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A study of acute renal failure in emergency room and critical care unit

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Abstract
Aim: To study the clinical profile, pathogenic factors and outcome of patients with Acute Renal Failure who admitted in emergency room and intensive care unit.
Methods: This is a prospective, descriptive study carried out on patients with acute renal failure who admitted in emergency room and intensive care unit over a period of 22 months (January 2017–October 2018) at Government General Hospital, Guntur Medical College, Guntur. The clinical presentation, causative factors, medications, co-morbid conditions were analysed. Renal functions namely nitrogenous compounds in blood were monitored.
Results: During the study period, 2076 patients were attended either emergency room and/or intensive care unit. Among these, 11.85%(n=246) patients were detected to have ARF sometime during their stay in the hospital as defined by the study criteria. In total, 176 (71.54%) and 70 (28.54%) were male and female with mean age of the patients 53.47± 17.316 yrs. Medical causes of admissions in 59.75%cases, surgical causes in 36.99%, and obstetrical causes in 3.66%cases respectively. Pre-renal failure was observed in 202 (82.11%) patients and intrinsic and postrenal reported in 30(12.19%) and 14 (5.69%) patients respectively. Sepsis was the major contributing factor for ARF in 134 patients, followed by respiratory tract infections in 26, cellulitis in 11, diabetic foot in 11, Cirrhosis of liver in 5, snake bite in 4, Chrystanthis collinis poisoning in 2, Aminoglycoside exposure was in 6 cases two cases of hanging cases etc were noted. Benign Prostatic Hyperplasia (BPH) and calculus obstruction causes of post renal failure seen in 4 and 3 cases. Stricture urethra contributed to post-renal failure in 2 cases. A single case of carcinoma cervix with bilateral ureteric obstruction was noted. HELLP syndrome seen in 4 cases, neurosurgical causes were attributed as the cause of ARF in 32 patients. Gastrointestinal, general surgical and orthopedic causes were responsible in 20, 19 and 6 cases respectively. Sepsis was observed in 134 patients (54.47%), followed by tachypnoeic (36.99%), Hypoxia in 30 (12.19%), anuric in 20 (8.13%), and oliguria in 19 patients (7.72%). Anemia seen in 150 patients (60.98%), leukocytosis in 141 patients (57.31%), thrombocytopenia in 88 patients (35.77%), Hypernatremia in 31 (12.60%) and hyponatremia in 65 (24.62%), Hyperkalemia in 43 (17.47%), hypokalemia in 29 (11.79%) cases, metabolic acidosis in 59 patients (23.98%). Intermittent hemodialysis was done in 41 patients (16.67%). 153 patients were supported with mechanical ventilation (62.19%). Mean ICU days was 8 days, the total mean hospitalization was 12 days. 53 cases with ARF were died during hospital stay (21.54%), 103 patients (41.87%) were recovered, and 49 patients were discharged against medical advice (16.66%) and 33 were discharged at request (13.41%). Septic shock was the cause of death in 39 patients (73.58%), Cerebrovascular accidents death in 7 patients (13.21%) and cardiac causes in 7 patients (7.54%). The gender, thrombocytopenia, Glasgow coma scale score, and the basic cause of admission did not show statistically significant difference among survivors and non survivors.
Conclusion: Ventilator requirement, co-morbid illness, decreased urine output and sepsis were found to be significantly correlated with mortality in patients of acute renal failure admitted to emergency room and ICU in that order of importance. It is important to note that many patients were discharged prematurely from the hospital possibly due to social problems. Hence, guidelines regarding acute renal failure in the emergency are lacking and ARF practice from critical care department should be adopted.

Keywords: Acute renal failure, sepsis, emergency room, intensive care unit

Introduction

Acute renal failure (ARF) is a common complication of critical illness, which is associated with high mortality and has a separate independent effect on the risk of death [1, 2].

The epidemiology and outcome of acute renal failure (ARF) in critically ill patients in different regions of the world are not well understood. The clinical condition of ARF is said to occur in anywhere from 1% to 25% of critically ill patients [1, 2], depending on the population being studied and the criteria used to define its presence.

The Kidney Disease Improving Global Outcomes (KDIGO) working group estimates a worldwide AKI prevalence of ~2100 people per million population [3].

There is increasing evidence that even a minor acute reduction in renal function is independently associated with a poor outcome, including complications, longer stay in hospital, high mortality, and increased risk of needing long-term dialysis [4, 5].

Furthermore, mortality in these populations ranges from 28% to 90%according to the majority of western reports [6, 7]. Prakash J noted mortality rate of 63% in patients with acute renal failure admitted to intensive care units [8].

There is a worldwide need to recognise patients at risk of AKI, to intervene early, and to circumvent the need for renal replacement therapy (RRT). Although a large proportion of patients presenting to the Emergency Department (ED) either have AKI or develop AKI later in hospital, the literature regarding epidemiology and management of such patients in the ED setting is lacking [9].

Thorough understanding of the epidemiological factors of a disease is very important in formulating a plan to prevent and treat it effectively. Hence, we undertake a study about the clinical spectrum including outcome of patients with acute renal failure who admitted in either our emergency room or intensive care units, Government general hospital, Guntur Medical College, Guntur, Andhra Pradesh.

Materials and Methods

This is a prospective, descriptive study done on patients with acute renal failure who admitted in emergency room and intensive care unit over a period of 22 months (January 2017– October 2018) at Government General Hospital, Guntur Medical College, Guntur.

The clinical presentation, causative factors, medications, co-morbid conditions were analysed and the renal functions namely nitrogenous compounds in blood were monitored.

Baseline renal profile obtained after admission, and patients with normal renal profile were only included and monitored for subsequent development of renal failure. After the initial identification of all cases, for patients who were found to have features of acute kidney injury after hospitalization, the details of presenting illness and clinical features were noted and recorded.

These patients were broadly classified as medical, surgical and obstetric based on the illness for which they were admitted. They were also further grouped into pre-renal, renal parenchymal and post-renal causes of ARF. These patients serial urine output, blood urea, serum creatinine and electrolytes were noted. The progress of these patients was also serially recorded by charts and tables upto recovery or death.

The complications of ARF such as Hyperkalemia, metabolic acidosis, development of altered sensorium and fluid overload were specifically looked for and recorded. The mode of intervention like hemodialysis or peritoneal dialysis or conservative treatment were analysed.

Sepsis was considered when the temperature was > 38.3^0C, total WBC >13000/mm3, peripheral blood picture – neutrophilic leucocytosis with band forms and positive cultures.

Oliguria was defined as urine output of less than 400 ml/day and anuria was defined as urine output less than 100 ml/day.

Radio contrast agents were considered to be the cause of renal failure when serum creatinine rose by more than 10% within 72 hours of using them. Use of any nephrotoxic drugs was also considered.

Renal replacement therapy was defined as either peritoneal dialysis or any technique of renal support requiring an extracorporeal circuit and an artificial membrane.

Study Population: The criteria for acute renal failure were oliguria defined as urine output less than 400 ml in 24 hours and/or azotemia defined as serum creatinine higher than 1.5 mg/dl or blood urea higher than 50 mg/dl. Patients with any dialysis treatment before admission to the ER or ICU or patients with end-stage renal failure and receiving dialysis and patients with documented renal failure from outside hospital or pre-existing ARF were excluded.

Statistical analysis: Statistical analysis was done with the help of both descriptive and inferential statistics. Descriptive statistics like mean, standard deviation are used for quantitative data. Chi-square test was applied to test the independence of different factors from survivability. Z-test is used to test for the difference between means. Stepwise logistic regression analysis with back ward elimination procedure is used to identify the significant risk factors influencing the prognosis in patients with ARF.

Results

Among these, 246 (11.85%) patients were detected to have ARF sometime during their stay in our hospital. The mean age of patients with ARF was 53.47± 17.316 years. 176 patients were men (71.54%). The common comorbid was Hypertension in 88 (35.77%) cases, followed by Diabetes Mellitus in 79 (32.11%), coronary artery disease in 29 (11.78%), Cerebrovascular disease in 14 (5.691%) cases, and COPD in 18 (7.317%) cases respectively.

Total cases with Anuria seen in 24 (9.756%), and Oliguria in 19 (7.72%).

Upon hematological examination, the mean Hemoglobin was observed as 11.1± 3, Total leukocyte count was 14469.91 ± 7724.6 (/mm3), and the mean Platelets 202878.04± 129584.2mm^3 respectively.

The major cause of admission in these patients with acute renal failure was medical in 147 patients (59.75%), Surgical and obstetrical causes accounted for 91 (36.99%) and 9 patients (3.66%) respectively. Pre-renal failure was observed in 202 (82.11%) patients and intrinsic and postrenal reported in 30 (12.19%) and 14 (5.69%) patients respectively.

Sepsis was the major contributing factor for acute renal failure in 134 patients. Respiratory tract infections were observed in 26 patients and cellulitis of legs in 11 patients, diabetic foot in 11, urinary tract infections in 7, malaria in 6, acute appendicitis in 2 and acute pancreatitis in 3 patients. Acute renal failure developed following acute gastroenteritis in 8 patients.

Trauma was related to acute renal failure in 24 patients. Road traffic accidents were found to be the common cause of trauma (14 patients). Polytrauma was seen in 5 patients, head injuries in 5, fractures of long bones in 4, vertebral fractures in 3. Blunt injury abdomen causing ileal perforation was responsible in one patient.

Cardiac causes were noted in 8 cases. Acute myocardial infarction was the culprit in 2 cases, heart failure in 5 cases. Cirrhosis of liver was observed in 5 patients of acute renal failure.

Acute renal failure developed following snake bite in 4 cases. Chrystanthis collinis poisoning was incriminated as the cause of acute renal failure in two patients and paraquat, glyphosate, oleander seed poisonings in one patient each. Aminoglycoside exposure was observed in 6 cases and non-steroid anti-inflammatory drugs in 8 cases. Two cases of hanging were also noted.

Benign Prostatic Hyperplasia (BPH) and calculus obstruction were the two most common causes of post renal failure, seen in 4 and 3 cases respectively. Stricture urethra contributed to post-renal failure in 2 cases. A single case of carcinoma cervix with bilateral ureteric obstruction was also noted in our study.

Pregnancy induced hypertension including post-partum eclampsia was attributed as the cause of acute renal failure in 4 cases. HELLP syndrome was seen in all the 4 cases.

Neurosurgical causes were attributed as the cause of acute renal failure in 32 patients. Gastrointestinal, general surgical and orthopaedic causes were responsible in 20, 19 and 6 cases respectively.

One hundred and eighteen patients (47.97%) were in dehydration at the time of admission. Anemia was observed in 114 patients (46.34%). Fifty-seven patients were edematous (23.17%). Sepsis was observed in 134 patients (54.47%). Ninety-four patients were febrile during admission (38.21%).

Hypotension was noted in 56 patients (22.76%) and hypertension in 145 patients (58.94%). Ninety-one patients were tachypnoeic (36.99%). Hypoxia was observed in 30 patients (12.19%).

Twenty patients were anuric (8.13%) and oliguria was noted in 19 patients (7.72%). Two hundred and three patients were non-oliguric (82.52%).

Three or more than 3 organs failed in 29 patients (11.78%), whereas two organs failed in 76 (30.89%) and only one organ failed in 120 patients (48.78%) respectively.

Mean hemoglobin concentration was 11.1± 3 gm/dl, mean leukocyte count 14,469 ± 7724 cells/cu mm and mean platelet count 2,02878 ± 1,29584 cells/cu m. Anemia was observed in 150 patients (60.98%), leukocytosis in 141 patients (57.31%), thrombocytopenia in 88 patients (35.77%) respectively.

Mean blood urea level was 107.51 ± 73.11 mg/dl and mean serum creatinine concentration was 2.55 ± 1.74 mg/dl. Mean serum sodium level was 138 ± 8 mEq/L and mean serum potassium level was 4.65 ± 1.05 mEq/L.

Hypernatremia was noted in 31 patients (12.60%) and hyponatremia in 65 patients (24.62%). Hyperkalemia was observed in 43 patients (17.47%) and hypokalemia in 29 patients (11.79%). Metabolic acidosis was seen in 59 patients (23.98%).

Intermittent hemodialysis was done in all 41 patients (16.67%) who required dialysis support. Continuous Renal Replacement Therapy (CRRT) was not done due to lack of proper equipment. One hundred and fifty-three patients were supported with mechanical ventilation (62.19%).

Mean number of days spent in intensive care unit was 8. Mean number of days of hospitalization was 12.

Fifty three patients with ARF were died during hospital stay (21.54%), and 103 patients (41.87%) were recovered from ARF. 49 patients were discharged against medical advice (16.66%) and 33 were discharged at request (13.41%). Among the patients who survived, 103 patients were recovered from ARF; 97 patients were completely recovered (87.38%) and 6 patients were recovered partially (7.21%) from ARF. Only eight patients remain dialysis dependent at the time of discharge (9.00%).

In cause of deaths, septic shock was the cause of death in 39 patients (73.58%), followed by Cerebrovascular accidents accounted for death in 7 patients (13.21%) and cardiac causes in 7 patients (7.54%). One patient died of paraquat poisoning and another died of aluminium phosphide poisoning.

The total number of patients admitted and died in our intensive care units and emergency room during the study period were 2076 and 149 respectively. The general mortality in our intensive care units and emergency room was 7.18%, which was far less than that of acute renal failure (21.54%).

The gender, thrombocytopenia, Glasgow coma scale score, and the basic cause of admission did not show statistically significant difference among survivors and non survivors.

Table 1: Factors influencing outcome in patients with ARF (Survivors (111) Vs. Non-survivors (53))

Factors	Survivors (Total No. 111)	Non-survivors (Total No. 53)	Significance
Mean age ± SD (years)	50.802±17.821	58.094 ± 16.906	Z-value= -2.538 P=0.01 Highly significant
Gender			
Male	77 (69.36 %)	43(81.13%)	Chi-square 2.5282 P= NS Not significant
Female	34 (30.63 %)	10 (18.867%)	
Co-morbid Conditions			
Present	78(70.27 %)	41(77.358%)	Chi-square 0.650 P=NS Not significant
Absent	33(29.729%)	12 (22.641%)	
Urine output (ml/24 hours)			
<100 Anuria	4 (3.603%)	7(13.207%)	Chi-square 10.044 *P*< 0.01 Highly significant
<400 oliguria	5 (4.504%)	7(13.207%)	
>400 Non-oliguria	102 (91.891%)	39(73.584%)	
Sepsis			
Present	40 (36.03%)	41(77.358%)	Chi-square 24.5048 *P*< 0.01 Highly significant
Absent	71 (63.963 %)	12(22.641%)	
Thrombocytopenia			

Present	35 (31.53%)	20(37.735%)	Chi-square 0.6195 P=NS Not significant
Absent	76(68.468%)	33(62.264%)	
Tachypnoea			
Present	29 (26.126 %)	25(47.169%)	Chi-square 7.192 *P*< 0.01 Highly significant
Absent	82 (73.87%)	28(52.83%)	
Metabolic Acidosis			
Present	14 (12.61%)	22(41.509%)	Chi-square 17.483 *P*< 0.01 Highly significant
Absent	97 (87.38%)	31(58.490%)	
Hypoxia			
Present	8 (7.207%)	10 (18.86%)	Chi-square 4.991 P= 0.05 Significant
Absent	103 (92.792%)	43 (81.13%)	
GCS			
<15	39 (35.13%)	26(49.05%)	Chi-square 2.905 P=NS Not significant
>15	72 (64.864%)	27 (50.94%)	
Basic Diagnosis			
Medical	57(51.35%)	34(64.150%)	Chi-square 2.9614 P=NS Not significant
Surgical	49 (44.14%)	18(33.962%)	
Obstetric	5 (4.504%)	1(1.88%)	
Ventilation			
Needed	44 (39.639%)	52(98.1132%)	Chi-square 50.533 *P*< 0.01 Highly significant
Not needed	67 (60.360%)	1(1.886%)	
MOSF			
Two	26 (23.42%)	19 (35.849%)	Chi-square 9.9600 *P*< 0.01 Highly significant
Three	9 (8.108%)	12 (22.64%)	
Dialysis			
Dialyzed	25 (25.23%)	15 (28.301%)	Chi-square 4.284 P=0.05 significant
Non dialyzed	83 (74.774%)	38 (71.698%)	
ICU stay in days (Mean)	9.06 ± 8.44	8.45±11.656	Z-value= 0.3407 P=NS Not significant
Diabetic Mellitus			
Present	31(27.927%)	23(43.396%)	Chi-square 3.886 >3.841(significant) P = 0.05
Not present	80(72.07%)	30(56.603%)	
Hypertension			
Present	36(32.43%)	45(84.906%)	Chi-square 39.51 >3.841(Highly significant) *P*< 0.01
Not present	75(67.56%)	8 (15.094%)	
Hyperkalemia			
Present	8 (7.207%)	13(24.528%)	Chi-square 9.639 >3.841(significant) *P*< 0.01
Not present	103(92.792%)	40(75.471%)	

Table 2: Distribution of men and women among survivors and non survivors

	Survivors (Total No. 111)	**Non-survivors (Total No. 53)**	**Significance**
Gender			
Male	77 (69.36 %)	43(81.13%)	Chi-square 2.5282 P= NS Not significant
Female	34 (30.63 %)	10 (18.867%)	
Co-**morbid Conditions**			
Present	78(70.27 %)	41(77.358%)	Chi-square 0.650 P=NS Not significant
Absent	33(29.729%)	12 (22.641%)	
Diabetic Mellitus			
Present	31(27.927%)	23(43.396%)	Chi-square 3.886 >3.841(significant) P = 0.05
Not present	80(72.07%)	30(56.603%)	
Hypertension			
Present	36(32.43%)	45(84.906%)	Chi-square 39.51 >3.841(Highly significant) *P*< 0.01
Not present	75(67.56%)	8 (15.094%)	
Basic Diagnosis			

Medical	57(51.35%)	34(64.150%)	Chi-square 2.9614 P=NS Not significant
Surgical	49 (44.14%)	18(33.962%)	
Obstetric	5 (4.504%)	1(1.88%)	
Sepsis			
Present	40 (36.03%)	41(77.358%)	Chi-square 24.5048 *P*< 0.01 Highly significant
Absent	71 (63.963 %)	12(22.641%)	
Urine **output (ml/24 hours)**			
Anuria	4 (3.603%)	7(13.207%)	Chi-square 10.044 *P*< 0.01 Highly significant
oliguria	5 (4.504%)	7(13.207%)	
Non-oliguria	102 (91.891%)	39(73.584%)	
Hyperkalemia			
Present	8 (7.207%)	13(24.528%)	Chi-square 9.639 >3.841(significant) *P*< 0.01
Not present	103(92.792%)	40(75.471%)	
Metabolic Acidosis			
Present	14 (12.61%)	22(41.509%)	Chi-square 17.483 *P*< 0.01, Highly significant
Absent	97 (87.38%)	31(58.490%)	
Hypoxia			
Present	8 (7.207%)	10 (18.86%)	Chi-square 4.991 P= 0.05 Significant
Absent	103 (92.792%)	43 (81.13%)	
GCS			
<15	39 (35.13%)	26(49.05%)	Chi-square 2.905 P=NS Not significant
>15	72 (64.864%)	27 (50.94%)	
Ventilation			
Needed	44 (39.639%)	52(98.1132%)	Chi-square 50.533 *P*< 0.01 Highly significant
Not needed	67 (60.360%)	1(1.886%)	
MOSF			
Two	26 (23.42%)	19 (35.849%)	Chi-square 9.9600 *P*< 0.01 Highly significant
Three	9 (8.108%)	12 (22.64%)	
Dialysis			
Dialyzed	28 (25.23%)	15(28.301%)	Chi-square 4.284,P=0.05, significant
Non dialyzed	83 (74.774%)	38 (71.698%)	
Thrombocytopenia			
Present	35 (31.53%)	20(37.735%)	Chi-square 0.6195 P=NS Not significant
Absent	76(68.468%)	33(62.264%)	
Tachypnoea			
Present	29 (26.126 %)	25(47.169%)	Chi-square 7.192 *P*< 0.01 Highly significant
Absent	82 (73.87%)	28(52.83%)	

Ventilatory requirement, presence of co-morbid conditions, sepsis and urine output per day were shown to correlate strongly with the mortality when stepwise regression analysis with backward elimination was done in these patients with acute renal failure. Dialysis and multi organ system failure were found to be not significantly associated with mortality by this stepwise logistic regerssion analysis.

Table 3: Stepwise logistic regression analysis (Backward elimination)

Variable		Model Log Likelihood	Change in -2 Log Likelihood	df	Sig. of the Change
Step 1	MOSF	-57.700	1.142	1	.285
	Ventilation	-90.646	67.034	1	.000
	Comorbid	-62.569	10.881	1	.001
	Urine output	-58.987	3.716	1	.054
	Sepsis	-60.800	7.342	1	.007
	Dialysis	-57.129	.000	1	.985
Step 2	MOSF	-57.733	1.209	1	.272
	Ventilation	-91.814	69.370	1	.000
	Comorbid	-62.583	10.909	1	.001
	Urine output	-60.097	5.936	1	.015
	Sepsis	-60.802	7.346	1	.007
Step 3	Ventilation	-93.826	72.189	1	.000
	Comorbid	-63.580	11.698	1	.001
	Urine output	-60.714	5.965	1	.015
	Sepsis	-62.104	8.744	1	.003

Discussion

The epidemiology and outcome of ARF in critically ill patients in different regions of the world are varied. The true incidence of ARF is not easily discerned from published reports because of variation in methods of case ascertainment, definitions of ARF, and catchment populations. The incidence of ARF is reported to be varied from 1% to 25% of critically ill patients [1, 2, 4], depending on the population being studied and the criteria used to define its presence. In our study, the incidence of acute renal failure among patients admitted to our emergency room and intensive care units was 11.85%.

In a study, Shigehiko Uchino and John A. Kellum found period prevalence of ARF of 5.7% after screening nearly 30,000 patients treated in intensive care unit from September 2000 to December 2001 [10]. Hou *et al*. in a prospective study of hospital acquired ARF among 2216 consecutive admissions, found that ARF developed in 4.9%, with iatrogenic factors (drugs and sepsis) accounting for 55% of all episodes [11]. Prakash J observed acute renal failure in 3.79% of cases admitted in intensive care units in India [8].

There is a progressive change in the demographic profile of patients being admitted to the intensive care unit. The mean age of our patients was 53.47± 17.316 years. Turney *et al.* [12] and Mehta RL *et al.* have also reported mean ages of their patients were 60.5 and 59.5 years respectively [13]. Statistically significant difference in the mortality was noted in survivors and non survivors according to age (p value 0.001) in our study. But Prakash J could not find it to be statistically significant in his study [8].

Underlying disorders leading to ARF showed variation in different studies. In our study, medical causes were observed to be major contributing factors for the development of acute renal failure (63.01%). Surgical and obstetrical causes accounted for 82 (33.33%) and 9 patients (3.66%) respectively.

Prerenal ARF was observed to be the most common cause of ARF who are admitted to our emergency room and intensive care units (82.11%).

It was noted that all forty-one patients (16.67%) were supported with intermittent hemodialysis only in our study. Continuous renal replacement therapy was not done due to lack of availability of proper equipment. The remaining 205 patients were managed conservatively with supportive therapies. Tarun Reddy K *et al.* [14] reported that 33 patients (44%) were managed with dialysis support, of which 22 were given intermittent hemodialysis, 1 patient was given slow low efficiency dialysis (SLED), 8 were given continuous veno-venous hemodialysis (CVVHD) and 2 were given intermittent peritoneal dialysis. The rest of 42 patients were managed conservatively with fluid management and with other symptomatic therapy. Most commonly observed complications in that study were altered sensorium 19 (25.3%), metabolic acidosis 15 (20%) and hyperkalemia 11 (14.7%). Prakash J reported that 25 of 46 patients (54.34%) required dialysis support, but majority of them were managed with intermittent peritoneal dialysis as only 3 patients could afford continuous renal replacement therapy (CRRT).

The mortality rate in patients with ARF remains high in majority of studies despite recent advances in dialysis techniques [15]. This may be explained because intensive care unit (ICU) patients today are older and more debilitated than previously. Data from PICARD suggest that the trend toward more complicated ARF continues into the 21st century. More than half of patients with ARF in the ICU require dialysis, and a large fraction has significant hemodynamic instability. Among the 134 patients who required dialysis and were assigned to CRRT alone, the average mean arterial blood pressure was below 70mmHg despite the use of vasopressor agents. These same patients had, on average, between three and four failed organ systems. Therefore, despite crude mortality rates that have remained high, it is reasonable to conclude that outcomes associated with ARF in the critically ill have indeed improved, at least marginally, in the recent past.

One hundred and three patients recovered from acute renal failure; of those who survived, 87.38% patients recovered completely from acute renal failure and 7.21 % recovered partially. Only 9% patients could not be recovered from acute renal failure and remain dialysis dependent forever.

Fifty-three patients died during hospital stay (21.54%) in our study. Eighty-two patients discharged in a compromised state at their own request out of which Forty-nine patients were discharged against medical advice (16.66%) and 33 were discharged at request (13.01%).

In contrast, Shigehiko Uchino *et al.* reported that overall hospital mortality was 60.3% (95% CI, 58.0%- 62.6%) in a multinational study in 2005. He observed that 52% of all ARF patients died in the ICU and another 8% died in the hospital after discharge from the ICU. Dialysis dependence at hospital discharge was 13.8% (95% CI, 11.2%- 16.3%) for survivors in that study.

Tarun Reddy K *et al.* reported that the overall mortality of patients admitted in ICU was 8.1% while those with ARF was 38.7% over a period of 12 months. He observed that metabolic acidosis, hyperkalemia, hypoalbuminemia and mechanical ventilatory requirement were associated with poor outcome. The precipitating factors such as sepsis, oliguria and hypotension also had their influence on mortality. Forty-two patients who were managed conservatively had a better outcome, of which only 15 patients died. Thirty-three patients were on dialysis, 5 of 23 patients on hemodialysis died, 7 of 8 patients on CVVHD died whereas both the patients on peritoneal dialysis died. Prakash J observed the mortality of ARF was 63% and recovery of renal function was not uniform in the survivors. The seventeen patients (37%) survived; with complete renal recovery in 9 patients (19.57%), partial recovery in 6 (13%) patients and dialysis dependency in two patients (4.3%). He also observed that duration of ICU stay was longer (12.52±3.82) in non survivors compared to survivors (6.41±4.80). Refractory hypotension and multi organ system failure (MOSF) were the commonest causes of death in ICU patients developing ARF. However, ARF per se was not responsible for death in any of these patients.

Hou *et al.* observed that the overall mortality of acute renal failure was 25 per cent in a study of hospital acquired acute renal failure.

Sepsis was found to the most common cause of death in our critically ill patients with ARF (73.58%). Cerebrovascular and cardiac causes contributed to 13.21% and 7.54% patients respectively.

Ravindra L Mehta *et al.* also have reported an incidence of comorbidity in excess of 30% according to the data from PICARD. Tarun Reddy K observed diabetes mellitus in 30.7 % of patients with ARF, chronic obstructive pulmonary

disease in 14.7%, coronary artery disease in 21.3%, hepatic dysfunction in 13.3%, cerebrovascular accident in 10.7%, valvular heart disease in 6.7%, hypothyroidism in 4% and haemophilia in 1.3% of patients.

Sepsis, Multiple Organ System Failure (MOSF), first reported by Tilney *et al*. in 1973, is uniformly associated with higher mortality [16]. Fry *et al.* [17]. Reported a mortality of 79% and 100% in patients with 3 or more organ system failures respectively. In an Indian study, Prakash J also observed that the mortality due to MOSF was high (>82.76%) and there was progressive increase in mortality as the number of organ system failures increased. The number of organ system failures was an important predictor of mortality. In our study, MOSF was correlated with mortality in critically ill patients with acute renal failure when the data analysed by chi-square test. Later, it was found to be not correlated with mortality after analysing the data by stepwise logistic regression analysis with backward elimination.

Need for mechanical ventilation is associated with higher mortality. Hilmar Bourchardi observed that prolonged ventilation may influence GFR and increases sodium retention. Prakash J *et al.* observed 23 of 31 (74.2%) ventilated patients died as compared to 6 of 15 (40%) patients who did not need ventilation. Similar was the observation with the other organ support system i.e., dialysis. There was excess mortality in the dialyzed group (80% vs 42.86%) than in the non-dialyzed group. This apparent paradox in case of both these life supporting systems seems to be due to the confounding effect of severity of the underlying disease process, sepsis and also the presence of multi-organ failure. But, in our study, it was noted that there was no such significant excess mortality in the dialyzed group. As there were no facilities for continuous renal replacement therapy in our institute, very sick people with hemodynamic compromise could not be supported with dialysis. However, the requirement for mechanical ventilation was strongly correlated with mortality in our patients with acute renal failure. One hundred and fifty-three patients were given ventilator support.

APACHE-III score system is useful in assessing the severity of illness and predicting mortality in the ICU patients [18]. The higher APACHE-III scores were reported in non survivors vs. survivors (100.44±29.26 vs.71.72±14.08) in a study from Taiwan (Yung-Chang Chan). Prakash J also observed much higher APACHE-III score (97.8±24.28) in patients who died in comparison to lower scores (68.12±7.6) in surviving patients in an Indian study.

Shigehiko Uchino *et al*. reported that study centre, older age, time between hospital and study inclusion, the Simplified Acute Physiology Score (SAPS II), use of mechanical ventilation, and vasopressors were all independent significant risk factors for mortality.

Prognostic factors in patients with acute renal failure have been analysed by several authors. Sepsis and MOSF correlated with high mortality among patients with ARF in an Indian study [19]. Qutub HO *et al.* [20] have reported MOSF, sepsis, disseminated intravascular coagulopathy, adult respiratory distress syndrome, and diabetes mellitus are associated with high mortality. Prakash J observed comorbid conditions, oliguria, need for ventilation and dialysis, sepsis and MOSF were correlated with high mortality.

Conclusion

The mortality rate appears less when compared to the majority of previous studies probably because of representation of a greater number of pre-renal acute renal failures in our study and better management of sepsis and trauma. It can be concluded that the development of acute renal failure in a critically ill patient will be associated with three times higher mortality than others. Septic shock was the most common cause of the death (72.22%) followed by cerebrovascular accidents and cardiac causes in that order. Ventilator requirement, co-morbid illness, decreased urine output and sepsis were found to be significantly correlated with mortality in patients of acute renal failure admitted to our emergency room and intensive care units in that order of importance. It is important to note that many patients were discharged prematurely from the hospital possibly due to social problems (32.93%). More research and guidelines were necessary to explore whether any other strategies in the emergency and ICU could improve the prognosis of patients with acute renal failure.

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