared with men who had an eGFR ≥60. In men, there was no evidence for a trend across eGFR categories for associations with body care. In age- and co-morbidity-adjusted analyses, men with eGFR <45 had an OR of 1.49 (1.09–2.04) to have high-home management scores (≥median) when compared with men with eGFR ≥60. There were increasing trends of higher social
interaction scores across decreasing categories of eGFR. In age- and co-morbidity-adjusted analyses men with eGFR <45 had an OR of 1.95 (1.10–3.46) for social interaction (<median), and OR 3.34 (1.73–6.45) to have high-social interaction scores (≥median) when compared with eGFR ≥60. Men with eGFR <45 had substantively lower morale (≥median) than men with eGFR ≥60 (age- and co-morbidity-adjusted OR 2.45, 95% CI: 1.02–5.87).

For women, there was an association of eGFR <45 with mobility scores (≥median) with OR 1.73 (1.02–2.94) (Figure 2). Across decreasing categories of eGFR, women reported body care scores ≥median (age- and

Table 1. Median and inter-quartile range quality-of-life scores at baseline, by age and sex

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Number with data on morale</th>
<th>Mobility</th>
<th>Body care</th>
<th>Home management</th>
<th>Social interaction</th>
<th>Morale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75–80</td>
<td>626</td>
<td>12.5 (6.3–24.3)</td>
<td>2.8 (0–7.4)</td>
<td>10.8 (0–26.5)</td>
<td>7.2 (2.0–13.2)</td>
<td>17.6 (5.9–33.3)</td>
</tr>
<tr>
<td>81–85</td>
<td>361</td>
<td>17.7 (7.8–30.5)</td>
<td>3.5 (0–12.2)</td>
<td>23.3 (8.5–43.0)</td>
<td>10.0 (4.6–17.5)</td>
<td>23.5 (11.8–41.2)</td>
</tr>
<tr>
<td>&gt;85</td>
<td>206</td>
<td>24.3 (11.7–38.6)</td>
<td>8.3 (2.2–21.5)</td>
<td>30.1 (10.8–57.8)</td>
<td>12.1 (7.5–18.2)</td>
<td>23.5 (17.6–41.2)</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75–80</td>
<td>799</td>
<td>15.0 (7.2–25.8)</td>
<td>5.4 (0–14.2)</td>
<td>21.0 (8.5–32.2)</td>
<td>9.5 (3.8–16.0)</td>
<td>29.4 (11.8–47.0)</td>
</tr>
<tr>
<td>81–85</td>
<td>603</td>
<td>21.3 (10.9–33.5)</td>
<td>9.4 (3.2–20.0)</td>
<td>28.6 (13.8–43.9)</td>
<td>12.2 (7.5–19.4)</td>
<td>29.4 (17.6–47.0)</td>
</tr>
<tr>
<td>&gt;85</td>
<td>368</td>
<td>32.2 (21.4–42.8)</td>
<td>15.5 (6.6–29.8)</td>
<td>43.2 (24.6–65.9)</td>
<td>17.5 (10.8–23.7)</td>
<td>35.3 (23.3–52.9)</td>
</tr>
</tbody>
</table>

Figure 1. Age- and co-morbidity-adjusted analyses of the association of categories of estimated glomerular filtration rate (eGFR, in ml/min/1.73 m\(^2\)) with categories of QOL (scores >0 to <median, and median and above) in 1,195 men for different dimensions (mobility, body care, home management, social interaction, morale) relative to men who report no problems. There were 123 men with eGFR <45, 341 men with eGFR 45–59 and 977 men with eGFR 60+. Odds ratios (OR) and corresponding 95% confidence intervals are displayed.
co-morbidity-adjusted OR for eGFR <45: 1.68, 95% CI: 1.25–2.27) as well as home management (age- and co-morbidity-adjusted OR for eGFR <45: 3.50, 95% CI: 1.18–10.35), compared with women with eGFR ≥60; the associations appeared somewhat stronger when compared with men, though CIs were wide. Women who had an eGFR <45 reported more problems of social interaction when compared with women who had eGFR ≥60, with age- and co-morbidity-adjusted OR for social interaction scores (<median) 2.20 (1.35–3.57) and for social interaction scores (≥median) 2.64 (1.61–4.33). There was no evidence of association of lower eGFR with poorer morale in women.

In sensitivity analyses, with QOL categorised as 0 or >0, associations remained unchanged when adjusted for other potential confounders (living alone, needing regular help, socio-economic status) in addition to adjustment for age, pre-existing cardiovascular disease and diabetes (Supplementary Tables S1 and S2, available in Age and Ageing online). There was little or no attenuation of associations of eGFR with different dimensions of QOL upon further adjustment for haemoglobin. In all analyses, there was little or weak evidence for an association of eGFR of 45–59 with dimensions of QOL.

**Discussion**

In age- and co-morbidity-adjusted analyses, we found in both men and women associations of eGFR <45 with the highest (poorest) scores of mobility, home management, social interaction, and morale when compared with those with eGFR ≥60. Men with eGFR <45 reported poorer morale, and women with eGFR <45 reported more problems with body care. This may reflect gender-specific contexts of older peoples’ lives. In sensitivity analyses, there was limited evidence for confounding by socio-economic status and circumstances of living. We found little evidence that these associations were explained by lower haemoglobin levels.
The strength of this study is the use of standardised and validated QOL questionnaires in a representative sample of community-dwelling people of ages 75 years or more. Our results do not apply to people aged younger than 75 or to nursing home residents. We explored whether the magnitude of the association varied with SIP domain scores by comparing those with no problems to with a few problems (less than the median) and those with a greater number of problems (greater than the median). This analysis showed clear trends with increasing scores for certain domains especially mobility and social interaction. A limitation was the small sample size in certain categories of analyses, in particular those with eGFR <45 (and especially eGFR <30) and in the highest category of QOL scores. However, our sensitivity analyses of having any problems as opposed to no problems in a given domain suggested no major confounding by other variables independently associated with QOL. It is possible that our results were confounded by other factors that we did not measure. Given the wide range of information on health and social problems in the study we think this is unlikely. The cross-sectional design of this study makes the judgement of temporal relations more difficult. However, we consider it unlikely that the QOL dimensions we assessed could have influenced eGFR levels. The formula used to estimate eGFR is not validated for this age, and creatinine measurements were not calibrated across laboratories. This may have led us to underestimate the true extent of these associations, though an eGFR <45 is less sensitive to the formula used as well as to the creatinine calibration method [29]. The data presented in this paper were collected over a decade ago, at a time when blood pressure targets and recommended drugs were more lenient in the over 75 year olds. We have no comparison QOL data in younger people from which to study the impact of CKD on QOL by age. A community-based study in Australia has studied this association (with QOL being measured by the SF36 questionnaire) in a younger sample of individuals and found that having lower eGFR was associated with poorer mobility in subjects aged >50 years [19].

The main implication of our results is that an older person for whom the laboratory returns a routine measurement of an eGFR <45 is more likely to suffer from range of underlying every-day problems when compared with people who have an eGFR ≥60. There was little impact of eGFR 45–59. This adds to the evidence supporting detection and management of eGFR <45 in older people and for separating classification of CKD stage 3 into 3a (eGFR 45–59) and 3b (eGFR 30–44). We have shown that the associations of eGFR <45 with QOL are not fully explained by co-existing cardiovascular disease, living circumstances or socio-economic status. Thus an eGFR <45 is not only a risk marker for future cardiovascular events or death [1, 8], but also of difficulties with carrying out physical and social activities of every-day life and of problems of morale in men. The adjusted analyses suggest that the associations of QOL with lower eGFR do not appear to be explained by pre-existing cardiovascular disease, or anaemia.

Much research in kidney disease has focused on detection and management of indicators such as anaemia or hypertension; there has been less attention paid to patient-centred outcomes relevant to everyday living. The results here highlight the need to identify strategies to improve QOL and functioning in older people with lower eGFR.

Key points

- A lower eGFR is associated with cardiovascular and all-cause mortality at older age. There are few data on the overall effects of CKD on morbidity and overall health outcomes in the older population.
- For men, an eGFR <45 ml/min/1.73 m² is associated with poorer mobility, more problems of social interaction and lower morale when compared with men with eGFR ≥60 ml/min/1.73 m².
- For women, there were associations of eGFR <45 ml/min/1.73 m² with problems of mobility, body care, home management and social interaction when compared with women with eGFR ≥60 ml/min/1.73 m².
- Our study suggests that lower eGFR is associated with dimensions of poorer QOL at older age in both men and women.

Conflicts of interest

None declared.

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Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

References

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