Epidemiology of Sepsis-Associated Acute Kidney Injury

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Background

- The ADQI defined SA-AKI as meeting both Sepsis-3 and KDIGO criteria within 7 days of sepsis diagnosis
- Subcategories of SA-AKI
  - Early: Occurs within 48 hours of sepsis onset
  - Late: Occurs > 48 hours after sepsis onset
- This study aimed to describe the epidemiological characteristics of SA-AKI

Methods

Data source
- Utilized EHR (2010 - 2022) at UAB and UK

Participants
- Inclusion: adult patients ≧ 18 admitted to ICU
- Exclusion: ESKD or kidney transplant

Definition of variables
- Sepsis-3:
  - Culture + Antibiotics
  - SOFA score ≧ 2
- AKI
  - KDIGO criteria using SCr and urine output
  - Baseline SCr
    - The closest outpatient SCr within 7 to 365 days before admission
    - If unavailable, prior inpatient SCr was also used
    - If still unavailable, the lowest SCr from 7 days before admission to discharge was considered
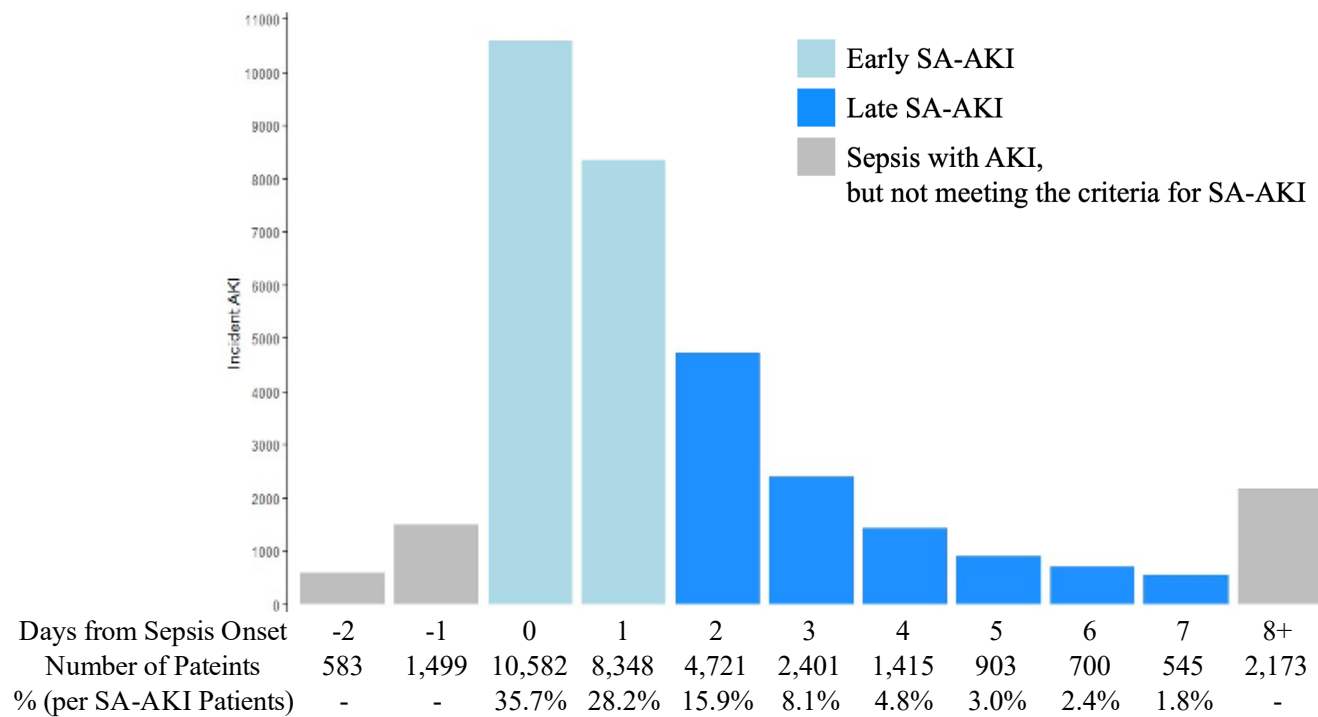- SA-AKI
  - AKI within 7 days of sepsis onset

Statistical Analysis
- Univariate comparison between Early vs Late SA-AKI
- Multivariate logistic regression models
  - Outcome: hospital mortality and MAKE at discharge
  - Comparison: Early vs Late SA-AKI
  - Covariates:
    age, sex, race, BMI, DM, HTN, CVD, CAD, CKD, liver cirrhosis, Charlson comorbidity index, baseline eGFR, exposure to nephrotoxin

Results

- 187,888 adult ICU patients
  - Sepsis: 63,536 (33.8% of the cohort)
  - AKI: 70,692 (37.6%)
  - SA-AKI: 29,615 (15.8%)
    - Early: 18,930 (63.9% among SA-AKI patients)
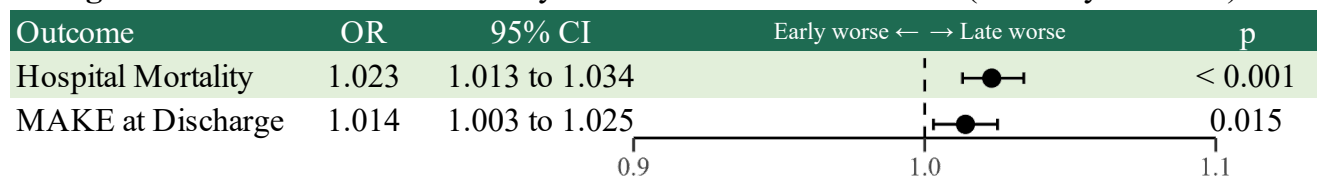   - Late: 10,685 (36.1%)

Figure 1: The Incidence of AKI Daily from the Onset of Sepsis

Days from Sepsis Onset	-2	-1	0	1	2	3	4	5	6	7	8+
Number of Pateints	583	1,499	10,582	8,348	4,721	2,401	1,415	903	700	545	2,173
% (per SA-AKI Patients)	-	-	35.7%	28.2%	15.9%	8.1%	4.8%	3.0%	2.4%	1.8%	-

Table 1: Clinical Characteristics and Outcomes Stratified by Early vs Late SA-AKI

		Overall (29,615)	Early (18,930)	Late (10,685)	p
Clinical Characteristics					
Age (years)	Median [IQR]	60 [48, 70]	59 [47, 69]	61 [50, 71]	<0.001
Sex (female)	n (%)	13,012 (43.9)	8,398 (44.4)	4,614 (43.2)	0.051
Race	n (%)				0.769
White		21,945 (74.1)	14,028 (74.1)	7,917 (74.1)	
Black		6,421 (21.7)	4,115 (21.7)	2,306 (21.6)	
Other		1,249 (4.2)	787 (4.2)	462 (4.3)	
Obesity	n (%)	12,480 (42.1)	7,899 (41.7)	4,581 (42.9)	0.057
Diabetes mellitus	n (%)	7,502 (25.3)	4,665 (24.6)	2,837 (26.6)	<0.001
Hypertension	n (%)	11,606 (39.2)	7,402 (39.1)	4,204 (39.3)	0.69
Cardiovascular disease	n (%)	9,594 (32.4)	5,816 (30.7)	3,778 (35.4)	<0.001
Liver cirrhosis	n (%)	2,693 (9.1)	1,628 (8.6)	1,065 (10.0)	<0.001
Chronic kidney disease	n (%)	5,292 (17.9)	2,992 (15.8)	2,300 (21.5)	<0.001
Charlson comorbidity index	Mean (SD)	4.38 (3.43)	4.24 (3.43)	4.62 (3.41)	<0.001
Baseline eGFR (mL/min)	Median (IQR)	81.4 [50.2, 105.8]	83.0 [50.6, 106.6]	78.4 [49.6, 103.9]	<0.001
Exposure to nephrotoxin	n (%)	21,547 (72.8)	13,505 (71.3)	8,042 (75.3)	<0.001
SOFA score at sepsis onset	Mean (SD)	5.7 (3.3)	6.09 (3.4)	5.11 (2.9)	<0.001
Septic shock	n (%)	5,964 (20.1)	4,134 (21.8)	1,830 (17.1)	<0.001
Clinical Outcomes					
Hospital death	n (%)	7,418 (25.0)	4,538 (24.0)	2,880 (27.0)	<0.001
MAKE at discharge	n (%)	11,162 (37.7)	7,013 (37.0)	4,149 (38.8)	<0.001
ICU free days	Mean (SD)	16.5 (11.3)	16.8 (11.1)	15.9 (11.5)	<0.001
MV free days	Mean (SD)	17.9 (12.3)	18.2 (12.1)	17.3 (12.6)	<0.001
RRT free days	Mean (SD)	20.2 (12.2)	20.5 (12.1)	19.8 (12.5)	<0.001
Max AKI Stage	n (%)				<0.001
Stage 1		12,657 (42.7)	7,512 (39.7)	5,145 (48.2)	
Stage 2		6,388 (21.6)	4,222 (22.3)	2,166 (20.3)	
Stage 3		10,570 (35.7)	7,196 (38.0)	3,374 (31.6)	

Figure 2: Odds Ratios for Mortality and MAKE in Late SA-AKI (vs. Early SA-AKI)

Outcome	OR	95% CI	Early worse ← → Late worse	p
Hospital Mortality	1.023	1.013 to 1.034		< 0.001
MAKE at Discharge	1.014	1.003 to 1.025		0.015

Conclusion

Early SA-AKI occurred in approximately two-thirds of SA-AKI patients who presented with higher acuity of illness at onset but had better outcomes compared to patients with late SA-AKI.

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