ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Outcomes in Acute Kidney Injury: Observation from a Tertiary Care Hospital

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Manuscript Info

Manuscript History:

Received: 17 August 2015
Final Accepted: 26 September 2015
Published Online: October 2015

Key words:

acute kidney injury, RIFLE, dialysis, sepsis, mortality

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Abstract

Background: Acute kidney injury is a rapid decline in glomerular filtration rate that has important implications on the morbidity and mortality of hospitalized patients. **Aims and objectives**: To evaluate the outcome of acute kidney injury in patients admitted in a tertiary care hospital. **Materials and Methods**: It was prospective study conducted over a period of two years. Patients admitted to the hospital with acute kidney injury were classified as per RIFLE classification and outcomes were studied. **Results**: among a total of 150 patients studied, 39 patients were in class risk(R) of AKI, 36(92.3%) improved, 2(5.1%) expired, 1(2.6%) had loss of function. 47 patients were in class injury, out of which 30(63.8%) improved, 11(23.4%) expired, 4(8.5%) had loss of function and 2(4.3%) progressed to ESRD. 64 patients were in class failure, out of which 8(12.5%) improved, 31(48.4%) expired, 20(31.3%) had loss of function and 5(7.8%) progressed to ESRD. **Conclusion:** Acute kidney injury has significant morbidity and mortality despite advances in medical care especially in crictical care settings. Class of RIFLE is predictive of outcome in AKI patients, with higher class associated with higher mortality and progression to end stage renal disease.

INTRODUCTION

Acute Kidney Injury (AKI) is a rapid reduction in kidney function causing a failure to maintain fluid, electrolyte and acid-base homoeostasis. It has been difficult to determine the epidemiology and outcomes of AKI due to many different definitions of AKI used previously. Small increaments in creatinine are associated with worse outcomes in a variety of different conditions, an observation made over recent years.[1] The term Acute Renal Failure (ARF) is used for subset of patients with an acute need for dialysis support.

Incidence of AKI is less frequent in the community (0.4% to 0.9%) compared to hospitalized patients (4.9% to 7.2%).[2,3] The incidence of AKI rises sharply with the number and severity of comorbidities, occurring in a rate around 20% to 40% in Intensive Care Units (ICU) and around 1% to 7% in intermediate care units.[4,5]

In critically ill patients, acute kidney injury is a common and serious complication. Despite advances in medical care the mortality related to AKI remains high.[6,7]. Uncomplicated AKI patients have mortality of around 10%, whereas patients with AKI and multi-organ failure, mortality above 50% have been reported.[6,8]

In critically ill patients several risk factors have been associated with increased hospital mortality. Use of vasopressors, mechanical ventilation, septic shock, multi-organ dysfunction, hepatorenal syndrome, cardiogenic shock and advanced age were main risk factors identified. [9,10]

Material and methods

It was a prospective study conducted over a 2 year period. Adult patients admitted to the tertiary care hospital with a wide variety of medical and surgical disorders were included after taking proper consent. Patients with acute kidney injury were classified on the basis of RIFLE classification. We studied 150 patients of acute kidney injury in the tertiary care hospital during the study period. Patients < 12 years of age, end stage renal disease (ESRD) or on chronic dialysis were excluded.

We classified patients according to the maximum RIFLE class (class R, Class I or Class F) reached during their hospital stay.We evaluated the outcome classes of RIFLE (Loss L and End stage renal disease E). To classify patients according to one of the RIFLE criteria, peak and baseline serum creatinine were seen. Patients who met any of the criteria of the RIFLE classification were classified as acute kidney injury patients. The peak serum creatinine was defined as the highest creatinine during their hospital stay. The baseline creatinine was defined by two ways, for patients without a baseline serum creatinine value, we assumed baseline serum creatinine as the lowest serum creatinine value. For patients for whom we had the previous creatinine data, the baseline creatinine was defined as that only.

RIFLE Criteria.

	GFR criteria	Urine output criteria
Risk	Increased creatinine x 1.5 or GFR decrease > 25%	UO < 0.5ml/kg/hr x 6 hr.
Injury	Increase creatinine x 2 or GFR decrease > 50%	UO < 0.5 ml/kg/hr x 12 hr.
Failure	Increased Creatinine x 3 or GFR decrease >75%	UO < 0.3 ml/kg/hr x 24 hr. or Anuria x 12 hr.
Loss	Persistent ARF = complete loss of kidney function >4 weeks	
ESRD	End Stage Kidney disease (> 3 months)	

GFR: glomerular filtration rate, ARF : Acute renal failure, UO : Urine output, ESRD : End stage renal disease.

Meticulous history, clinical examination and laboratory investigations were carried out in all patients. Data were collected from the patients during their hospital stay. Important data were recorded regarding exposure to nephrotoxic drugs, baseline serum creatinine, type of dialytic support instituted, ventilator and vasopressor support, comorbid conditions,input and output.

Necessary investigations included complete blood count, kidney function tests, liver function tests, blood glucose, arterial blood gas analysis, urine examination.radiological tests including X-ray chest, ultrasonography abdomen. Urine culture,blood cultures, coagulation profile were done, if required. Patients who needed dialysis were dialysed either by peritoneal dialysis or intermittent hemodialysis, depending upon the clinical status of the patients.

The primary outcome of this study was the hospital mortality and progression to end stage renal disease according to the RIFLE classification (class R, Class I, class F,class L,class E). The secondary outcomes were length of hospital stay and the need for renal replacement therapy.

For quantitative data mean, standard deviation and t – test were used to compare the two groups of survivors and non survivors. X2 test was applied for qualitative data and Z test was applied to compare the two proportions. Multinomial logistic analysis was performed on the various parameters in both survivors and non survivors.

RESULTS

Out of 150 patients of acute kidney injury in our study, 66(44%) were females and 84(56%) were males. The age range was 18-80 years, with a mean of 45.5±15.4 years. The etiologies of acute kidney injury were septic AKI in 25 (16.7%) patients, ischemic AKI in 44(29.3%) patients, nephrotoxic AKI in 32(21.3%) patients, glomerular disease in 21(14%) patients, renal vasculitis in 12(8%) patients and miscellaneous causes in 16(10.7%) patients. In a total of 150 patients, 39 patients were in class risk(R) of AKI, 36(92.3%) improved, 2(5.1%) expired, 1(2.6%) had loss of function. 47 patients were in class injury, out of which 30(63.8%) improved, 11(23.4%) expired, 4(8.5%) had loss of function and 2(4.3%) progressed to ESRD. 64 patients were in class failure, out of which 8(12.5%) improved, 31(48.4%) expired, 20(31.3%) had loss of function and 5(7.8%) progressed to ESRD. So, RIFLE class of acute kidney injury and outcome were statistically significant (p = 0.000) as shown in Table 1.

Table 1. Outcome in relation with class of RIFLE

			Outcome				
			Improved	Expired	Loss of function	ESRD	Total
Stage	Risk	Count	36	2	1	0	39
		% within Stage	92.3%	5.1%	2.6%	.0%	100.0%
	Injury	Count	30	11	4	2	47
		% within Stage	63.8%	23.4%	8.5%	4.3%	100.0%
	Failure	Count	8	31	20	5	64
		% within Stage	12.5%	48.4%	31.3%	7.8%	100.0%
Total		Count	74	44	25	7	150
		% within Stage	49.3%	29.3%	16.7%	4.7%	100.0%

In 84 male patients, 41 (48.8%) improved, 31(36.9%) expired, 11(13.1%) had loss of function and 1(1.2%) progressed to ESRD. Out of 66 female patients, 33(50.0%) improved, 13 (19.7%) expired, 14(21.2%) had loss of function and 7 (4.7%) progressed to ESRD.

Sepsis-AKI was present in 25 patients, 2(8%) improved, 19(76%) expired, 2(8%) had loss of function and 2(8%) progressed to ESRD. Ischemic AKI was present in 44 patients, out of which 19(43.2.0%) improved, 17(38.60%) expired, 5(11.4%) had loss of function and 3(6.8%) progressed to ESRD. Nephrotoxic AKI was present in 32 patients, out of which 29(90.6.0%) improved, 3(9.4%) had loss of function. Renal vasculitis was present in 12 patients, out of which 2 (16.7%) improved, 1(8.3%) expired, 8 (66.7%) had loss of function and 1 (8.3%) progressed to ESRD. Miscellaneous causes were found in 16 (%), out of which 5(31.3%) improved, 6 (37.5%) expired, 5 (31.3%) had loss of function. So etiology of acute kidney injury and outcome were statistically significant (P=0.00).

Nephrotoxic drug exposure was present in 31 patients, 27(87.1%) improved and 4(12.9%) had loss of function. Nephrotoxic drug exposure was absent in 119 patients, out of which 47(39.5%) improved, 44 (37%) expired, 21 (17.6%) had loss of function and 7 (5.9%) progressed to ESRD. So nephrotoxic drug exposure had no significant effect on the outcome of acute kidney injury ($p = 0.10$).

Out of 150 patients, 11 patients were on mechanical ventilation, 11(100%) expired. 139 patients were not on mechanical ventilation, out of which 74(53.2%) patients improved, 33(23.7%) patients expired, 25(18%) patients had loss of function and 7(5%) progressed to ESRD. So need for mechanical ventilation was statistically significant on the outcome of patients with acute kidney injury (p = 0.000).

Renal replacement therapy was instituted in 53 patients, 37 received peritoneal dialysis, 7 hemodialysis and 9 received both. out of 53 patients who received dialysis, 9 (16.98%) patients improved, 24 (45.28%) patients expired, 17 (32.07%) patients had loss of function and 3 (5.66%) patients progressed to ESRD. 97 patients had not received dialysis, out of which 65 (67.0%) improved, 20 (20.6%) expired, 8 (8.2%) had loss of function and 4 (4.1%) progressed to ESRD. So need for dialysis and outcome were statistically significant (P = 0.000).

Vassopressor support was required in 56 patients, with 26 on dopamine, 3 on nor-adrenaline and 27 on dual support. out of 56 patients on pressor support, 13 (23.21%) patients improved, 32 (57.14%) patients expired, 6 (10.71%) patients had loss of function and 5 (8.92%) patients progressed to ESRD. 94 patients had not received any pressor support, out of which 61 (64.89%) improved, 12(12.76%) expired, 19(20.21%) had loss of function and 2(2.12%) progressed to ESRD. So need for vassopressor support and outcome were statistically significant (P = 0.000)

DISCUSSION

According to RIFLE classification, 26% patients were in class risk, 31.3% in class injury & 42.7% in class failure in our study, which is consistent with the study of Dinna N Cruz et al.,[11] who also reported 19%, 35% & 46% in class risk, class injury & class failure respectively. It is also consistent with the study of Hoste et al[6].

In our study, etiology of acute kidney injury were ischemic - AKI (29.3%), sepsis AKI (16.7%), Nephrotoxic AKI (21.3%), Renal vasculitis (8%), Glomerular disease (14%) and miscellaneous causes in(10.7%) patients. Ischemic AKI is the most common cause of AKI (29.3%) patients which in contrast to J. Prakash et al[12] who found sepsis as a leading cause of acute kidney injury in 69.5% patients. The reason for this disparity is that J.Prakash et al found sepsis as a leading cause of AKI in ICU patients.

Patients with acute kidney injury had hospital motality rate of 29.33% in our study, which is consistent with the study of Woo Young et al[13] who reported hospital mortality of 25.7%. de, Mondonca A et al[14] reported hospital mortality rate of 42% in ICU patients.

The need for vasopressor support had significant effect on the outcome of patients with acute kidney injury in our study. Patients with vasopressor support had mortality rate of 57.14% compared to mortality rate of 12.76% in patients who had no need of vasopressor support. This is consistent with the study of Uchino et al.,[14] who also found that need for vasopressors increased the mortality of patients with acute renal failure.

Exposure to nephrotoxic drugs and outcome of acute kidney injury in our study has no significant effect, with a mortality rate of zero in those with history of nephrotoxic drug exposure, compared to 37% in those without any exposure to nephrotoxic drugs. This lower mortality risk in patients with exposure to nephrotoxic drugs in our study is consistent with the study of Dinna N cruz et al[11] who also found that nephrotoxic drug exposure to patients with acute kidney injury had low mortality.

In our study, patients with maximum RIFLE class risk (R), class injury (I) and class failure (F) had hospital mortality rate of 5.1%, 23.4% and 48.4% respectively. This is consistent with the study of Dinna N Cruz et al[11] who found hospital mortality rate of 20%, 29.3% and 49.5% for RIFLE class risk, class injury and class failure respectively in patients of acute kidney injury, except for lower mortality in class risk(R).The RIFLE class of acute kidney injury had significant effect on outcome in our study. Patient with RIFLE class Risk (R) has lower mortality rate compared to class Injury (I), which in turn has low mortality rate as compared to class Failure (F), which is consistent with the studies of Osterman et al.[15], Dinna N Cruz et al[11], Abo Saif NY et al[16], Bagshaw et al[17], Hoste et al[6]. Uchino et al[15] reported that there was an almost linear increase in hospital mortality rate with increasing RIFLE class, with patients in the risk group having a mortality rate more than three times higher than that of patients without AKI.

CONCLUSION

Acute kidney injury has significant morbidity and mortality despite advances in medical care especially in crictical care settings. Class of RIFLE is predictive of outcome in AKI patients, with higher class associated with higher mortality and progression to end stage renal disease.. Patients requiring mechanical ventilation and vasopressor support had significant effect on mortality in our study.

Source of support – Nil
Conflict of interest – Not declared

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