Journal of Biology and Today's World
Journal home page: http://journals.lexispublisher.com/jbtw

Received: 21 August 2016 • Accepted: 12 November 2016

Short C

doi:10.15412/J.JBTW.01060102

Acute Renal Failure in Patients Admitted to Intensive Care Unit

Farshid Rahimi-Bashar[1], Tahereh Peyrovi[1], Mohammadhossein Jarahzadeh[2*], Farzaneh Esna-Ashari[3]

[1] Department of Anesthesiology, School of Medicine, Hamadan University of Medical Sciences, Hamadan, Iran
[2] Department of Anesthesiology and Critical Care, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
[3] Department of Community Medicine, Hamadan University of Medical Sciences, Hamadan, Iran

*Correspondence should be addressed to Mohammadhossein Jarahzadeh, Department of Anesthesiology and Critical Care, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. Post code: 8915887857; Tel: +983538224101; Fax: +983538224100; Email: Drjarahzadehicm@gmail.com.

ABSTRACT

ARF is common in the setting of critical illness and is correlated with a high risk of mortality. The aim of this study was to determine the risk factors and short term outcome of Acute Renal Failure (ARF) in intensive care unit (ICU). This study was designed as an analytic cross-sectional study. First, 201 Patients who hospitalized in the ICU enrolled in this study. ARF was defined as a plasma creatinine levels according to Acute Kidney Injury Network (AKIN) criteria.The assessed risk factors of ARF were age, gender, Cause of hospitalization in the ICU, Imaging with Contrast agents, mechanical ventilation, antibiotic (aminoglycoside), diuretic, diabetes mellitus, hypertension, hypotension, and higher death risk by APACHE II score. Patients were followed until discharge or death. ARF developed in 8 % of the patients, with 43.8 % resulting in death. Acute renal failure was significantly associated with age > 50 years, receiving antibiotic, imaging with contrast agents, diabetes, hypertension, mechanical ventilation, and diuretic. ARF has a wide incidence and mortality when it occurs in ICU. There is a very close link with multiple organ dysfunction and hemodynamic status. Results of our study demonstrated that ARF developed in 8 % of the patients.

Key words: Acute renal failure (ARF), Intensive care unit, Prognostic factors, Risk factors, Mortality.

Journal of Biology and Today's World is published by *Lexis Publisher*; Journal p-ISSN 2476-5376; Journal e-ISSN 2322-3308.

1. INTRODUCTION

Acute renal failure (ARF) also known as acute kidney injury (1) refers to a clinical syndrome characterized by a rapid reduction in excretory function of renal, with the accumulation of products of nitrogen metabolism such as urea and creatinine and other waste products (2). ARF occurs in 20%-25% of patients admitted to the intensive care unit (ICU) and is related to adverse patient impacts and high health care costs (3-5). Although the existence of multiple organ dysfunction certainly contributes to the high mortality, ARF independently rises morbidity and mortality (6). In patients who are admitted in the ICU, 5%-30% will require long-term dialysis without renal recovery (7). Recent epidemiological researches demonstrate the great variation in etiologies and risk factors which cause the increased mortality associated with ARF (chiefly when dialysis is required) (8). The relative significance of factors contributing to ARF will be diverse depending on the pathology and patient characteristics (9). Although ARF is common in the setting of critical illness and is correlated with a high risk of mortality, little is known about its epidemiology and impact of how these differ in diverse regions of the world (10). Since the onset of AFR often is clinically silent, the investigation about ARF causes and risk factors is a challenge (11). Furthermore, AFR is a common and significant diagnostic and therapeutic challenge for clinicians (12). So, the aim of the present study was to evaluate the frequency of ARF among ICU patients, and to analyze the risk and prognostic factors of ARF and its effect on mortality. Analysis of a well-described subgroup of patients admitted to the ICU (e.g., patients after surgery or trauma patients) can display more exact information about the epidemiology and risk factors of ARF (9).

2. MATERIALS AND METHODS

We conducted this cross-sectional study on 201 patients that admitted in General intensive care unit of the Besat Hospital of Hamadan from 2013 to 2014. It was an epidemiological study to determine the frequency and risk factors of acute renal failure in these patients. We used

convenient method in sampling. The sample size was calculated by estimating a prevalence in the population formula with accepted error 0.05 and accepted differences 0.2.The inclusion criteriawere, at least 48-h in ICU, plasma creatinine levels according to Acute Kidney Injury Network (AKIN) criteria, older than 12 years old, and APACHE SCOREII less than 20. Patients with kidney failure before hospitalization in the ICU were excluded. We used the Acute Kidney Injury Network (AKIN) criteria for diagnosis of acute renal failure in hospitalized patients: The increased serum creatinine (SCr) levels using the AKIN criteria include three stages; Stage 1: ≥0.3-mg/dl increase or 50% increase over baseline within 48 h; Stage 2: ≥100% increase over baseline (doubling); Stage 3: ≥200% increase over baseline or 0.5-mg/dl increase to at least 4.0 mg/dl (13). Participants or their first degree family members signed the informed consent for data collection.The Acute Physiology and Chronic Health Evaluation (APACHE) II score was calculated using age, Laboratory findings (Hematocrit, WBC, rectal temperature, MAP (mean arterial blood pressure), heart rate, respiratory rate, serum sodium, serum potassium, oxygenation, PH blood, serum creatinine) and history of severe failure of vital organs (such as heart, liver, kidney). Patients with the APACHEII score higher than 20 were excluded. The assessed risk factors of ARF includeage, gender, Cause of hospitalization in the ICU, Imaging with Contrast agents, mechanical ventilation, Receiving antibiotic (aminoglycoside), receiving diuretic, diabetes mellitus, hypertension, hypotension, and higher death risk by APACHE II score. Patients were followed until discharge or death. Data were analyzed using SPSS-20 software. Proportion data were analyzed by the chi-square test. P-value < 0.05 considered statistically significant.

3. RESULTS AND DISCUSSION

Totally 201 patients were enrolled. The mean age of participants was 53.05 ± 8.67 years old (range: 16-86) and 37.3 % of participants were female. The participants were divided into two groups of younger than 50 years (77 patients) and older than 50 years (124 patients). ARF developed in 8 % of the patients, with 43.8 % resulting in death. About 185 patients did not develop acute renal failure and 13 patients (7%) without ARF died. Statistical and clinical Significance was shown between the occurrence of acute renal failure and mortality. Also, acute renal failure was significantly associated with age > 50 years, receiving antibiotic, imaging with contrast agents, diabetes, hypertension, mechanical ventilation, and receiving diuretic. Hypotensionand genderhad no significant association with occurrence of ARF (Table 1).

Table 1. Frequency of acute renal failure based on risk factors

Risk factors		With ARF, N (%)	P-value
Age(year)	> 50 y	15(12.1)	<0.05
	< 50 y	1(1.3)	
Gender	Male	13(10.3)	>0.05
	Female	3(4)	
Cause of hospitalization	Trauma	4(3.9)	<0.05
	Surgery	12(12.2)	
Antibiotic	Yes	15(25.4)	<0.05
	No	1(0.7)	
Imaging with Contrast agents	Yes	10(50)	<0.05
	No	6(0.7)	
Diabetes	Yes	12(70.6)	<0.05
	No	4(2.1)	
Hypertension	Yes	13(56.5)	<0.05
	No	3(1.7)	
Hypotension	Yes	3(9.7)	>0.05
	No	13(7.6)	
Mechanical ventilation	Yes	16(12.9)	<0.05
	No	0(0)	
receiving diuretic	Yes	11(52.4)	<0.05
	No	5(2.8)	
Chi-Square test			

Aim of our study was to determine the frequency, causes and outcome of ARF in Patients admitted to the ICU. The epidemiology and impact of ARF in critically ill patients in different areas of the world are not well understood. The prevalence and hospital mortality reported in researches have varied broadly (10). ICUs have seen arise in admissions involving AFR ranging from 13% up to 78% (14-17). Although Multiple organ failures contribute to wide mortality in patients with ARF and arepowerful predictors of death (6, 18, 19), AFRindependently is animportant risk factor for mortality and can be relatedto mortality greater than 50% (35). In our study ARF developed in 8 % of the patients, with 43.8 % resulting in death.Significant relationship was shown between the occurrence of acute renal failure and mortality. Many patient populations deserve special debate regarding their risks for developing AFR (20). Several risk factors have been identified for the development of AFR including hypotension, pulmonary disease, liver failure, hypertension, hypovolemia, sepsis, increased age, male gender, mechanical ventilation, and many medications (vasopressors, ACE inhibitors, aminoglycosides, NSAIDs, etc.) (21, 22). Patients with diabetes mellitus may be at high risk of developing ARF (23). In our study, acute renal failure was significantly associated with age > 50 years, receiving antibiotic, imaging with contrast agents, diabetes mellitus, hypertension, mechanical ventilation, and receiving diuretic. Hypotension and gender had no

significant association with occurrence of ARF. Most studies have blended surgical and nonsurgical populations (24). Data from surgical patientsdisplay a similar incidence of postoperative AFR generally ranging from 16.7%-30% (20). Trauma patients are younger than many other hospital populations, but as the median age of trauma patients rises, their incidence of AFR does not differ significantly from other ICU populations (24). Our study showed that the frequency of ARF in post-surgery patients was significantly higher than trauma patients. Incidence of contrast-induced AFR in ICU patients ranged 11.5%-19% (25, 26), and mortality 13.1%-35.9%, much lesser than reported in researches not involving intravenous contrast (20). In our study, 50 % of patient underlying imaging by contrast agents Suffered ARF, while in patients without imaging by contrast agents, the occurrence of ARF was significantly lower (0.7 %). Various studies have shown that taking diuretics increases the risk of acute renal failure. In our study, 52.4 % of patients treated with diuretics developed ARF, but 2.8 % of patients without receiving diuretics developed ARF. This difference was statistically significant. Numerous studies have shown older persons to be at anincreased risk for ARF (12), which is not unexpecteddue to kidney function decreases in the elderly.Result of our study also confirmed this finding.

4. CONCLUSION

ARF has a wide incidence and mortality when it occurs in ICU. There is a very close link with multiple organ dysfunction and hemodynamic status.Results of our study demonstrated that ARF developed in 8 % of the patients, with 43.8 % resulting in death. Acute renal failure was significantly associated with age > 50 years, receiving antibiotic, imaging with contrast agents, diabetes, hypertension, mechanical ventilation, and receiving diuretic.

ACKNOWLEDGMENT

Not mentioned any acknowledgment by authors.

FUNDING/SUPPORT

Not mentioned any Funding/Support by authors.

AUTHORS CONTRIBUTION

This work was carried out in collaboration among all authors.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this paper.

REFERENCES

1. Hsu C-Y, McCulloch C, Fan D, Ordonez J, Chertow G, Go A. Community-based incidence of acute renal failure. Kidney international. 2007;72(2):208-12.
2. Bellomo R, Kellum JA, Ronco C. Acute kidney injury. The Lancet. 2012;380(9843):756-66.
3. Moore E, Bellomo R, Nichol A. The meaning of acute kidney injury and its relevance to intensive care and anaesthesia. Anaesthesia and intensive care. 2012;40(6):929.
4. Ricci Z, Ronco C. Dose and efficiency of renal replacement therapy: continuous renal replacement therapy versus intermittent hemodialysis versus slow extended daily dialysis. Critical care medicine. 2008;36(4):S229-S37.
5. Geri G, Guillemet L, Dumas F, Charpentier J, Antona M, Lemiale V, et al. Acute kidney injury after out-of-hospital cardiac arrest: risk factors and prognosis in a large cohort. Intensive care medicine. 2015;41(7):1273-80.
6. Carl DE, Grossman C, Behnke M, Sessler CN, Gehr TW. Effect of timing of dialysis on mortality in critically ill, septic patients with acute renal failure. Hemodialysis International. 2010;14(1):11-7.
7. De Galasso L, Emma F, Picca S, Di Nardo M, Rossetti E, Guzzo I. Continuous renal replacement therapy in children: fluid overload does not always predict mortality. Pediatric Nephrology. 2016;31(4):651-9.
8. Mehta RL, Kellum JA, Shah SV, Molitoris BA, Ronco C, Warnock DG, et al. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. Critical care. 2007;11(2):R31.
9. Hoste EA, Lameire NH, Vanholder RC, Benoit DD, Decruyenaere JM, Colardyn FA. Acute renal failure in patients with sepsis in a surgical ICU: predictive factors, incidence, comorbidity, and outcome. Journal of the American Society of Nephrology. 2003;14(4):1022-30.
10. Uchino S, Kellum JA, Bellomo R, Doig GS, Morimatsu H, Morgera S, et al. Acute renal failure in critically ill patients: a multinational, multicenter study. Jama. 2005;294(7):813-8.
11. Xue JL, Daniels F, Star RA, Kimmel PL, Eggers PW, Molitoris BA, et al. Incidence and mortality of acute renal failure in Medicare beneficiaries, 1992 to 2001. Journal of the American Society of Nephrology. 2006;17(4):1135-42.
12. Liangos O, Wald R, O'Bell JW, Price L, Pereira BJ, Jaber BL. Epidemiology and outcomes of acute renal failure in hospitalized patients: a national survey. Clinical Journal of the American Society of Nephrology. 2006;1(1):43-51.
13. Waikar SS, Bonventre JV. Creatinine kinetics and the definition of acute kidney injury. Journal of the American Society of Nephrology. 2009;20(3):672-9.
14. Carbonell N, Blasco M, Sanjuan R, Garcia-Ramon R, Blanquer J, Carrasco A. Acute renal failure in critically ill patients. A prospective epidemiological study. Nefrologia: publicacion oficial de la Sociedad Espanola Nefrologia. 2003;24(1):47-53.
15. Bahloul M, Ben HC, Damak H, Kallel H, Ksibi H, Rekik N, et al. Incidence and prognosis of acute renal failure in the intensive care unit. Retrospective study of 216 cases. La Tunisie medicale. 2003;81(4):250-7.
16. Metnitz PG, Krenn CG, Steltzer H, Lang T, Ploder J, Lenz K, et al. Effect of acute renal failure requiring renal replacement therapy on outcome in critically ill patients. Critical care medicine. 2002;30(9):2051-8.
17. Paudel MS, Wig N, Mahajan S, Pandey RM, Guleria R, Sharma SK. A study of incidence of AKI in critically ill patients. Renal failure. 2012;34(10):1217-22.
18. Mehta RL, Pascual MT, Gruta CG, Zhuang S, Chertow GM, Group PS. Refining predictive models in critically ill patients with acute renal failure. Journal of the American Society of Nephrology. 2002;13(5):1350-7.
19. Boussekey N, Capron B, Delannoy P-Y, Devos P, Alfandari S, Chiche A, et al. Survival in critically ill patients with acute kidney injury treated with early hemodiafiltration. The International journal of artificial organs. 2012;35(12):1039-46.
20. Case J, Khan S, Khalid R, Khan A. Epidemiology of acute kidney injury in the intensive care unit. Critical care research and practice. 2013;2013.
21. Piccinni P, Cruz D, Gramaticopolo S, Garzotto F, Dal Santo M, Aneloni G, et al. Prospective multicenter study on epidemiology of acute kidney injury in the ICU: a critical care nephrology Italian collaborative effort (NEFROINT). Minerva anestesiologica. 2011;77(11):1072.
22. Yue J, Wu D, Li C, Zhai Q, Chen X, Ding S, et al. Use of the AKIN criteria to assess the incidence of acute renal injury, outcome and prognostic factors of ICU mortality in critically ill patients. Zhonghua yi xue za zhi. 2011;91(4):260-4.
23. Mou S, Wang Q, Liu J, Che X, Zhang M, Cao L, et al. Prevalence of non-diabetic renal disease in patients with type 2 diabetes. Diabetes research and clinical practice. 2010;87(3):354-9.
24. Seymour CW, Rea TD, Kahn JM, Walkey AJ, Yealy DM, Angus DC. Severe sepsis in pre-hospital emergency care: analysis of incidence, care, and outcome. American journal of respiratory and critical care medicine. 2012;186(12):1264-71.
25. Hoste EA, Doom S, De Waele J, Delrue LJ, Defreyne L, Benoit DD, et al. Epidemiology of contrast-associated acute kidney injury in ICU patients: a retrospective cohort analysis. Intensive care medicine. 2011;37(12):1921-31.
26. Chua H-R, Glassford N, Bellomo R. Acute kidney injury after cardiac arrest. Resuscitation. 2012;83(6):721-7.