Effect of Acute Kidney Injury on CKD Progression and Proteinuria

KL Horne[1], R Packington[1], S Shaw[1], A Akani[1], D Moore[1], NV Kolhe[1], RJ Fluck[1], MW Taal[1,2] and NM Selby[1,2]

[1]Department of Renal Medicine, Derby Hospitals NHS Foundation Trust, Derby, UK
[2]Centre for Kidney Research and Innovation (CKRI), University of Nottingham, UK

Introduction

Episodes of AKI may have profound longer term sequelae on renal function and patient outcomes. However, the majority of studies in this area are retrospective and many focus only on specific patient groups. Hence there is a need to examine the long term effects of AKI on patient outcomes in a prospective studies that include general hospitalised patients from across the entire spectrum of AKI severity.

Methods

The AKI Risk In Derby (ARID) study is a prospective matched parallel group cohort study examining long term effects of AKI in a general hospitalised population.
Cases (hospitalised patients with AKI) and controls (hospitalised patients without AKI) were recruited 3mnths after hospital admission and matched 1:1 for age, baseline GFR stage and diabetes (Figure 1).
Renal function and proteinuria were measured at recruitment (3months) and 1year, and will be measured at 3 and 5 years. CKD progression was defined as: ≥25% decrease in eGFR plus a decline in GFR stage.

Results

1125 patients were recruited; 866 were successfully matched (433 AKI, 433 controls, summarised in figure 2).

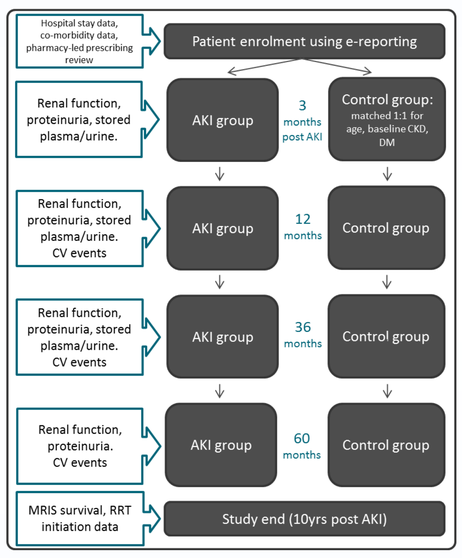


Figure 1
Flow diagram of ARID study design

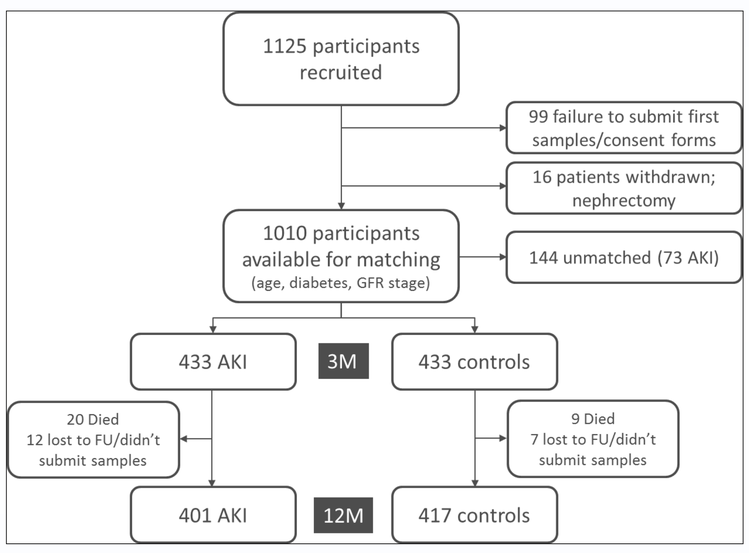


Figure 2
CONSORT diagram of participants in the ARID study. Retention rates at 1Y are >97%

Matching and baseline characteristics of cohorts

Groups were well matched:

- Age: 71yrs (IQR13) in controls vs. 71yrs (IQR14) in AKI, p=0.73.
- Baseline eGFR: 70.3±20ml/min in controls vs. 70.0±20ml/min in AKI, p=0.58.
- Diabetes: 22% in each group
- No major differences in co-morbidity
- In AKI group, proportions in stages 1,2,3 were 59%, 24% & 17%
- 62% AKI occurred <24hrs from admission (c-AKI); 38% was hospital acquired (h-AKI)

CKD progression

eGFR was lower at all time-points after baseline in the AKI group. At 1yr, eGFR was 74.3±23ml/min in controls and 63.1±22ml/min in AKI group, p<0.001. Data are shown in figure 2.

CKD progression at 12 months was much more common in AKI groups as compared to controls: 23.3% (93pts) vs. 4.6%, p<0.001.

Rates of mortality relatively low over first year: 9 (2.1%) controls vs. 20 (4.6%) AKI, p=0.04

Proportion of patients reaching a combined renal endpoint* over one year was also low: 1 (0.2%) control vs. 7 (1.6%) AKI, p=0.06

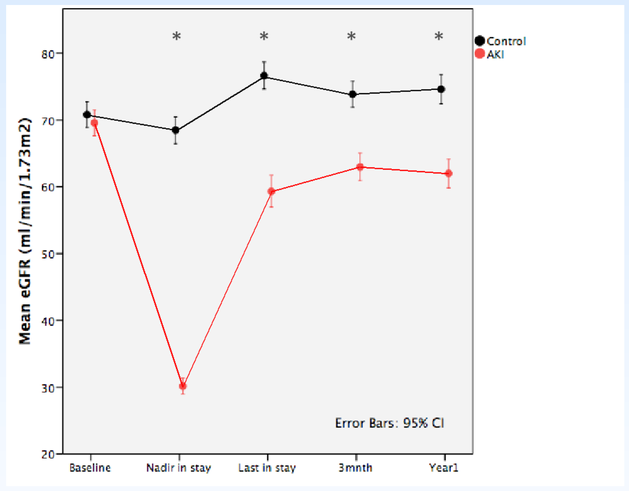
*(doubling serum creatinine, eGFR<15 or initiation of RRT)

Results

Patterns of recovery and CKD progression

In AKI patients, the pattern of CKD progression was not uniform over time. Odds of CKD progression varied across different time periods (baseline to 3M, 3M to 1Y) as shown in table 1.
In AKI group:

- 30% of those with 'CKD progression' at 3M subsequently improved and no longer had CKD progression at 1Y; the remaining 70% had failure of recovery and persistent CKD
- 14% of those who did not have CKD progression at 3M did progress later, and met definition of CKD progression at 1Y



	At 3M	Between 3M & 12M
OR for CKD progression in AKI group	7.78 (95%CI 4.1-14.9)	1.96 (95%CI 1.1-3.7)

Figure 1 and table 1
*Figure 1: eGFR in AKI group (red) and control group (black) over time. Groups had identical eGFR at baseline, but during hospitalisation, at 3months and at 1yr, eGFR was significantly lower in AKI group. * p<0.001*
Table 1: Odds ratio for CKD progression with AKI at different time-points; difference is most marked between baseline and 3M, then diminishes in the period between 3M and 1year

Proteinuria

Proteinuria was more common and more severe in AKI group (fig 4).

In those with proteinuria (n=233) median PCR in control group was 26mg/mmol (IQR 40) vs. 36mg/mmol (IQR 49) in AKI, p=0.03

There was a clear relationship between AKI severity and prevalence and severity of proteinuria as shown in figure 5.

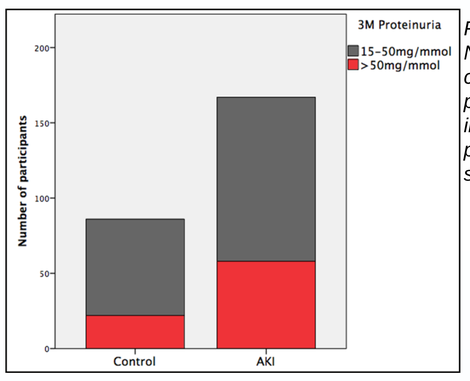


Figure 4 (left)
No of patients in AKI and control groups with proteinuria at 3M; grey indicates mild-moderate proteinuria, red indicates severe proteinuria

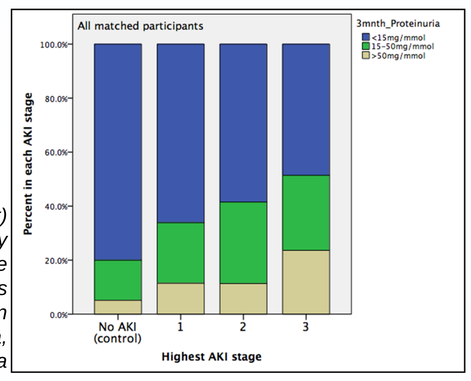


Figure 5 (right)
Proteinuria stratified by AKI severity. Blue indicates % of patients with no proteinuria; green mild-moderate proteinuria, beige severe proteinuria

Associations with CKD progression at 1 year

In the AKI group, there were a number of factors that associated with CKD progression on univariable analysis including: age; AKI duration; AKI severity; proteinuria at 3M; delta eGFR (between baseline and 3M); and several biochemical variables.

On multivariable analysis, several of these factors fell out of the model. Results of the multivariable analysis showing independent associations with CKD progression at 1Y are shown in table 2.

Variable	Univariable associations with CKD progression at 1 year (OR, 95% CI)	Multivariable associations (OR, 95% CI)
Age (per 10yrs)	1.32 (1.03 – 1.05) *	1.42 (1.02 – 1.97) *
Delta eGFR (baseline to 3M, per 5ml/min)	0.58 (0.52 - 0.67) *	0.58 (0.5 – 0.66) *
Proteinuria at 3M: 15-50mg/mol	1.81 (1.1 – 3.1) *	1.83 (0.92 – 3.6)
Proteinuria at 3M: >50mg/mol	3.37 (1.76 – 6.45) *	3.55 (1.6 – 7.8) *
Hb at 3M	0.97 (0.96 – 0.99) *	0.97 (0.96– 0.99) *

Table 2

Conclusions

Loss of renal function and proteinuria are both common sequelae of AKI, even in those with AKI stage 1.

Differential patterns of non-recovery, late recovery and late CKD progression over the first year after AKI mean that surrogate endpoints of CKD progression should be utilised with caution. It is also unclear at present to what extent these groups may differ.

Prospective studies provide opportunity to develop strategies to stratify risk of adverse outcome on an individual basis.

nicholas.selby@nottingham.ac.uk
@DerbyRenalTeam
www.nottingham.ac.uk/research/groups/renal

54 ERA
189--SP
Clinical AKI - epidemiology I
Nicholas Selby
DOI: 10.3252/pso.eu.54ERA.2017
ePosters supported by F. Hoffmann- La Roche Ltd.