

Study of incidence of acute renal failure and its associated factors and complications amongst patients admitted in intensive care unit of a tertiary care teaching hospital

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Abstract

Background: Impairment of renal function is a serious complication in critically ill patients. Mortality of acute renal failure remains high ranging from 35% to 86% despite haemodialysis therapy and substantial improvement of dialysis techniques. Therefore attention must be paid to the conditions favouring deterioration of renal function in order to prevent acute renal failure or to intervene in an early phase when less invasive therapies might be even more promising. **Methods:** This prospective study was conducted in a tertiary care teaching hospital in Mumbai from 1st January 2006 to 31st December 2006. All patients consecutively admitted in intensive care unit were studied. **Results:** Total number of patients admitted during the said period to the Intensive care Unit was 406, of which 50 had evidence of acute renal failure. The incidence of acute renal failure in the critically ill patients included in our study was 12.31%. There was a statistically significant difference in the incidence of fluid overload, oliguria and hyperkalemia between the pre-renal and renal failure groups. **Conclusion:** The incidence of acute renal failure in the critically ill patients was 12.31% and commonest predisposing factors associated with acute renal failure were acute insults like hypotension, sepsis and risk factors like age >50 years and pre-existing renal disease.

Key Words: Acute Renal Failure, Intensive Care Unit, Tertiary Teaching Hospital, Incidence

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INTRODUCTION

“Bones can break, muscles can atrophy, glands can loaf, Even the brain can go to sleep, without immediately Endangering our survival, but should the

Kidneys.....neither bone, muscle, neither gland nor brain could carry on”.----- Idem

Acute renal failure (ARF) can be broadly defined as a rapid deterioration of renal function resulting in the accumulation of nitrogenous wastes such as urea and creatinine.^[1] In some clinical settings such as intensive care units, acute renal failure occurs in up to 30% of patients. Development of acute renal failure increases the likelihood of a fatal outcome by eightfold in hospitalized patients. An early diagnosis and prompt therapy is essential in view of the high frequency and mortality.^[2] Impairment of renal function is a serious complication in critically ill patients. Mortality of acute renal failure remains high ranging from 35% to 86% despite haemodialysis therapy and substantial improvement of dialysis techniques. Therefore attention must be paid to

the conditions favouring deterioration of renal function in order to prevent acute renal failure or to intervene in an early phase when less invasive therapies might be even more promising.^[3] Critically ill patients in intensive care units are more likely to develop acute renal failure and to die than patients outside those units, probably because of more severe underlying disease. The outcome of these patients is largely dependent on factors predisposing to acuter renal failure, even though the severity and complications of acute renal failure may partly contribute.^[4] Knowledge of these predisposing factors including hypotension, sepsis, dehydration, age, hypertension, diabetes, pre-existing renal disease as well as Complicating factors like severity of the underlying illness and number of organ system failures is important in efforts to improve prognosis. The present study was attempts to study the incidence, predisposing factors, complications and management of renal failure in critically ill patients as well as correlate the outcome with the severity of illness and with renal replacement therapy.

MATERIALS AND METHODS

This prospective study was conducted in a tertiary care teaching hospital in Mumbai from 1st January 2006 to 31st December 2006. All patients consecutively admitted in

intensive care unit (ICU) were studied. Patients who were brought dead on admission and those who expired within two hours of admission were excluded from the study. The end point of the study was either recovery from illness or death of the Patient or transfer out of the patient from the ICU. The data of the patients included name, age, sex, a detailed history, clinical examination findings, clinical diagnosis, serum blood urea nitrogen, serum creatinine levels, serum sodium, potassium, calcium, inorganic phosphorous, uric acid, routine urine examination, number of organ system failures other than renal, predisposing factors including acute insults like hypotension, sepsis, dehydration and risk factors like age, hypertension, diabetes, pre-existing renal disease; complications like fluid overload, metabolic acidosis, oliguria, uraemic encephalopathy; management including conservative and hemodialysis lastly the outcome of these patients. Criteria for acute renal failure included a reduction in renal function with a rise in serum creatinine concentration of more than 0.5 mg/dl in patients with a baseline creatinine of less than 1.5 mg/dl. Acute renal failure in this group was defined as a rise in creatinine of 1mg/dl or greater.

RESULTS

Table 1: Bio-social characteristics of study population

Particulars	Number	Percentage
Total no. of Patients	406	100%
Incidence of ARF patients	50/406	12.3%
Age (in yrs)		
12 – 20 yrs	05	10.0 %
21 – 50 yrs	29	58.0%
>50 yrs	16	32.0 %
Gender		
Male	33	66.0%
Female	17	34.0%
Type of ARF		
Pre-renal failure	06	12.0%
Renal failure	43	86.0%
Post-renal failure	01	02.0%

It was seen from Table 1 that total number of patients admitted during the said period to the Intensive care Unit was 406. Out of which 50 had evidence of acute renal failure. There were 66% males and 34% females in this study population. There were 58% patients in the age group of 21-50 years followed by 32% in the age group of >50 yrs.

Table 2: Predisposing factors of acute renal failure in study population

Predisposing factors	Pre-renal (n=6)	Renal (n=43)	Post-renal (n=1)
Hypotension	03(50%)	18 (41.86%)	01 (100%)
Sepsis	03 (50%)	30 (69.76%)	01 (100%)
Dehydration	02 (33.33%)	12 (27.90%)	-
Nephrotoxic drugs	-	-	-
Radiocontrast dye exposure	-	-	-
Hemoglobinuria/ Myoglobinuria	-	-	-

	Age (> 50 yrs)	-	10 (23.25%)	-
	Hypertension	-	09 (20.93%)	-
	Diabetics	-	03 (6.97%)	-
Risk factors	Pre-existing renal disease	-	02 (4.65%)	01 (100%)
	Hyperuricemia/ Gout	-	-	-
	Long term diuretic administration	-	-	-

It was seen from Table 2 that there was no statistically significant difference in the incidence of hypotension, sepsis and dehydration between the pre-renal and renal failure groups. The observed difference being less than twice the standard error of difference between two proportions in each cases. However, there was a statistically significant difference in the incidence of age being more than 50, between the two groups. The observed difference being 23.25%, which is more than twice the standard error of difference between two proportions.

Table 3: Complications of acute renal failure among study population

Complications	Pre-renal (n=6)	Renal (n=43)	Post-renal (n=1)
Fluid overload	-	12 (27.90%)	-
Oliguria	02 (33.33%)	22 (51.16%)	01 (100%)
Hyperkalemia	01 (16.66%)	20 (46.51%)	01 (100%)
Metabolic acidosis	01 (16.66%)	29 (67.44%)	01 (100%)
Uraemic encephalopathy	-	06 (13.95%)	-
Pericardial infusion	-	-	-

It was seen from Table 3 that there was a statistically significant difference in the incidence of fluid overload, oliguria and hyperkalemia between the pre-renal and renal failure groups. Also, there was a grossly apparent difference seen in the incidence of uraemic encephalopathy in the two groups. However, since no patient in the pre-renal group had uraemic encephalopathy. There was no statistically significant difference in the incidence of metabolic acidosis in the two groups.

DISCUSSION

Renal involvement is common, especially among critically ill patients admitted in intensive care units and is associated with a high mortality rate inspite of technical advance in renal replacement therapy and supportive care over the past decades.⁸⁻¹¹ The present study was aimed at studying the incidence, predisposing factors and complications of acute renal failure in critically ill patients. We also studied the number of organ system failures and correlated it with the outcome. A study of various urinary abnormalities in these patients and their correlation with the outcome was done. The outcome of acute renal failure in critically ill patients was studied in relation to predisposing factors, complications, individual organ system failures, the nature of illness of the patients and biochemical parameters. The outcome of acute renal failure in critically ill patients was correlated with the severity of the renal failure. We also studied the management of critically ill patients with acute renal failure and correlated the outcome with renal replacement therapy. Out of 406 consecutively admitted patients, 50 were found to have evidence of acute renal failure with an incidence of 12.31%. A similar study by Groeneveld *et al*¹² on critically ill patients admitted to a medical intensive care unit showed an incidence of acute renal insufficiency of 16%. Another study by Mehta *et al*¹³ on critically ill patients admitted to medical-surgical intensive care unit showed an incidence of acute renal

failure of 14.9%. The maximum incidence of acute renal failure in our study was found in the 21-50 year age group, out of which there was a male predominance. In a study by Ramussen *et al*¹⁴ on multivariate analysis of causes and risk factors of acute renal failure, the mean age of patients included in the study was 58 years with a range from 16 to 88 years. The above discrepancy in the mean age of patients with acute renal failure in our study and the other study could be because of predominantly elderly admissions in the western studies. We classified the critically ill patients with acute renal failure into 3 types depending upon the type of renal involvement as follows: Pre-renal, intrinsic renal and post-renal (obstructive) failure. The predominant type of renal failure among critically ill patients in our study was that of intrinsic acute renal failure with an incidence of 86%. The most common predisposing factors leading to acute renal failure among critically ill patients in our study were acute insults like hypotension, sepsis, dehydration and risk factors like age more than 50 years, hypertension, diabetes and pre-existing renal disease. Though we did not find a statistically significant difference in the incidence of hypotension, sepsis and dehydration between the pre-renal and intrinsic renal failure groups, we did find age more than 50 years a statistically significant. In the study conducted by Groeneveld *et al*¹² advancing age, prior chronic disease, cardiovascular failure and sepsis were directly related to the development of acute renal

failure. Another study conducted by Mehta *et al*¹³ revealed four risk factors for acute renal insufficiency in critically ill patients, namely hypotension, sepsis, Aminoglycoside antibiotics and radio contrast dye; present alone or in combination. The common complications of acute renal failure in critically ill patients in our study were fluid overload, oliguria, hyperkalemia, metabolic acidosis and uraemic encephalopathy. We found a higher incidence of fluid overload, oliguria, and hyperkalemia in the intrinsic renal failure group as compared to the pre-renal failure group. There was no statistically significant difference in the incidence of metabolic acidosis in the two groups. Uraemic encephalopathy was found to be a complicating factor only in the intrinsic renal failure (13.95%). We also found an increase in the number of other organ system failures compared on Day 1 and the day of expiry among those who expired. This was statistically significant in both the renal and post-renal failure groups. The study conducted by Groeneveld *et al*¹² also showed increased mortality with a rising number of organ system failures among critically ill patients with acute failure. We found a statistically significant increase in the incidence of fluid overload, oliguria, hyperkalemia, metabolic acidosis and uraemic encephalopathy among those who died in the intrinsic renal failure group.

CONCLUSION

The incidence of acute renal failure in the critically ill patients included in our study was 12.31%. The commonest predisposing factors associated with acute renal failure in a ICU setting were acute insults like hypotension, sepsis and risk factors like age more than 50 years and pre-existing renal disease. In most cases, more than one predisposing factor was present. The commonest complications of acute renal failure in a ICU setting were fluid overload, oliguria, hyperkalemia, metabolic acidosis and uraemic encephalopathy. The mean number of organ system failures in the renal and post-renal failure group was higher among those who died. This was statistically significant. Thus, a rise in the mean number of organ system failures was associated with a poor outcome. Statistically significant risk factors leading to acute renal failure were: age more than 50 years, hypotension, sepsis and pre-existing renal disease. The mean blood urea nitrogen (>100) and mean serum creatinine (>3mg/Dl) values were significantly higher

among those who died. Also, there was a statistically higher incidence of hyperkalemia, hypoxia, hyponatremia and metabolic acidosis among those who expired. We did not find a statistically significant difference in the number of patients who received renal replacement therapy and those who were conservatively treated, among those who died and those who survived.

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