Frailty and Acute Kidney Injury: a 1-Year Follow-up of a Prospective Cohort

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INTRODUCTION

The demand that acute kidney injury (AKI) places on the healthcare system is well documented, with both increased morbidity and mortality.[1] The Clinical Frailty Score (CFS) is a tool developed to assess an individual's level of frailty and we have previously demonstrated an association between CFS and AKI.[2] At 2 weeks following an acute medical admission, there is a higher mortality in those who are both "severely frail" (a frailty score of 7 to 9) and have an AKI on presentation than those who are frail or have AKI in isolation.[3] However, there is currently no information regarding longer term outcomes in this group. We present 1-year follow-up data for our prospective cohort.[3]

METHODS

This was a single-centre prospective cohort study. The 2-week data has been previously published.[3] Data were collected on unselected acute medical admission and takes over 12 non-consecutive days in June–July 2017. All patients aged ≥ 65 were included and given a CFS based on preadmission status.[2] Patients with a CFS of 1–4 were deemed "no significant frailty", 5–6 "mild to moderately frail" and 7–9 "severely frail". Baseline creatine was determined by results over the previous year; patients were excluded if no baseline creatinine was available or if they were currently receiving renal replacement therapy. AKI was staged as per the Kidney Disease: Improving Global Outcomes parameters.[4] Outcome measures of mortality and emergency re-attendance to hospital were assessed at 1 year following admission alongside the data previously analysed. Data were analysed using SPSS statistics. A p value < 0.05 was considered statistically significant. No ethical approval was required, and a STROBE checklist was followed.

RESULTS

All 164 patients (77 male) were reviewed at 1 year. Thirty-one patients (19%) had an AKI on admission (28 patients, stage 1; 3 patients, stage 2). A total of 50 out of 164 had died at 1 year (30.5%).

AKI at presentation remained significantly associated with death at 1 year (55.6% AKI group vs 29.7% no AKI group; $p = 0.02$) resulting in a relative risk (RR) of 1.84 (95% CI 1.16–2.92). There was no difference in re-attendances between the groups. Aside from AKI, only ischaemic heart disease (RR 0.51; 95% CI 0.27–0.98, $p = 0.03$) and active malignancy (RR 2.27; 95% CI 1.45–3.57, $p < 0.01$) were found to be significantly associated with mortality at follow-up (Table 1).

There remained a significantly increased rate of death at 1 year in those who were severely frail (47.2% of group) versus no frailty (22.2%) or mild-moderate frailty (27.75%) respectively ($p = 0.02$ and $p = 0.04$). There was no significant difference in re-attendances between the frailty groups. Having both AKI and severe frailty resulted in a statistically significant relative risk of death at 1 year of 2.79 (95% CI 1.66–4.71, $p < 0.01$) compared to these risk factors alone (Table 2).

DISCUSSION

Patients who were both severely frail and had an AKI were found most likely to die at 1 year (relative risk of 2.79 (95% CI 1.66–4.71)). At 2-week follow-up, 36.3% of patients who were severely frail and had an AKI died[3]; a further 30.4% of

Table 1 One-Year Mortality Risk Factors

Variable	Died at 1 year ($n = 50$)		Alive at 1 year		p
	n	$\%$	n	$\%$	
AKI	15	30.0	16	14.0	0.02*
Ischemic heart disease	9	18.0	40	35.1	0.03*
Chronic kidney disease	7	14.0	14	12.3	0.76
Hypertension	25	50.0	61	53.5	0.68
Cerebrovascular accident/transient ischemic attack	8	16.0	16	14.0	0.74
Heart failure	7	14.0	12	10.5	0.52
Dementia	14	28.0	21	18.4	0.17
Diabetes	14	28.0	32	28.1	0.99
Parkinson's disease	3	6.0	5	4.4	0.66
Chronic obstructive pulmonary disease	13	26.0	20	17.5	0.21
Active malignancy	12	24.0	8	7.0	< 0.01*
Previous malignancy	6	12.0	8	7.0	0.29

*$p < 0.05$ statistically significant

Table 2 Comparison Between Combination of Groups with Mortality at 1 Year

	Died at 1 year (%)	RR of death at 1 year*	p
AKI and severely frail ($n = 12$)	8 (66.7)	2.79 (95% CI 1.66–4.71)	< 0.01[†]
AKI and not severely frail ($n = 19$)	7 (36.8)	1.54 (95% CI 0.78–3.04)	0.21
Not AKI and severely frail ($n = 24$)	9 (37.5)	1.57 (95% CI 0.85–2.91)	0.15
Not AKI and not severely frail ($n = 109$)	26 (23.9)		

Control group those without AKI and not severely frail (CFS < 7)
†p < 0.05 statistically significant

these patients had died by 1 year resulting in a mortality of 66.7% in this group. This is a higher relative risk of mortality at 1 year than those who had an active malignancy or ischaemic heart disease, which were the only other risk factors found to be significantly associated with 1-year mortality. Whilst it might be expected that increased frailty would be associated with more hospital re-attendances, this was not shown to be the case.

Whilst it remains unclear about the exact underlying physiological changes that occur, this evidence continues to suggest that the CFS could be used as a surrogate marker of these changes. We again support the use of CFS as a bedside test for predicting not only the development of AKI in acute illness, but the combination being a predictor of mortality at 1 year.[3] It may be that this could be used in particular when discussing with patients and families about end-of-life planning.

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REFERENCES

1. **Waikar SS**, **Liu KD**, **Chertow GM**. Diagnosis, epidemiology and outcomes of acute kidney injury. Clin J Am Soc Nephrol 2008;3:844–61.
2. **Rockwood K**, **Song XW**, **MacKnight C**, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005;173:489–95.
3. **Morton S**, **Isted A**, **Avery P**, **Wang J**. Is frailty a predictor of outcomes in elderly inpatients with acute kidney injury? A prospective cohort study. Am J Med 2018;131:1231–56.
4. **Khwaja A**. KDIGO Clinical Practice Guidelines for Acute Kidney Injury. Nephron Clin Pract 2012;120:C179-C84.