Prescribing Patterns At The Time Of AKI: Opportunities To Improve Care

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Introduction

Medications may contribute to the onset of acute kidney injury (AKI) or require dose adjustment with acutely changing renal function. Currently, there is limited information about medication prescribing at the time of AKI and how this impacts on patient outcomes. We present a description of prescribing patterns at the time of AKI in the context of a prospective case-control study.

Methods

- The AKI Risk In Derby (ARID) study examines long term effects of AKI in a general hospitalised population. Baseline data from this study were used to look at prescribing patterns in patients with AKI, compared against controls.
- From a total of 1125 participants, 866 were successfully matched and included in this analysis, with prescribing data from during the index hospital admission and baseline data collection at 3months after hospital discharge.
- Cases (hospitalised patients with AKI) and controls (hospitalised patients without AKI) were recruited 3months after hospital admission and matched 1:1 for age, baseline GFR stage and diabetes.
- Renal function and proteinuria were measured at recruitment (3months), and will be measured at 1,3 and 5 years. CKD progression was defined as: ≥25% decrease in eGFR plus a decline in GFR stage.
- Pharmacists, part of the research team, took a detailed medication history at sequential time points during hospital admission for:
  - ACE inhibitors (ACEi), angiotensin receptor blockers (ARB), non-steroidal anti-inflammatory drugs (NSAIDs), diuretics, iodinated contrast, metformin, proton pump inhibitors (PPIs) and statins.
  - Drug dosing of antibiotics and low molecular weight heparins (LMWH) were assessed.

Results

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. 69.6±20ml/min in AKI, p=0.58.
- Diabetes: 94 (22%) in each group
- No major differences in co-morbidity
- In AKI group: 59%, 24% and 17% had AKI stages 1,2 and 3.
- 62% AKI occurred <24hrs from admission (c-AKI); 38% was hospital acquired (h-AKI)
- eGFR was lower in AKI group at 3months (63±22ml/min vs. 74±21ml/min, p<0.001) and CKD progression more common (16.9% versus 2.5%, p<0.001) as compared to controls.

At hospital admission:

- More AKI patients than controls received ACEi/ARBs (222 (51%) vs 170 (39%),p=<0.001) and NSAIDs (51 (12%) vs 28 (7%), p=0.007)
- No difference in proportion of AKI and control patients receiving diuretics, statins, metformin or PPIs (20% of AKIs received contrast vs 25% of controls, p=0.06)

Within 24hrs of AKI:

- Prescribing of all classes of medications (except NSAIDs) fell in AKI patients (Figure 1), although less so with statins and PPIs. There were a slight rise in NSAID use in surgical patients for pain management.
- h-AKI was associated with a higher proportion of patients receiving NSAIDs (19% vs. 9%, p=0.012) and contrast (29% vs 14%, p<0.001). Discontinuation rates of all medications were higher in c-AKI.

At hospital discharge:

- Contrasting to admission, fewer AKI patients received ACEi/ARB (28%) versus controls (37%, p=0.004); of AKI patients taking ACEi/ARB on admission only half were receiving these at discharge.
- Discharge documentation contained AKI diagnosis in 214 (49%) cases and information regarding medication changes in 32%. Specific advice regarding monitoring of renal function was provided in 37% cases.

Drug dosing in AKI:

201 (46%) AKI patients received antibiotics and 283 (65%) LWMH during their hospital episode.
Only 69% and 68% of these patients received the correct dose; in the remainder dose was not adjusted for renal function.

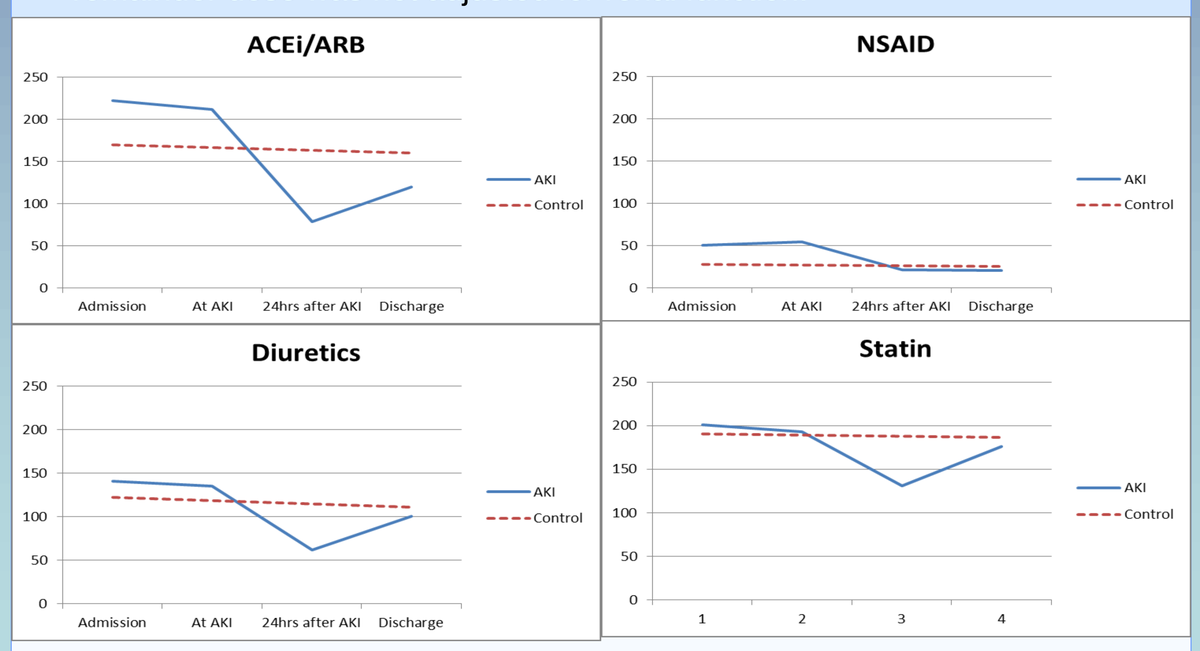

Figure 1.
Numbers of AKI patients (blue line) and controls (dashed red line) prescribed different classes of medications at four time points during hospitalisation: time of admission; time of AKI; 24hrs after AKI onset; at discharge.

No changes in prescribing between admission and discharge were seen in controls. In AKI: ACEi/ARB were stopped in 60%, NSAIDs stopped in 65%, diuretics stopped in 52% and metformin stopped in 55% of AKI cases who were taking these at admission.

Outcomes at discharge and 3 months:

- The 294 AKI patients with complete renal recovery at discharge were more likely to be receiving an ACEi/ARB at that time point (32% versus 18%, p=0.001) versus AKI patients with incomplete recovery.
- A higher proportion of AKI patients who had CKD progression at 3months took diuretics on discharge (37% vs. 21%, p=0.002), and fewer received PPIs (36% vs. 49%, p=0.038) versus AKI patients without progression.
- There was no association of receipt of ACEi/ARB at any time point with CKD progression at 3months.
- Proteinuria at 3months was not associated with ACEi/ARB cessation during hospital stay. A higher proportion of AKI patients who received ACEi/ARB at both admission and discharge had proteinuria.

Conclusion

- A number of prescribing patterns relevant to onset of AKI can be described, with fewer relating to recovery of renal function post AKI. Increased diuretic use at discharge associates with CKD progression at 3month but may reflect underlying associations with cardiac disease.
- Prescriber awareness of the importance of suspending relevant medications at time of AKI is evident, particularly for ACEi/ARB.
- The significant reduction in patients taking ACEi/ARB after an episode of AKI highlights the importance of follow-up to ensure that these prescriptions are reviewed and ACEi/ARB restarted when indicated. Failure to do so may impact on long term patient outcomes.
- Dose adjustment of medications in patients with AKI and communication with primary care following hospitalisation are areas in which improvements are still required.
- Proteinuria that is detected following an episode of AKI is not a result of ACEi/ARB cessation during hospitalisation.
- The ARID study will report on longer term prescribing patterns and their associations with renal, cardiovascular and patient outcomes.

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