

Risk Factors and Impact of Acute Kidney Injury in Neurocritical Care

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INTRODUCTION

Acute kidney injury (AKI) is a severe complication in medical and surgical intensive care units (ICU). AKI is associated with high morbidity and mortality. Incidence, risk factors and prognostic impact of AKI are well established in this setting. Data concerning the neurocritically ill patient are lacking.

The aim of this study was to determine the incidence of AKI and identify risk factors in this special population.

METHODS

Patients admitted to the neurocritical care unit (NCCU) at our hospital between 2005 and 2011 with a stay above 48 hours were analyzed retrospectively for incidence, cause, impact and outcome of AKI (AKIN stage ≥ 2).

RESULTS

- Within 7 years 681 patients were included (mean age 60.7 ± 15.8 years, 55.4% male). Most frequent diagnosis was intracerebral hemorrhage (48.5%) followed by cerebral neoplasm (14.5%) and ischaemic stroke (14.2%). Except for stroke, none of the underlying diseases were associated with AKI.

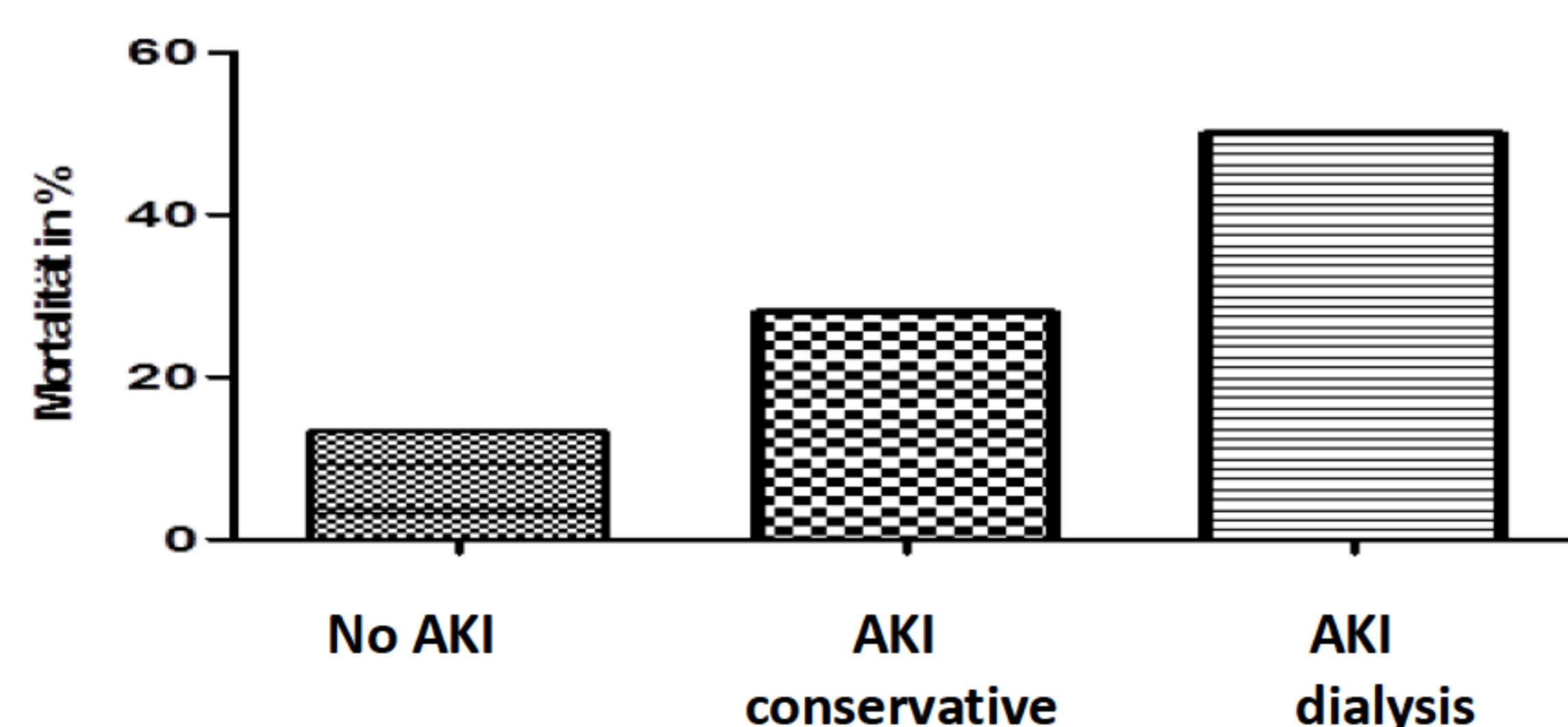
- Chronic renal failure (CKD) was known in 57 patients (8.4%). AKI incidence was 11.6%. Conservative treatment was sufficient in 43 patients (54.4%). 36 patients (45.6%) developed dialysis dependent AKI.

- Sepsis was the main cause of AKI (>50%). Independent risk factors for AKI were CKD (OR 12.65; 95%CI 6.34-25.24; $p < 0.0001$), infection (OR 2.84; 95%CI 1.12-7.17; $p = 0.027$) and nephrotoxic medication (OR 2.10; 95%CI 1.17-3.76; $p = 0.013$). Surgical intervention or contrast medium were not associated with NCCU AKI.

- AKI was associated with prolonged mechanical ventilation, length of ICU as well as length of hospital stay

- Risk of dying correlates with severity of AKI (no AKI 13.3%, conservative treatment 28%, hemodialysis 50%). Dialysis dependent AKI increased the odds for dying (OR 4.51; 95%CI 1.50-13.50; $p = 0.007$).

- 2 patients (5.6%) did not recover from AKI.



Graphic 1. Mortality of AKI correlates with severity of AKI in NCCU. While progressing through AKIN-Stage mortality increases constantly.

CONCLUSION

Despite a different spectrum of underlying diseases, causes and course of AKI in the setting of neurocritical care follows known rules. The main cause for AKI in this setting is sepsis, frequently caused by ventilator associated pneumonia, and is associated with a high mortality. Interestingly exposure to contrast media is not associated with AKI in this setting.

	AKI (n=79)	control (n=602)	p
patient and treatment-data			
age [years]	65.81 \pm 13.85	59.98 \pm 15.88	0.002
Male [n(%)]	51 (64.6)	326 (54.2)	0.092
neurologic disease	45 (57)	195 (32.4)	<0.001
SAPS-Score at admission	34.97 \pm 11.83	29.34 \pm 10.98	<0.001
SAPS-Score max	48.62 \pm 12.47	34.49 \pm 11.71	<0.001
SAPS-Score total	691.5 \pm 660.9	312 \pm 258.9	<0.001
mechanical ventilation [h]	341.1 \pm 345.5	182.5 \pm 198.8	<0.001
length of ICU-stay [days]	14.67 \pm 11.9	11.45 \pm 9.24	0.045
length of hospital stay [days]	23.06 \pm 16.41	19.57 \pm 15.61	0.058
deaths [n(%)]	30 (38)	80 (13.3)	<0.001

Tbl. 1. AKI vs Non-AKI patients. Variables are expressed as mean and standard deviation or numbers and proportions.

	AKI (n = 79)	control (n = 602)	P	Multivariate-analysis		
comorbidities [n(%)]				OR	95% CI	p
Hypertension	58 (73.4)	342 (56.8)	0.01			
Diabetes	29 (36.7)	98 (16.3)	<0.001			
CAD	22 (27.8)	105 (17.4)	0.031			
PAD	8 (10.1)	17 (2.8)	0.005			
CVD	54 (68.4)	271 (45)	<0.001	2.28	1.27-4.12	0.006
CKD	32 (40.5)	25 (4.2)	<0.001	12.65	6.34-25.24	<0.001
risk-profile [n(%)]						
operation	46 (58.2)	412 (68.4)	0.075			
contrast dye	49 (60.8)	424 (70.4)	0.152			
antibiotics	75 (95)	464 (76.9)	<0.001			
nephrotoxics	40 (50.6)	165 (27.4)	<0.001	2.09	1.17-3.76	0.013
infection	71 (89.9)	437 (72.6)	<0.001	2.84	1.12-7.17	0.027

Tbl. 2. Risk factors for AKI on NCCU. Variables are expressed as mean and standard deviation or numbers and proportions. CAD: coronary arterial disease; PAD: peripheral arterial disease; CVD: cerebrovascular disease; CKD: chronic kidney disease

	survivor vs. non-survivor	
	univariate	multivariate
AKI	<0.001	0.024 OR: 2.56 (95% CI: 2.53-8.19)
AKI-RRT	<0.001	0.007 OR: 4.51 (95% CI: 1.51-13.51)

Tbl. 3. Survivor vs. Non-Survivor. Acute kidney injury increased the risk for dying.