Research paper

Preoperative kidney function linked to mortality and readmission outcomes at Day 90 and 30 in older emergency surgical patients

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A B S T R A C T

Introduction: Impaired preoperative kidney function is associated with an increase in post-procedural major complications and mortality in older elective surgical population. However, little is known about the impact of poor kidney function on outcomes in emergency surgical setting in this age group. This study aimed to quantify the effect of impaired kidney function on 30 and 90 days mortality; and readmission within 30 days following an acute surgical admission in older patients.
Material and methods: The Older Persons Surgical Outcomes Collaboration 2015 cohort study, in four UK centres and one in Belgium, examined the above relationships. A logistic regression model was used to assess the odds of outcomes when comparing impaired eGFR to normal eGFR. A total of 402 patients were included with a mean age of 76.2 years (range 65–103 years), of which 209 (52%) were male.
Results: The prevalence of eGFR <60 ml/min/1.73 m^2 was 34.1% ($N = 137$). Patients with an eGFR of <60 ml/min/1.73 m^2 on admission were more likely to die at 30 and 90 days when compared to patients with eGFRs ≥ 60 ml/min/1.73 m^2; respective adjusted OR = 2.98 (95%CI 1.38–6.43, $P = 0.006$) and 3.37 (95%CI 1.82–6.27, $P < 0.001$). No differences were observed for 30-day readmission to hospital.
Conclusions: Admission eGFR provides prognostic information which is useful to clinicians in an acute surgical setting. Whether closer monitoring and focused management at improving kidney function improves outcome in this patient population warrants further investigation.

1. Introduction

The prevalence of Chronic Kidney Disease (CKD) stages 3–5 in the UK is reported to be between 5.8% [1] and 8.5% [2], with the prevalence increasing with age [1–3]. Estimates of over 40% have commonly been described in Europe and the United States, in community dwelling older people aged over 80 years [4,5]. Patients with CKD have been found to have a poor self-awareness of their disease and its implications [6] and recognition amongst medical professionals has been found to be deficient [7,8].

Impaired kidney function is associated with a high hospital admission rate and subsequently higher risk of adverse outcomes after medical interventions [9,10] and surgical interventions [8,11,12].

There are few studies assessing the effect of eGFR in the general surgical setting and none have been conducted in an elderly emergency general surgical setting. In 2008, a systematic review on CKD and short term postoperative mortality found that patients with CKD undergoing elective non-cardiac surgery, which encompassed general surgical and vascular procedures, demonstrated a two to five fold higher risk of mortality or cardiovascular events compared to those with normal renal function [13]. Early stages of CKD were found to have a detrimental effect on survival and morbidity. For example, a general and vascular surgical population, with a mean age of 58 years and CKD stage 3, death within 30 days

of an operation was 2.3 times higher and post-operative complications 1.2 times higher, when compared to normal renal function [8].

To date, little is known about the impact of impaired eGFR on outcomes in the emergency surgical setting in older patients. The objective of this international prospective study was to consider the relationship between renal impairment on a range of clinically significant outcomes in an elderly emergency general surgical population.

2. Methods

2.1. Study population and data sources

Data collection was performed in 4 UK hospitals (University Hospital of Wales; Royal Alexandra Hospital Paisley; Aberdeen Royal Infirmary; Central Manchester Foundation Trust) and one Belgian Hospital (Ghent University Hospital). All hospitals are part of the Older Persons Surgical Outcomes Collaboration [www.opsoc.eu].

Data were collected prospectively using hospital electronic records or physical records and stored securely with patient identifiable data removed. The relevant institutional approvals were acquired in all participating centres.

Inclusion criteria were:

- all patients aged 65 years or older;
- unplanned admission to a general surgery ward.

There were no exclusion criteria and all acute surgical emergency admissions were consecutively included during the study period.

Baseline demographic data were collected on participating patients; haemoglobin (<130 g/L classified as anaemia); albumin (≤35 g/L classified as low), number of medications (grouped as either being <5 or ≥5 medications); diabetic history; multimorbidity (defined using 20 pre-specified conditions) [14] and categorised as ≤2 or 3 or more; and whether the patient had surgery or not.

2.2. Outcomes

The primary outcome of interest was Day 90 mortality, and secondary outcomes were mortality at Day 30 and admission to hospital within 30 days of discharge.

2.3. Categorising renal function

Patient's eGFR were acquired in one of two ways; manually calculated using an online calculator; found here http://egfrcalc.renal.org/, which uses the modification for diet in renal disease equation and required the input of the patient's admission creatinine, age, sex and race. The other method involved recording the eGFR value automatically calculated from an admission blood electrolyte test.

For the purpose of this study, eGFR was categorised into the CKD stages according to the guidelines set out by the National Kidney Foundation (NKF) [3]. CKD stages 1 and 2 require evidence of kidney damage to differentiate correctly, data which were not routinely available on the hospital electronic systems. All eGFR records that were ≥60 ml/min/1.73 m^2, were categorised as CKD stage 1–2. The remaining stages were defined along the criteria of the NKF.

2.4. Statistical analysis

A descriptive analysis of the patient demographic and clinical data on admission was performed on the primary outcome

(mortality at Day 90). Primary and secondary outcomes were analysed using a multivariable logistic regression base model to determine the effect of eGFR, adjusted for clinically important covariates of albumin and age group. Subsequently, a forward stepping multivariable logistic model fitting approach using a likelihood ratio test of clinical covariates after adjustment of the base model (age group, albumin and eGFR) was performed. As an exploratory analysis, comparison of the effects of eGFR partitioned into the established kidney function categories, against the binary partition of greater than, versus less than 60, was carried out. All adjusted odds ratios (ORs) were reported with their associated 95% confidence internal (95% CI) and P-values. Statistical analysis was carried out using Stata version 13.0.

3. Results

A total of 402 patients admitted as an acute surgical emergency in five participating centres were included in the study and their baseline characteristics summarised in Table 1. Mean age was 76.2 years (range 65–103 years), with 209 (52%) being male. A total of 65.9% and 34.1% of patients were classified as having normal renal function (eGFR ≥ 60 ml/min/1.73 m^2) or impaired renal function (eGFR < 60 ml/min/1.73 m^2) respectively.

Missing data for albumin, poly-pharmacy, length of stay and diabetic status, which individually were missing in <3% of participants, which were considered to be missing at random.

Table 1 also summarises the outcomes of patients presenting as acute surgical emergency. In total, there were 22 and 40 deaths within 30 and 90 days of presentation respectively, and 95 readmissions within 30 days of discharge.

The proportion of patients who died within 90 days of first presentation at hospital was significantly greater in patients with renal impairment (16.1%), when compared to patients with normal eGFR (6.8%, P < 0.01). A similar trend was seen with 30 day mortality, with 9.5% of renal impaired patients experiencing the outcome when compared to non-renal impaired patients (3.4%, P = 0.01). No difference in readmission between those with renal impairment (24.8%) and patients with normal renal function (23%, P = 0.48).

Multivariable analyses showing predictors of 90 day mortality; 30 day mortality and Readmission within 30 days of discharge are shown in Tables 2 and 3. Table 3 shows a summary of additional covariates, which were adjusted for age group, albumin and eGFR.

3.1. Outcome 1: mortality within 90 days

After adjustment of age group and albumin; the odds of mortality at 90 days was higher in patients with an admission eGFR of <60 ml/min/1.73 m^2 (OR = 3.37, 95%CI 1.82–6.27, P ≤ 0.001) when compared to patients with normal eGFR.

Stratifying admission eGFR into the CKD classification, mortality was again higher and worsened with decreasing eGFR when compared to normal eGFR. The following adjusted ORs were demonstrated in the corresponding CKD classifications; CKD 3a (OR = 2.99, 95%CI 1.36–6.57, P = 0.006), CKD 3b (OR = 3.24, 95%CI 1.31–8.05, P = 0.11) and CKD 4 + 5 (OR = 4.57, 95%CI 1.81, 11.50, P = 0.001), when compared to the normal eGFR group. Supplementary Table 1 summarises the multivariable analysis of stratified eGFR on outcomes.

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