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Renal Data from Asia–Africa

Associated Factors of Dialysis-Dependence among Acute Kidney Injury Patients in Intensive Care Unit

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ABSTRACT. Acute kidney injury (AKI) is a common problem in hospitals and many end up requiring dialysis. The aim was to identify the associated factors of dialysis-dependent of AKI patients admitted to the intensive care units (ICUs). A retrospective cohort study was conducted where a list of 121 AKI patients admitted to ICU in Hospital Universiti Sains Malaysia was retrospectively reviewed. AKI patients aged below 18 years old, had kidney transplantation or chronic dialysis before ICU admission and had incomplete medical record were excluded from the study. Simple and multiple logistic regression analysis were used. The mean [standard deviation (SD)] age of patients was 56 (17.15) years. Majority of patients were males (63.2%) and Malay ethnic (54.1%). 49.3% of patients were in stage I, 48.3% in stage II and 76.2% in stage III. The mean (SD) duration of patients stayed in ICU was 7 days (6.92) for non-dialysis dependent and 12 days (8.37) for dialysis-dependent. The associated factors were male gender [adjusted odds ratio (OR): 3.68; 95% confidence interval [CI]: 1.53, 8.86; P = 0.004], AKI Stage III (adjusted OR: 4.51; 95% CI: 1.28, 15.91; P = 0.019), admitted in ICU (adjusted OR: 3.05; 95% CI: 1.28, 7.29; P = 0.012), and longer length of stay (adjusted OR: 1.10; 95% CI: 1.03, 1.18; P = 0.003). The factors influence of dialysis-requiring AKI were observed to be dependent on the male male gender, suffer from the advanced stage (Stage III), admitted to the ICU and had a longer length of stay in ICU. Therefore, it is important for physicians to identify patients who are at high risk of developing AKI and implement preventive strategies.

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Introduction

Acute kidney injury (AKI), is an epitomized

by the rapid loss of the kidney's excretory function and leads to by the accumulation of end products of nitrogen metabolism such as urea and creatinine or decreased in urinary output, or both.[1,2] The 2012 report published by the Malaysian Registry of Intensive Care showed an AKI incidence of 14% in intensive care units (ICUs) across Malaysia.[3]

AKI continues to be a critical illness with profound effects on patients' outcomes.[4] Incidence of AKI in a large integrated healthcare delivery system in United States was reported to be 5000 cases per million people per year for non-dialysis-requiring AKI to 295 cases per million people per year for dialysis-requiring diseases.[5] Collins et al reported that in 2009, from 398,861 people on dialysis, 380,760 were on hemodialysis (HD) (95% of all dialysis patients), and 18,101 patients were on peritoneal dialysis (PD) (5% of all dialysis patients).[6] Dialysis-requiring AKI in critically ill patients is associated with mortality of 40%–70% and the disease itself is an independent risk factor for death.[7]

This study reviewed all cases of AKI patients admitted to the ICUs to assess the dialysis-dependent. In Malaysia, there are a few specific studies on AKI patients, but there is no well-documented study on factors influence the dialysis-dependent. This study conducted to determine the associated factors of dialysis-dependent among AKI patients in ICU. Hopefully, the result of this study could help in developing targeted strategies and activities for the early management of AKI and references for future studies.

Materials and Methods

The study was conducted in Hospital Universiti Sains Malaysia (USM), a tertiary hospital where it also serves as referral centers for nearby districts and states. The medical record of all AKI patients admitted in ICU, including high-dependency unit, coronary care unit, and general intensive care unit (ICU) from January 2007 to December 2013 were reviewed retrospectively.

Patients aged above 18 years old were included in this study. Patients are excluded if they are: undergoing kidney transplantation or chronic dialysis before ICU admission and have an incomplete medical record.

After screening for the inclusion and exclusion criteria, a total of 121 patients were eligible for this study. Data extraction sheets were used to record all the medical information. The following information was recorded on a standardized checklist form: sex, age, ward admitted, comorbid, characteristics of patients, and clinical parameters. The reason for admission to the ICU was also recorded. When a patient was treated with dialysis, the initial mode of dialysis, date of ICU discharge, survival at ICU, and the length of stay in the ICU were also recorded.

Ethical approval was obtained from the Human Research Ethics Committee of USM. Permission to access the patient's folder was obtained from Hospital Director of Hospital USM.

Data entry and analysis was conducted using the Statistical Package for the Social Science version 22.0 for Windows (IBM Corp., Armonk, NY, USA). Data distributions and frequencies (%) were examined. All continuous variables were expressed as a mean and standard deviation (SD) or as a median and interquartile range based on data distribution. Simple and multiple logistic regression were used to determine the associated factors. Results are presented as the crude and adjusted odds ratio (OR), 95% confidence interval (CI) and P value. The level of significance was set at <0.05.

Result

Table 1 presents the demographic details of AKI patients admitted to the ICU in Hospital USM. AKI patients who were dialysis-dependent (63.2%) were predominance in males rather than females (41.5%). The mean (SD) age of patients who were dialysis-dependent was 56 (17.15) years old. Most of AKI patients who were dialysis-dependent (54.1%) were of Malay ethnic.

The characteristics of AKI patients admitted

Table 1. Demographic characteristics of acute kidney injury patients in Hospital Universiti Sains Malaysia (n = 121).

Variable	Dialysis dependent	
	No Frequency (%)	Yes Frequency (%)
Age	51.86 (19.03)*	56.34 (17.15)*
Gender		
Female	31 (58.5)	22 (41.5)
Male	25 (36.8)	43 (63.2)
Ethnicity		
Other	6 (50.0)	6 (50.0)
Malay	50 (45.9)	59 (54.1)
Smoking		
Never	40 (45.5)	48 (54.5)
Former	5 (50.0)	5 (50.0)
Current/active	11 (47.8)	12 (52.2)

*Mean (standard deviation).

to ICU in Hospital USM is summarized in Table 2. Half of the patients (50.0%) presented with comorbid and become dialysis-dependent. AKI patients who were dialysis-dependent were in Stage I (49.3%), Stage II (48.3%), and Stage III (76.2%). Most of the AKI patients who were dialysis-dependent admitted to ICU (64.5%) and 61.5% patient admitted to ICU because of surgery. There were 64.9% of AKI patients who had a surgical history. The mean (SD) duration of patients stayed in ICU was 7 days (6.92) for non-dialysis dependent and 12 days (8.37) for dialysis-dependent.

Table 3 shows the associated factors of dialysis-dependent among AKI patients admitted in the ICU, Hospital USM. The associated factors were male gender (adjusted OR: 3.68; 95% CI: 1.53, 8.86; P = 0.004), AKI Stage III (adjusted OR: 4.51; 95% CI: 1.28, 15.91; P = 0.019), admitted in ICU (OR: 3.05; 95% CI: 1.28, 7.29; P = 0.012) and longer length of stay (OR: 1.10; 95% CI: 1.03, 1.18; P = 0.003).

Table 2. Characteristics of AKI patients in Hospital Universiti Sains Malaysia (n = 121).

	Dialysis Dependent	
	No Frequency (%)	Yes Frequency (%)
Comorbid		
No	6 (28.6)	15 (71.4)
Yes	50 (50.0)	50 (50.0)
AKI stage		
I	36 (50.7)	35 (49.3)
II	15 (51.7)	14 (48.3)
III	5 (23.8)	16 (76.2)
Ward admitted		
HDU	3 (100.0)	0 (0.0)
CCU	26 (61.9)	16 (38.1)
ICU	27 (35.5)	16 (38.1)
Surgical history		
No	36 (56.2)	28 (43.8)
Yes	20 (35.1)	37 (64.9)
Length of stay	7.09 (6.92)*	12.08 (8.37)*

*Mean (SD), AKI: Acute kidney injury, HDU: High dependency unit, CCU: Coronary care unit, ICU: Intensive care unit, SD: Standard deviation.

Table 3. Associated factors of dialysis-dependent among AKI patients in Hospital Universiti Sains Malaysia (*n* = 121).

	Simple logistic regression			Multiple logistic regression		
	b	Crude Odd ratio (95% CI)	*P*	b	Adjusted Odd ratio (95% CI)	*P*
Gender						
Female	-	1.00	-	-	1.00	-
Male	0.89	2.42 (1.16, 5.06)	0.018	1.30	3.68 (1.53, 8.86)	0.004
AKI Stage						
I	-	1.00	-	-	1.00	-
II	−0.04	0.96 (0.41, 2.28)	0.926	−0.03	0.97 (0.36, 2.57)	0.946
III	1.19	3.29 (1.09, 9.96)	0.035	1.51	4.51 (1.28, 15.91)	0.019
Ward admitted						
Non-ICU	-	1.00	-	-	1.00	-
ICU	1.19	3.29 (1.52, 7.110	0.002	1.12	3.05 (1.28, 7.29)	0.012
Length of stay	0.09	1.10 (1.04, 1.16)	0.002	0.10	1.10 (1.03, 1.180	0.003

b: Regression coefficient; CI: Confidence interval, AKI: Acute kidney injury, ICU: Intensive care unit.

Discussion

Over the past six decades, the AKI morbidity and mortality remained relatively high.[8] Dialysis-requiring AKI is a severe illness associated with poor prognosis.[9] The current study revealed that among ICU patients with AKI, approximately 53.7% patients had died. Renal replacement therapy (RRT) required in some patients when AKI became severe enough.[2] Dialytic support, mainly in the form of HD treatment, was finally offered when indicated. The current study showed that 41.3% patients received HD, and 12.4% received PD for AKI episodes needing dialysis.

In this study, there were more males required RRT. Recent publications found that male gender to be associated with increased risk of dialysis-requiring AKI.[6,10-12] In addition, Mallhi et al found that better access to health-care facilities and ease of reporting to physicians might be another reason for high incidence of AKI among males.[13] Few studies revealed that gender is not a significant of dialysis-dependent among AKI patients.[14-17]

Patients with AKI Stage III were more likely to have dialysis-dependent compared to patients with AKI Stage I as reported in the result. AKI Stage III means that the increase in serum creatinine to 300% from baseline.[8]

The current results showed that patients admitted to ICU had a significant influence on dialysis-dependent. More than half of AKI patients (64.5%) who were admitted to ICU received dialysis. It is similar to the study by Bagshaw et al which indicated that the incidence of AKI is greater than 40% at admission to the ICU[18] and is associated with increased morbidity, mortality, and costs of care.[19] AKI patients who were admitted in ICU, in a case of surviving were 5%–20% risk of dialysis dependence.[20]

Other important factor that influences the dialysis-dependent among our AKI patients was the length of ICU stay. The mean length of ICU admission stay for this study was 12 days for a dialysis-dependent AKI (SD: 8.37 and 95% CI: 10.00–14.15) and seven days those who were not dialysis-dependent (SD: 6.29 and 95% CI: 5.24–8.94). Chertow et al also found that AKI was consistently associated with an independent increase in the length of stay.[21]

The present study had several limitations, including its retrospective design. Our study was also a single-center study; thus, the results may not be generalized; however, we believe that this is the first review of dialysis-dependent among AKI patients admitted to ICU in Malaysia.

Conclusion

As a conclusion, the incidence of dialysis-requiring AKI was observed to be influenced by gender, stage of AKI, type, and length of ICU admission. Patients with AKI portended significant longer ICU stay were likely to add to the health-care burden. Prior knowledge of dialysis-requiring AKI would provide information to identify individuals at higher risk and on the other hand, provide the opportunity to clinicians for appropriate management of such patients in timely manners. Besides that, AKI also increases morbidity and possess financial burden to patients and the health-care system that is particularly important in resource-limited settings.

Acknowledgment

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