Department of Clinical Epidemiology

Five-year Risk of End-stage Renal Disease Among Intensive Care Patients Surviving Dialysis-requiring Acute Kidney Injury: A Nationwide Cohort Study

Henrik Gammelager[1], Christian Fynbo Christiansen[1], Martin Berg Johansen[1], Else Tønnesen[2], Bente Jespersen[3], Henrik Toft Sørensen[1]
Departments of Clinical Epidemiology[1], Anesthesiology and Intensive Care Medicine[2], and Nephrology[3], Aarhus University Hospital, Denmark

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Background

- Dialysis-requiring acute kidney injury (AKI) is common among intensive care unit (ICU) patients.[1,2]
- Follow-up data on long-term risk of end-stage renal disease (ESRD) among ICU patients remain sparse.[3]

Objectives

- To assess the 5-year risk of ESRD after dialysis-requiring AKI, compare it with the risk in other ICU patients, and examine the risk within subgroups of ICU patients.

Methods

Study Design

- Nationwide cohort study.

Study Population

- Adult patients (age ≥15) admitted to an ICU in Denmark from 2005 through 2010, who survived for 90 days after ICU admission.
- We excluded patients with pre-existing ESRD (n=1697).

Data Sources

- Individual-level linkage of Danish nationwide registries.
- *The Civil Registration System:* Contains complete information on migration, vital status and exact date of death on all Danish residents.
- *The Danish National Registry of patients:* Variables include among others hospital and hospital department, date of hospital admission and discharge, surgical procedures, major treatments, and one up to 20 discharge diagnoses (assigned by the discharging physician).
- *National Registry on Regular Dialysis and Transplantation:* Contains information on all Danish residents with chronic kidney disease actively treated with either ongoing dialysis or kidney transplantation.

Exposure

- Dialysis-requiring AKI, defined as patients in need of acute dialysis at or after ICU admission. The reference cohort was ICU patients' not receiving acute dialysis ('other ICU patients').

Outcome

- Subsequent ESRD was defined as a need for chronic dialysis for more than 90 days or a kidney transplant.

Statistical Analyses

- We followed patients who survived the first 90 days after ICU admission until ESRD, death, emigration, 5 years from ICU admission, or until December 31, 2011, whichever came first.
- We estimated the cumulative ESRD risk for patients with dialysis-requiring AKI and for other ICU patients, taking into account death as a competing risk.
- We compared ESRD risk for dialysis-requiring AKI patients with the risk in other ICU patients by hazard ratios (HR), computed using a Cox model adjusted for potential confounders.

Results

Characteristics

- ICU patients with dialysis-requiring AKI were slightly older, more often males, and had in general more preexisting comorbidity. They were also more often treated with mechanical ventilation or inotropes/vasopressors (Table 1).

Table 1: Characteristics by Dialysis-requiring AKI Status

	Dialysis-requiring AKI[a] n = 3,062	Other ICU patients[a] n = 104,875
Age, median (IQR), y	65 (55-73)	62 (46-72)
Gender		
– Female	1,116 (36.4)	45,440 (43.3)
– Male	1,946 (63.6)	59,435 (56.7)
Preexisting comorbidity		
– Chronic kidney disease[b]	325 (10.6)	1,961 (1.9)
– Diabetes	547 (17.9)	8,715 (8.3)
– Hypertension	748 (24.4)	16,218 (15.5)
– Congestive heart failure	307 (10.0)	5,837 (5.6)
– Myocardial infarction	147 (4.8)	4,848 (4.6)
– Cerebrovascular disease	244 (8.0)	7,933 (7.6)
– Peripheral vascular disease	286 (9.3)	6,517 (6.2)
– Malignant neoplasm	329 (10.7)	12,402 (11.8)
Surgical status[c,d]		
– No surgery	1,250 (40.8)	38,406 (36.6)
– Surgery		
· Acute cardiac surgery	162 (5.3)	2,510 (2.4)
· Acute non-cardiac surgery	1,126 (36.8)	30,559 (29.1)
· Elective cardiac surgery	248 (8.1)	14,080 (13.4)
· Elective non-cardiac surgery	276 (9.0)	19,320 (18.4)
ICU treatments		
– Mechanical ventilation	2,320 (75.8)	33,742 (32.1)
– Inotropes/vasopressors	2,244 (73.3)	26,705 (25.5)

[a] Values are expressed as number (percentage) unless otherwise indicated.
[b] Patients with preexisting ESRD or previous treated with dialysis were not considered for the current study.
[c] Surgical status identified by surgery at or up to 7 days before ICU admission.
[d] Acute and elective status classified according to hospital admission type.

ESRD Risk within 90 to 180 Days

- The cumulative risk of ESRD was 8.5% (95% CI: 7.5-9.5) for patients with dialysis-requiring AKI compared with 0.1% (95% CI: 0.0-0.1) for other ICU patients. (Table 2)
- The adjusted HR of ESRD for patients with dialysis-requiring AKI compared with other ICU patients was 105.6 (95% CI: 78.1-142.9). (Table 2)

ESRD Risk within 181 Days to 5 Years

- The cumulative risk of ESRD was 3.8% (95% CI: 3.0-4.8) for patients with dialysis-requiring AKI compared with 0.3% (95% CI: 0.3-0.4) for other ICU patients. (Table 2)
- The adjusted HR of ESRD for patients with dialysis-requiring AKI compared with other ICU patients was 6.2 (95% CI: 4.7-8.1). (Table 2)

ESRD Risk within Subgroups

- The impact of dialysis-requiring AKI on ESRD was evident within all subgroups of ICU patients, regardless age, gender, surgical status and comorbidity, however highest within subgroups with low baseline risk of ESRD, such as young patients and patients without chronic kidney disease.

Table 2: Cumulative Risk and Hazard Ratios of ESRD

Follow up/cohort	N	ESRD (n)	Cumulative risk % (95% CI)	Adjusted HR[a] (95% CI)
90 to 180 days				
– Dialysis-requiring AKI	3,062	260	8.5 (7.5-9.5)	105.6 (78.1-142.9)
– Other ICU patients	104,875	57	0.1 (0.0-0.1)	1 (reference)
181 days to 5 years				
– Dialysis-requiring AKI	2,579	76	3.8 (3.0-4.8)	6.2 (4.7-8.1)
– Other ICU patients	101,417	249	0.3 (0.3-0.4)	1 (reference)

[a] Adjusted for age group, gender, chronic kidney disease, diabetes, hypertension, congestive heart failure, myocardial infarction, peripheral vascular disease, cerebrovascular disease, cancer, and surgical status.

Conclusion

- Dialysis-requiring AKI is an important risk factor for ESRD up to 5 years after ICU admission.

References:
[1] Uchino S et al. JAMA. 2005, 294:813-818.
[2] Bagshaw SM et al. Crit Care. 2005, 9:R700-R709.
[3] Coca SG et al. Am J Kidney Dis. 2009, 53:961-73.

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Contact: hg@dce.au.dk