

PROGNOSTIC FACTORS OF ACUTE RENAL FAILURE IN PATIENTS ADMITTED TO INTENSIVE CARE UNIT

Thaer Mohamed Alahmad^{*1}, Ibrahim Suliman² and Maissa Barakat³

¹Department of General Internal Medicine, Tishreen University, Faculty of Medicine, Lattakia, Syria.

²Department of Nephrology, Tishreen University, Faculty of Medicine, Lattakia, Syria.

³Department of Anesthesia, Tishreen University, Faculty of Medicine, Lattakia, Syria.

Received date: 11 November 2020

Revised date: 02 December 2020

Accepted date: 22 December 2020

*Corresponding author: Thaer Mohamed Alahmad

Department of General Internal Medicine, Tishreen University, Faculty of Medicine, Lattakia, Syria.

ABSTRACT

Background: Acute renal failure (ARF) has been recognized as common condition in patients admitted to intensive care unit (ICU) and it is associated with increased risk of morbidity and mortality. **Objective:** the present study aims to determine incidence, risk factors, and outcome of acute renal failure in patients admitted to ICU. **Materials and Methods:** This is prospective, observational study conducted in ICU in Tishreen University Hospital-Lattakia -Syria from November 2018 to December 2019. Patients aged 18 to 70 years were screened for ARF according to (RIFLE) criteria. **Results:** During study period, of 152 patients, 49 (32.2%) developed ARF. Independent predictors of ARF were age older of 65 year (OR=3.8 [1.9 – 7.8], p:0.008), presence of infection on admission (OR=3.3 [2.1–8.9], p:0.002), history of diabetes mellitus (OR=2.4 [1.1–4.9], p:0.001), MAP<65 (OR=4.1 [1.4–12.2], p:0.003) as well as hypertension (OR=5.4 [2.4 –11.8], p:0.001). The average length of stay in ICU for patients with ARF was longer than those without ARF (17.6 vs 10.5, p:0.002) with high rate of mortality (45% vs 22.3%, p:0.02). **Conclusion:** Acute renal failure in critically ill patients is associated with worsening prognosis, so identification risk factors of ARF and initiate preventive measures should be part of the management.

KEYWORDS: Acute renal failure, intensive care.

INTRODUCTION

Acute renal failure (ARF) is defined as sudden decrease in kidney function resulting in failure of kidney to eliminate nitrogenous waste products and maintain homeostasis of water and electrolytes.^[1] The two major causes of ARF that occurs in hospital are prerenal diseases and acute tubular necrosis (ATN).^[2]

ARF in intensive care unit (ICU) is common and is associated with significant morbidity and mortality that increase with progress degree of renal dysfunction.^[3] The incidence in ICU is increasing and reach up to 67%, variability of incidence is depending on population analyzed and criteria employed in definition ARF.^[4] The common causes of ARF in ICU are sepsis, cardiac surgery, malignancy, and acute liver failure.^[5] Early diagnosis of ARF and prompt management is essential to reduce mortality that can reach up to 50%.^[6,7] The absence of local studies prompted us to carry out this research to identify risk factors associated with ARF.

MATERIALS AND METHODS

Study design and data collection

We prospectively studied patients aged 18 to 70 years admitted to the ICU in Tishreen University Hospital – Lattakia-Syria from November 2018 to December 2019. Patients with one of the following: evidence of preexisting CKD stage III or IV, need for renal replacement therapy, and those who had renal transplantation were excluded.

Demographic data including age, sex and related to comorbidities were recorded. All patients were screened for ARF by using serum creatinine, urea, sodium, in addition to urine output measurement. The outcomes at discharge including mortality were also recorded.

Definitions

Acute renal failure: We used RIFLE criteria for diagnosis acute renal failure in ICU. RIFLE criteria defines failure as a three- fold increase of serum creatinine or serum creatinine >4 mg/dl or decrease in GFR of >75%.^[8]

Mean arterial Pressure(MAP): is defined as the average pressure in patient's arteries during cardiac cycle, normal range is(65-110 mmHg).^[9]

Outcome: Recovery was recorded once creatinine improved to known baseline. Chronic kidney disease defined as renal function had not recovered during 3 months. Statistical Analysis Statistical analysis was performed by using IBM SPSS version20. Basic Descriptive statistics included means, standard deviations(SD), Frequency and percentages.

Differences of distribution examined using chi- square test or Fisher exact test if it need. Risk factors were evaluated in univariate analysis, and in multivariate analysis by a multiple logistic stepwise regression procedure. Variables with p less than 0.05 were included in the model. Odd ratios were estimated from b

coefficients obtained, with respective 95% confidence intervals(CI 95%).

RESULTS

A total of 152 patients were admitted to our ICU from November 2018 to December 2019, 49 patients (32.2%) developed ARF during their stay in ICU. The baseline characteristics of patients are as given in table(1).

Patients who developed ARF were older(median age 69 vs 55 years, p:0.002),with significant difference between both sexes(p:0.01).They are more likely to have infection on admission(28.6% vs 10.7%, p:0.02).

Diabetes mellitus, hypertension, and renal disease were more common in patients with ARF (p<0.001).

Table 1: Demographic characteristics of the study population by comparison of ARF and non-ARF groups.

Variables	ARF- patients n=49(32.2%)	Non-ARF patients n=103(67.8%)	p-value
Age(year)	69 [34 - 70]	55 [18 - 70]	0.002
<u>Sex</u>			
Male	21(42.9%)	66(64.1%)	0.01
Female	28(57.1%)	37(35.9%)	
<u>Causes of admission</u>			
Pulmonary	5(10.2%)	11(10.7%)	0.9
Cardiac disease	2(4.1%)	12(11.7%)	0.3
Cancer Infection	2(4.1%)	8(7.8%)	0.1
Neurological	14(28.6%)	11(10.7%)	0.02
Renal disease	16(32.7%)	42(40.8%)	0.1
Gastrointestinal	8(16.3%)	6(5.8%)	0.04
Others	2(4.1%)	4(3.9%)	0.4
	0(0%)	8(7.8%)	0.09
<u>Co=morbidities</u>			
Diabetes mellitus	22(44.9%)	26(25.2%)	0.01
Hypertension	38(77.6%)	40(38.8%)	0.0001
Hyperuricemia	0(0%)	4(3.9%)	0.1
Systemic diseases	3(6.1%)	1(1%)	0.06
Renal diseases	6(12.2%)	2(1.9%)	0.008
Others	18(36.7%)	36(35%)	0.8
MAP	77.02±21.8[37 -113]	91.6±17.6 [40-147]	0.001
<u>Laboratory findings</u>			
Urea	82.7±48.7	53.6±46.3	0.001
Cr	2.5±1.9	1.3±1.8	0.001
Na	138.6±5.7	136.7±4.1	0.03
Length of ICU stay(days)	17.6[2 - 130]	10.5[1 - 45]	0.02
<u>Outcome</u>			
Recovery	30(61.2%)	88(85.4%)	0.03
Chronic disease	6(12.2%)	0(0%)	0.008
Hospital mortality	22(44.9%)	23(22.3%)	0.02

Stay in the ICU was longer in patients with ARF (17.6 vs10.5 day in patients without ARF, p:0.02), and mortality rate was higher in patients with ARF(44.9% vs22.3%, p:0.02) .

Table 2: Risk factors for developing ARF in study population by multivariate logistic regression.

Factor	OR(95% CI)	p-value
Age>65	3.8 [1.9 – 7.8]	0.008
Hypertension	5.4 [2.4 – 11.8]	0.0001
MAP<65	4.1 [1.4 – 12.2]	0.003
Infection at admission	3.3 [2.1 – 8.9]	0.002
Diabetes mellitus	2.4 [1.1 – 4.9]	0.001

Significant independent risk factors for developing ARF were: Age>65, infection on admission, history of

diabetes mellitus, hypertension and MAP<65 Fig.1.

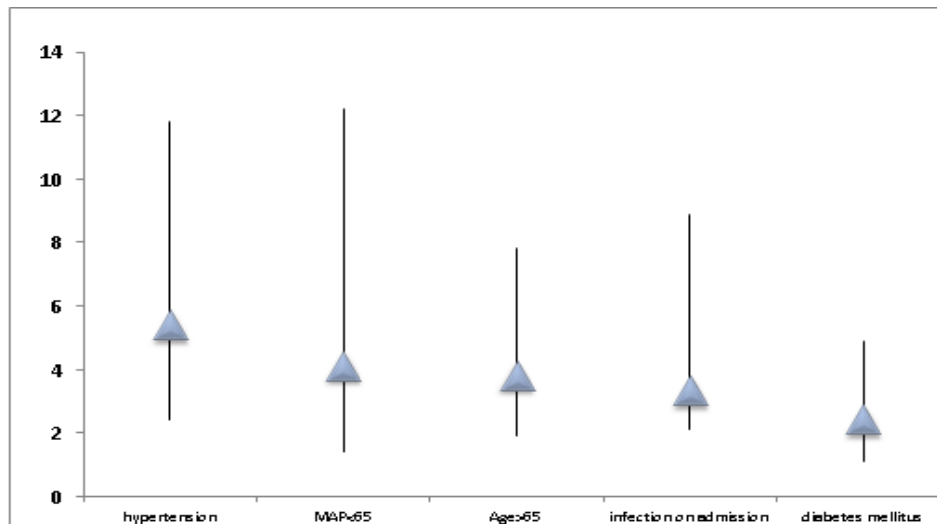


Figure 1: Risk factors for developing ARF in study population.

DISCUSSION

This prospective study demonstrated incidence, characteristics, and predictive risk factors of ARF in patients aged 18-70 years admitted to ICU. The overall incidence of ARF (32.2%) in our study was comparable with previous studies. Vincent *et al* reported that the incidence of ARF in ICU was 24.7%^[10], Zahra *et al* also found that incidence of ARF in ICU was 31.1% in Iran.^[11] In contrast to that, Vohra *et al* found that incidence of ARF in ICU in India was low(3.8%)^[12], and this may be explained by the difference of criteria used for definition of ARF in the different studies.

ARF was more frequently in patients with infection on admission and co-morbid conditions such as diabetes mellitus and hypertension, these findings agree with results of other studies. Herrera *et al* found that ARF was more frequently in patients with diabetes mellitus, high blood pressure, and sepsis on admission.^[13] Sherif *et al.*, 2017 also found that patients with ARF had co-morbidities such as diabetes mellitus and CVD, in addition to that sepsis was more common in those patients.^[14]

In the present study, the most important risk factors for ARF were: advanced age, presence of infection on admission, hypertension, MAP<65, and diabetes mellitus, and those have been reported as risk factors in other studies (Vincent *et al.*, 2000) and(Ryan *et al.*,

2019).^[15]

Mortality rate was higher in patients with ARF than those without ARF(45% vs 22%), and this is comparable with other studies. Vincent *et al* found that ICU mortality was 43% in patients with ARF.

To the best of our knowledge, this is the first study investigate epidemiology, and prognostic factors for ARF in patients admitted to ICU in Syria.

CONCLUSION

ARF is a common complication in patients admitted to ICU and is associated with substantial morbidity, mortality in addition to high medical costs, so that early diagnosis is essential to improve prognosis.

List of abbreviations

ARF: acute renal failure, ICU: intensive care unit, MAP: Mean arterial pressure, RIFLE: Risk, Injury, Failure, Loss, End-stage Renal Disease, CVD: cardiovascular diseases.

ACKNOWLEDGEMENTS

We would like to thank all doctors in Nephrology department for assistance, and special thanks to Eyad Elhatoom, MD. Specialist of Anesthesiology & Critical care medicine, Chief of ICU Department Tishreen

University Hospital.

REFERENCES

1. Schrier RW, Wang W, Poole B, Mitra A. Acute renal failure: definitions, diagnosis, pathogenesis, and therapy. *J Clin Invest*, 2004; 114(1): 5-14.
2. Lameire N, Van Biesen W, Vanholder R. Acute renal failure. *Lancet*, 2005; 365(9457): 417-30.
3. Uchino S, Kellum JA, Bellomo R. Acute renal failure in critically ill patients: a multinational, multicenter study. *JAMA*, 2005; 294(7): 813-8.
4. Hoste EA, Clermont G, Kersten A. RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill patients: a cohort analysis. *Crit Care*, 2006; 10(3): R73.
5. Benjamin R. Griffin, Kathleen D. Liu, and J. Pedro Teixeira. *Critical Care Nephrology: Am J Kidney Dis*, 2020. 75(3): 435-452. doi:10.1053/j.ajkd.2019.10.010.
6. Wang HE, Muntner P, Chertow GM, Warnock D. Acute kidney injury and mortality in hospitalized patients. *Am J Nephrol*, 2012; 35(4): 349-55.
7. Herrera-Gutierrez ME, Sellar-Perez G, Maynar-Moliner J. Prevalence of acute kidney injury in intensive care units. *J Crit Care*, 2013; (28): 687-94.
8. Ricci Z, Cruz D, Ronco C. The RIFLE criteria and mortality in acute kidney injury: a systemic review. *kidney Int*, 2008; (73): 538-546.
9. Pocock G, Richards CD. *The human body; An introduction for the biomedical and health science*. 1st ed. New York: Oxford University Press Inc, 2009.
10. J. L. Vincent, A. de Mendonca, P. M. Suter, R. Moreno, F. Cantraine. Acute renal failure in the ICU: risk factors and outcome evaluated by the SOFA score. *Intensive Care Med*, 2000; (26): 915-921.
11. Zahra Najmi, Hamid Reza Samimigham, Soudabeh Kheirkhah, Anousheh Haghighi. Acute Kidney Injury in intensive care unit: Incidence, Risk factors and Mortality Rate. *Saudi J Kidney Dis Transpl*, 2011; 22(3): 464-470.
12. R Vohra, J Prakash, AS Murthy, SK Mathur. Acute Renal Failure in the Intensive Care Unit. *Journal of the Association of Physicians of India*, 2006; 54: 784-88.
13. J. Herrera-Mendez, L. D. Sanchez-Velazquez, A. Gonzalez-Chavez, G. Rodriguez- Teran. Incidence of the acute renal failure in the intensive care unit at the General Hospital of Mexico: Risk factors and associated morbidity and mortality. *Rev Med Hosp Gen Mex*, 2015; 78(2): 62-66.
14. Sherif Abdelmonem, Samar Abd Elhafeez, Mohamed Abdelhady, Matthew James. Risk, Predictors, and outcomes of acute kidney injury in patients admitted to intensive care units in Egypt. *Scientific Reports* 7:17163(2017)/DOI:10.1038/S41598-017-17264-7.
15. Ryan E Aylward, Elizabeth van der Merwe, Sisa

Pazi, Minette van Niekerk, Jason Ensor. Risk factors and outcomes of acute kidney injury in South African critically ill adults: *BMC Nephrology*, 2019; 20-460.