Original Article

Factors determining Outcome of Acute Renal Failure Patients

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Abstract

Objective: Acute Renal Failure (ARF) is a common medical problem. Delay in diagnosis is associated with increased mortality. Variety of conditions can lead to ARF. Many factors can influence the outcome of ARF. This study was done to find the predictive factors related to outcome of ARF.

Methods: One hundred adult patients of acute renal failure admitted to Ziauddin Hospital were studied. Certain factors related to outcome of ARF were identified and analyzed.

Results: Among such factors oliguria, levels of urea, creatinine and potassium were found significant poor prognostic predictors on univariate analysis as far as outcome of treatment modality is concerned. The multivariate analysis revealed that the presence of oliguria is the only significant independent predictor ($P<0.001$) for good outcome with dialysis.

Conclusion: Oliguria was found to be the major predictor of non recovery of renal function (JPMA 55:526;2005).

Introduction

Acute renal failure (ARF) is a less appreciated problem with various etiologies.[1] ARF is reversible if recognized and managed early.[2] Delay in diagnosis of ARF may lead to irreversibility followed by increased morbidity and mortality.[3] Early identification, referral and treatment of pre-renal failure, good pre-natal care and cautious therapeutic decisions can substantially improve the incidence and outcome of ARF.[4] Data on overall epidemiology of ARF is crucial to implement adequate resources for the management of this entity.[3] Different aspects regarding outcome of ARF, in relation to severity scores, ICU setting, age, dialysis, and underlying illness have been studied in various parts of the world.[5,6]

The probability of death in patients with ARF is still high.[7] A valid prognostic Index available on patient's admission and during follow up could be helpful for decision making.

ARF could be a presenting problem, as well as a frequent complication in already hospitalized patients for conditions other than ARF.[2] It affects as many as 5% of all hospitalized patients with a higher prevalence in critical care units, patients with multi organ dysfunction syndromes and elderly patients with complex diseases. The outcome in terms of mortality is high in hospitalized patients with ARF as compared to patients with ARF in community setups.[8]

ARF has 46.5% mortality and the most frequent causes of death are sepsis, respiratory failure and multiple organ failure. ARF is an important marker of the gravity of the underlying disease and not the cause of death.[9]

This study was meant to describe various etiological factors of ARF in a teaching hospital of Karachi. It is focusing on certain factors that can influence on outcome of ARF. So that in a country with low economical support system, specially for health care, prognosis of a reversible condition, that is, ARF can be determined.

Patients and Methods

One hundred patients of more than 15 years of age of either sex admitted in Ziauddin Hospital, meeting following inclusion criteria were included in the study. Patients who presented with oliguria or anuria for more than 24 hours and showed rise in urea and creatinine, or increase in serum creatinine of 0.5 mg per deciliter over base line value, or an increase of more than 50 percent over the normal value.

The patients who did not fulfill the inclusion criteria or had one of the following was excluded from the study: patients with known renal diseases, established diabetic or hypertensive nephropathy, bilateral small shrunken kidneys, disparity of renal sizes of more than 2.0 cm or polycystic kidney disease.

Clinical evaluation included a history of nausea, vomiting and/or diarrhoea, bleeding, previous renal insufficiency, heart failure or recent symptoms of dyspnoea, jaundice, hepatitis or chronic liver disease, oedema, high blood pressure or change in colour of urine, present and past medications, prolonged episode of hypotension, use of any contrast dyes and renal stone disease, or evidence of lower urinary tract obstruction. All results were recorded in a self designed ARF questionnaire.

Laboratory Tests

Dipstick Urine analysis and microscopy was done in all patients. If positive for protein quantification was done by sulphosalicylic acid test.

Urine electrolytes were estimated, particularly the fractional excretion of sodium (FENa).

Complete Blood count was done by automated analyzer SYSMEX K 1000, Urea, BUN, Serum creatinine, Electrolytes by Nova II-Ion selective electrode method and Calcium, Uric acid, Phosphorus by automatic analyzer.

Ultrasonography was done in all cases using CHP-SAY (Toshiba) 3.75 MHz. Real time (Dynamic) concave Probe.

Special tests were carried out in situations where routine laboratory tests failed to establish the cause of renal failure.

Immunologic tests included ANA, LECELL, C3 AND C4, Anti DNA, ASOT, Anti GBM. Renal biopsy was done in selected cases.

A daily estimation of urine output, urea, creatinine was performed and exposure to therapeutic options/ management were recorded. The therapeutic management options were conservative and dialysis. The criteria for carrying out haemodialysis were uremic symptoms and metabolic acidosis, hyperkalemia, fluid overload, oliguria, anuria non-responsive to fluid therapy and rising urea, creatinine, and uremic pericarditis.

The haemodialysis was carried out through a double lumen catheter. The date of insertion of double lumen was noted along with site. Days and number of sessions of dialysis required for individual patients were also noted. The decision to do the peritoneal dialysis was similar as far as criteria were concerned but haemodialysis was deferred because of low blood pressure, intracranial bleeds, or recent surgery.

The outcome of the patients who were followed up was recorded under four categories.

1. Requiring conservative therapy and improved.
2. Requiring dialysis support temporarily and improved.
3. Requiring temporary dialysis and discharged with advice for future dialysis.
4. Expired, despite any of the above.

All patients were followed daily until discharged, died or attained normal renal functions.

Data Analysis

Data entry was done using SPSS package. Data was analyzed by mean, standard deviation, frequency and comparison between various groups using student t test for statistical significance. Factor(s) determining outcome of ARF were analyzed by univariate and multivariate analysis.

Results

The study included 100 patients of ARF with a mean age of 48 years. Age ranged from 18 to 80 years. The male to female ratio was 1.6:1.

Causes leading to ARF included conditions related to medical (75%), surgical (17%) and obstetrical (5%) origin. Three cases did not belong to either group.

Most common medical illness causing ARF was hypovolemia secondary to acute gastroenteritis (32%). Abdominal surgical procedures among surgical group were mainly associated with ARF. Post partum hemorrhage and eclampsia were the two conditions associated with ARF in obstetrical cases (Table 1).

Table 1. Etiological Subgroups of ARF in Hospitalized Patients.

S.No.	Etiological Group	Etiological Sub Group	Number of Cases	Total
1	Medical	Gastroenteritis	24	75
		Sepsis	16	
		Myocardial infarction and CHF	10	
		Malaria	9	
		Cerebro vascular accident	6	
		Pancreatitis	5	
		Chronic liver disease	2	
		Rhabdomyolysis	2	
		Autoimmune hemolytic anemia	1	
2	Surgical	Laprotomy	5	17
		Cholecystectomy	4	
		CABG	3	
		Miscellaneous	3	
		Orthopedics Surgeries	2	
3	Obstetrics	Postpartum hemorrhage	3	5
		Eclampsia	2	
4	Others		3	3
	Grand Total			**100**

Patients were classified in two groups by treatment modality used, conservative or dialysis. Seventy-four patients received conservative management remaining 26 were dialyzed. This frequency of treatment modalities was

same for patients having medical origin of disease. Surgical illnesses were treated mostly by conservative method, four out of 5 patients were dialyzed in obstetrical group (Table 2).

Table 2. Treatment Modalities for Etiological Groups.

S.No	Etiological Groups	Conservative (% of Total)	Dialyzed (% of Total)	Total
1	Medical	55 (73)	20 (27)	75
2	Surgical	15 (88)	2 (12)	17
3	Obstetrical	1 (20)	4 (80)	5
4	Others	3 (100)	0	3
Grand Total		74	26	100

Two broad outcomes in this study were improved (87) or expired (13). Among those who improved (n=87) by the end of the study 63 (72%) were managed conservatively, while 20 (22%) were dialyzed temporarily. Four (5%) patients were advised long term dialysis. Among those who expired (n=13), 11 (84%) received conservative treatment and 2(16%) underwent dialysis. Factors affecting outcome of patients with ARF in terms of improved and expired are shown in Tables 3 and 4.

The patients were divided into subgroups for each factor by level defined in Table 3 and 4. These subgroups were compared for outcome of ARF (Table 3). Treatment groups were also compared for each subgroup in terms of outcome of ARF (Table 4).The multivariate analysis revealed that the presence of oliguria is the only significant independent predictor (P<0.001) for good outcome with dialysis.

Discussion

Acute Renal Failure is a fairly common condition in hospitalized patients.[9] Barret et al reported 200 patients of ARF in a three years study.[5] Another prospective study from Arabian Gulf reported 77 patients of ARF in 2 years.[9] A study from university hospital of Philippines reported 110 patients of ARF in 5 years period.[10] This study included 100 patients with ARF in a teaching hospital over a period of 3 years. ARF is a syndrome with multiple causes which explains its common occurrence in hospitalized patients. ARF affects patients cared for by nearly all health care professionals.[11] Liano has grouped ARF into medical (34%), ICU (27%), Surgical (23%), Obstetrical (1%), nephrological (13%) and traumatic (2%) ARF.[12] Saxena in his review classified etiology of ARF in medical (75%), obstetrical (15%), obstructive and surgical cases (10%).[13] This study validates the difference in proportion of etiological groups between developing and developed world, as it was reported by Naqvi et al[14] in which the major cause was medical conditions (57%) followed by obstetrical (24%), obstructive (7%), surgical (5%) and undetermined cause (7%).

Table 3. Univariate analysis of factors affecting outcome of ARF.

	Variables	Number of Cases	Outcome (% of cases) Improved	Expired	P. Value
1	**Etiology**				
	Medical	75	62 (85)	11 (15)	0.083
	Surgical	17	15 (88)	2 (12)	
	Obstetrical and Others	8	8 (100)	-	
2	**Oliguria**				
	Present	54	47 (87)	7 (13)	0.990
	Absent	46	40 (87)	6 (13)	
3	**Acidosis**				
	Present	47	40 (85)	7 (15)	0.596
	Absent	53	47 (89)	6 (11)	
4	**Age**				
	< 40	34	32 (94)	2 (6)	0.228
	≤ 40	66	55 (83)	11 (17)	
5	**Treatment**				
	Conservative	74	63 (85)	11 (15)	0.551
	Dialyzed	26	24 (92)	2 (8)	
6	**Level of K**				
	< 5.0	85	76 (89)	9 (11)	0.197
	> 5.0	15	11 (73)	4 (27)	
7	**WBC**				
	< 11,000	37	31 (84)	6 (16)	0.671
	> 11,000	63	56 (89)	7 (11)	
8	**Urea**				
	≤200	67	61 (91)	6 (9)	0.162
	> 200	33	26 (79)	7 (21)	
9	**Creatinine**				
	≤5.5	57	48 (84)	9 (16)	0.513
	> 5.5	43	39 (91)	4 (9)	
10	**Associated Diseases**				
	Present	49	44 (90)	5 (10)	0.65
	Absent	51	43 (84)	18 (16)	
11	**HB %**				
	< 12.0	45	39 (87)	6 (13)	0.834
	≥12.0	55	48 (87)	7 (13)	
12	**Heart Rate**				
	≤100	58	53 (91)	5 (9)	0.219
	> 100	42	34 (81)	8 (19)	
13	**FENa**				
	<1%	24	21 (87)	3 (13)	
	1-3%	39	33 (87)	6 (13)	0.619
	>3%	37	34 (92)	3 (8)	

Table 4. Univariate analysis of factors affecting outcome of ARF for Treatment Modality.

S. No.	Variables	Number	Treatment		P Value
			Conservative	Dialyzed	
			(% of Cases)		
1	**Etiology**				
	Medical	75	58 (77)	17 (23)	NS
	Surgical	17	10 (59)	7 (41)	
	Obstetrical and Others		8	6 (75)	2 (25)
2	**Oliguria**				
	Present	54	31 (57)	23 (43)	0.001
	Absent	46	43 (94)	3 (6)	
3	**Acidosis**				
	Present	47	38 (81)	9 (19)	NS
	Absent	53	36 (68)	17 (32)	
4	**Age**				
	<40	34	28 (82)	6 (18)	NS
	>40	66	46 (70) 2	0 (30)	
5	**Urea**				
	<200	67	56 (84)	11 (16)	<0.01
	>200	33	18 (54)	15 (46)	
6	**Creatinine**				
	<5.5	57	50 (88)	7 (12)	<0.001
	>5.5	43	24 (56)	19 (44)	
7	**Hb**				
	<12	45	29 (64)	16 (36)	NS
	>12	55	45 (82)	10 (18)	
8	**Heart Rate**				
	<100	58	44 (76)	14 (24)	NS
	>100	42	30 (71)	12 (29)	
9	**Serum K**				
	<5	85	67 (79)	18 (21)	<0.01
	>5	15	7 (47)	8 (53)	
10	**WBC**				
	<11000	37	26 (70)	11 (30)	NS
	>11000	63	48 (76)	15 (24)	
11	**Associated Disease**				
	Present	49	36 (74)	13 (26)	NS
	Absent	51	38 (74)	13 (26)	

The reason is that infections as a cause of ARF has declined all over the world but it is still a significant and major cause for renal insufficiency in the developing world. A large proportion of medical causes in developing countries is due to a high incidence of infections, specially gastrointestinal diseases and falciparum malaria.

The frequency of etiological groups in this study matches closely to studies from neighboring countries.[15] However the causes in each subgroup has slight variation. The conditions like snake bite, leptospirosis, heavy metal poisoning and glomerulonephritis may cause ARF but are not recorded in this study. This may be secondary to less endemicity of these conditions, for example, snake bite is common in rural areas than the study site, which is an urban medical center.

The prognosis of ARF depends on the cause and severity of the disease. Because of the ability to provide long-term renal replacement therapy, in the form of dialysis or renal transplantation, a poor renal outcome is not necessarily fatal.

Mortality of ARF in hospitalized patient is reported from 14-70% in different studies.[4] Mortality in this study is (13%). Previous health status, original disease, a hospital and/or ICU management of ARF and age of the patient also seem to affect outcome. The poor outcome of ARF in advanced age may be a reflection of increased frequency of chronic (malignancy, cardiac and pulmonary failure) diseases.

ARF observed in the ICU setting has a poorer prognosis than the ARF treated in other hospital areas. Since this study included less number of patients who developed ARF in ICU, the mortality is lower than reported studies.[16]

Many factors affect the outcome of ARF in hospitalized patients.[17] Dela Cruz et al[10] concluded four variables significantly increased the risk of death from ARF: older age, hyperkalemia, oliguria, and presence of sepsis on admission.[4] Obialo and his associates[18] reported oliguria as a factor causing increased mortality among patients with ARF. Similar factors including increasing age, higher levels of FEna, urea, creatinine and potassium along with associated medical illnesses, oliguria and acidosis contributed to high mortality in this study. Our analysis demonstrated oliguria to be the major predictor of nonrecovery of renal function ($P<0.001$), as reported in almost all other studies mentioned above.

Acknowledgements

We are thankful to Late Dr. Sarwar Jehan Zuberi and Dr. Syed Ali Jaffer Naqvi for their guidance in initiation of this study. Thanks also go out to Mr. Ejaz Alam for help in data handling and analysis. Gratitude is expressed to Mr. Rizwan for his computer and text formatting.

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