3rd Asia Pacific AKI CRRT 2019

EC-CCN Excellence Center for Critical Care Nephrology

King Chulalongkorn Memorial Hospital
The Thai Red Cross Society

Interactions of Acute Kidney Injury (AKI) and Acute Respiratory Failure (ARF) in Critically Ill Patients

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Background

AKI and ARF are common disorders among critically ill patients. ARF and its treatment can worsen kidney function via multiple complex mechanisms including impaired gas exchange, hemodynamic instability, and biotrauma from mechanical ventilation. AKI can also cause damage to lungs by uremic and fluid retention, acid base imbalance, and dysregulated immune response. Our primary goal is to explore the characteristics and outcomes of critically ill patients with different patterns of AKI and ARF.

Methods

Data were retrieved from SEA-AKI study, a multinational multicenter database of adult ICUs from Thailand, Laos and Indonesia. AKI was defined using KDIGO criteria stage 2-3. ARF was defined by being mechanical ventilated. Primary outcome was in-hospital mortality. Patients were assigned into 6 patterns of AKI and ARF sequence: none, ARF alone, AKI alone, ARF first, AKI first, and concurrent AKI-ARF. We excluded those with ESRD, missing data, and having both AKI and ARF on the first day of enrollment due to inability to determine pattern. A final cohort of 5468 patients were eligible for the analysis. Descriptive statistics were done to characterize each group of patients. Cox proportional hazards model and adjusted survival analysis for 28-day mortality was also done by R version 3.6.1. P-value of ≤0.05 was considered significant.

Results (1)

Table 1 Baseline clinical characteristics of each pattern

	None (n=2156)	ARF alone (n=1920)	AKI alone (n=632)	ARF first (n=658)	AKI first (n=79)	Concurrent (n=23)	*P* value
Age, mean (SD)	57.6 (17.9)	58.83 (19.6)	60.8 (18.1)	64.5 (17.9)	60.8 (17.4)	62.1 (20.5)	<0.001
Female, n (%)	885 (41.0)	748 (39.0)	286 (45.3)	289 (43.9)	35 (44.3)	10 (43.5)	0.058
ICU type, n (%)							<0.001
- Surgical	148 (6.9%)	119 (6.2%)	27 (4.3%)	11 (1.7%)	8 (10.3%)	0 (0.0%)	
- Mixed	1409 (65.7%)	772 (40.3%)	332 (52.6%)	148 (22.5%)	43 (55.1%)	9 (39.1%)	
- Medical	588 (27.4%)	1026 (53.5%)	272 (43.1%)	498 (75.8%)	27 (34.6%)	14 (60.9%)	
Comorbidity, n (%)							
- HT	822 (38.1%)	651 (33.9%)	247 (39.1%)	265 (40.3%)	32 (40.5%)	10 (43.5%)	0.016
- DM	485 (22.5%)	363 (18.9%)	172 (27.3%)	160 (24.4%)	31 (39.2%)	6 (26.1%)	<0.001
- CKD	127 (5.9%)	75 (3.9%)	97 (15.3%)	46 (7.0%)	9 (11.4%)	2 (8.7%)	<0.001
- CAD	118 (5.5%)	126 (6.6%)	67 (10.7%)	66 (10.1%)	5 (6.3%)	2 (8.7%)	<0.001
- CVD	58 (2.7%)	84 (4.4%)	25 (4.0%)	46 (7.0%)	2 (2.5%)	0 (0.0%)	<0.001
- Malignancy	151 (7.0%)	149 (7.8%)	42 (6.6%)	63 (9.6%)	8 (10.1%)	2 (8.7%)	0.269
Max AKI staging, n (%)							NA
- KDIGO stage 2	NA	NA	201 (33.1%)	255 (48.5%)	13 (16.9%)	13 (65.0%)	
- KDIGO stage 3	NA	NA	406 (66.9%)	271 (51.5%)	64 (83.1%)	7 (35.0%)	
Max non-renal/non-respiratory SOFA, mean (SD)	1.82 (2.32)	4.23 (2.46)	1.96 (2.27)	5.43 (2.95)	5.28 (3.05)	5.00 (3.19)	<0.001
APACHE II, mean (SD)	11.65 (7.23)	17.05 (6.47)	12.73 (5.94)	19.06 (6.29)	15.87 (5.42)	12.83 (4.64)	<0.001
Anemia, n (%)	628 (29.1%)	524 (27.3%)	209 (33.1%)	234 (35.6%)	31 (39.2%)	5 (21.7%)	<0.001
Vasopressor use, n (%)	128 (9.8%)	355 (23.4%)	97 (20.5%)	235 (37.4%)	24 (34.3%)	7 (31.8%)	<0.001

Results (2)

Fig 1 In-hospital mortality

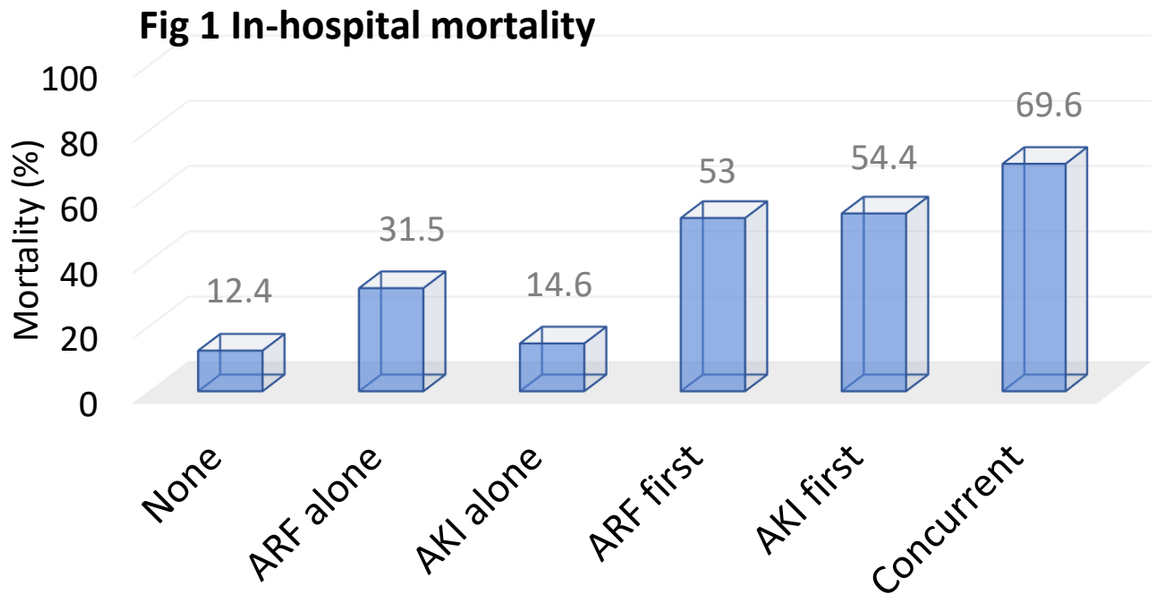
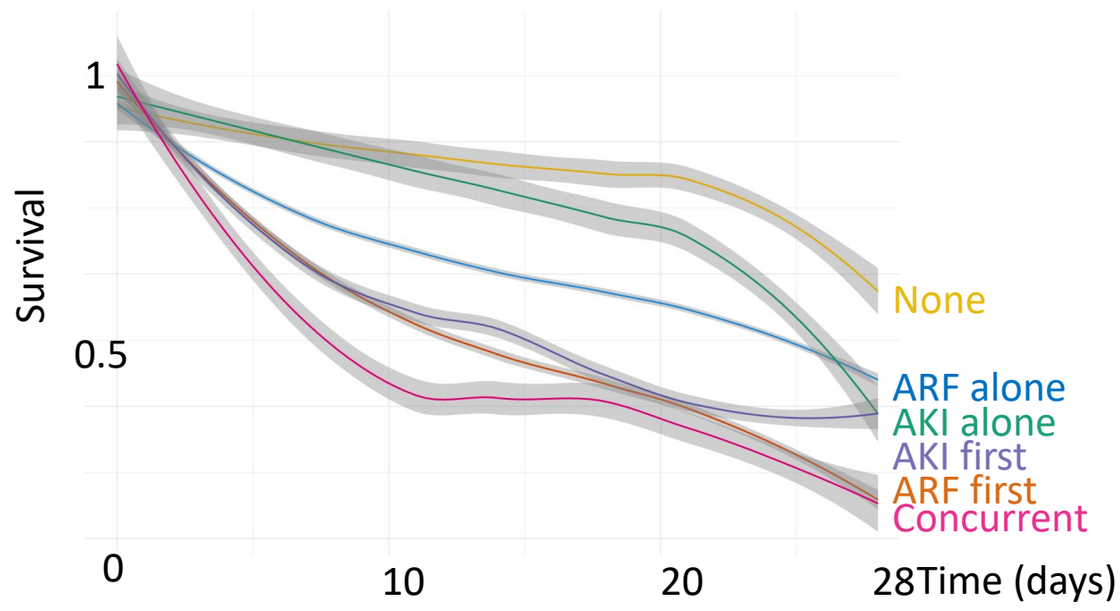


Fig 2 Adjusted 28-day survival analysis



Conclusion

Clinical characteristics and outcomes of different AKI-ARF interactions were described. Double organ failure had the worst outcomes, especially concurrent AKI-ARF group. Further investigation is still needed to describe the underlying mechanisms.

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