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Acute renal failure renal replacement therapy & outcome

Abstract

Acute Renal Failure is an intractable problem, which can be actively and effectively managed, but can be prevented only to a little extent. Acute renal failure requiring dialysis is associated with high mortality and morbidity. In a study conducted by analyzing the literature and taking 15897 acute renal failure patients, it was found that mortality rates in most studies exceeded 30%.[1] Despite technical advancements in the management of acute renal failure over the last 50years, mortality rates seem to have remained unchanged at around 50%.[1] In Kerala, the studies on acute renal shut down are sparse. Also the clinico demographic profile of patients with acute renal failure varies in different parts of the world. Our objective was to study the clinico demographic profile of acute renal failure patients who underwent renal replacement therapy and to identify the determinants of outcome at discharge or death. The present study is a retrospective cohort of 107 patients who required renal replacement therapy in Medical College, Thiruvananthapuram. The relevant data were collected from the case records of patients by a data collection sheet. Outcome was taken as survived or expired at the time of discharge or death. Continuous variables were represented as means and standard deviations. The statistical significance assessed by Odds ratio and Chi-square test.

The present study had a mortality of 32.7% with women more prone. The average age of the subjects was 43.16±16.45years. Univariate analysis of the variables with the outcome like women gender (p=0.490), pre-morbidities (p=0.079), only one co-morbidity in a patient (p=0.769), oliguria on the day of Ist dialysis (p=0.549), oliguria on the next day of the Ist dialysis (p=0.363) and Liano's score 0.3 & above on the day of Ist dialysis (p=0.065) were associated with increased mortality. Ages 45years & above (p=0.006), sepsis syndrome (p=0.0008), more than one co-morbidity in a patient (p=0.032) and Liano's score on the day after the Ist dialysis (p=0.024) were associated with obvious increase in mortality, which were statistically significant. Snake envenomation had the best prognosis (p=0.037) and serum creatinine level had weak association with outcome (p=0.065). The study conducted on 107 patients revealed 32.7% mortality. Snake envenomation had the best prognosis and sepsis syndrome the worst. Age 45years & above and women gender were bad prognostic indicators. Pre-morbidities, co-morbidities and oliguria were probable bad indicators. Liano's score 0.3 and above was a good predictor of mortality. Unfortunately, serum creatinine level had only weak association with the outcome.

Keywords: oliguria, liano's score, creatinine, dialysis

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Introduction

Acute renal failure is present in 1 to 5 percent of patients at hospital admission and affects 15 to 20 percent of patients in intensive care units.[2] In a study in Madrid, pre-renal type of acute renal failure accounted for 21% of cases, post-renal type constituted 10% of cases and intrinsic-type accounted for 69% of cases.[2] Renal replacement therapy is the life saving procedure for patients with acute renal shut down. It came as a treatment option since the 1960s. Intermittent Haemodialysis, Continuous Venovenous Haemodialysis or Continuous Arteriovenous Haemodialysis and Peritoneal Dialysis are the frequently used treatment options. Outcome in acute renal failure is usually determined by the severity of the underlying diseases and other complications, rather than by renal shut down alone. The Madrid data showed that 60% of deaths were due to the primary disease and the remaining 40% were due to cardiopulmonary failure or infection. In Kerala, studies on acute renal failure and its outcome are rare. The clinico demographic profile and determinants of outcome of acute renal failure patients varies in different parts of the world. In the context of developing countries, where the facilities for renal replacement therapy are limited, sometimes there is need for selecting patients on the basis of prognostic indices; even though these modalities of treatment should not be forbidden to anyone under any circumstances. In this era of highly sophisticated technology, there is also an ethical question of prolonging the artificial life support for patients with irreversible multi-organ failure with renal replacement therapy. By finding out the determinants of prognosis, we can prioritise the use of highly expensive dialysis modalities.

Materials and methods

Design

Retrospective cohort. Exposure was subjects enlisted for renal replacement therapy. Outcome was either discharge or death.

Setting

Dialysis unit, Department of Nephrology, Medical College, Thiruvananthapuram, Kerala, Medical college Thiruvananthapuram is a tertiary care referral hospital which catered 2,02,596 out-patients and 65,429 in-patients in 2003.

Subjects

107 patients who underwent renal replacement therapy between 28/12/2003 and 20/12/2004.

Data collected

Collection of data on demography (age, gender), clinical picture (aetiology, pre-morbidities (AppendixI), co-morbidities (Appendix I), Liano's score variables (Appendix II), urine output, biochemical (serum creatinine level) and outcome.

Method of collection of data

A data collection sheet (Appendix III) prepared and collected the required data from the Record library.

Data analysis

Continuous variables were represented by means and standard deviations. The different variables were compared with the outcome with Odds ratio (with 95% CI) and Chi-square test. Liano's score (Appendix II) was also calculated before first dialysis & on the following day and compared with the outcome.

Inclusion criteria

Patients on Intermittent Haemodialysis or Continuous venovenous Haemodialysis with serum creatinine level more than 1.4mg/dl.

Exclusion criteria

a) Paediatric and Obstetric cases.

b) Renal transplant rejection patients.

c) Chronic kidney disease.

d) Initial sessions of renal replacement therapy done outside.

e) Any malignancy or collagen vascular diseases.

f) Patients discharged against medical advice.

Results

Age & gender

The mean age of the subjects was 43.1±16.4years with 72.9% of the patients were in the age group of 12 to 54years, the fruitful period of life with associated economic loss. In the present study men to women ratio was 2.3:1.

Outcome

In the present study, there was 32.7% mortality with mean Liano's score 0.279±0.132 on the day of first dialysis.

Serum creatinine level before discharge

Before discharge 50% of the patients were having serum creatinine level more than 3mg/dl.

Urine output before discharge

In the present study, 98.6% of the patients were non-oliguric at discharge. Only one patient had persistent oliguria at discharge.

Discussion

Age & gender

In two studies in India, average ages for patients were in the range of the present study. 3, 4 this may be due to the fact that older people need not always approach the hospital for treatment. Also the co-morbidities may be so severe that the elderly could have expired before the need for dialysis was appreciated. In studies in Taiwan and India, gender ratio were well in favour of men.[3,4] In accordance with the present study. The most probable explanation of this male predominance can be due to the pronounced exposure of men to the circumstances leading to acute renal failure like snake envenomation, hepatorenal syndrome (especially Weil's disease) etc.

Outcome

In the Madrid study, mortality was around 65.9% in dialyzed patients (Liano's score 0.57±0.23) when compared with 33.2% mortality with conservative management (Liano's score 0.35±0.19) with p<0.001.2 this proves that mortality is directly linked to the severity of the disease. In an Indian study, mortality was 48.6%.8 thus the mortality varies in different parts of the world.

Urine output before discharge

In studies in France and Madrid, mortality rates were almost the same for patients below and above 65years with p>0.90[5] and p=0.954.[6] The disparity in the present study could be due to the difference in the age groups selected. Also the elderly could have been stricken with pre-morbid illnesses, which went unnoticed for long periods due to the inefficient screening. However it might also be contributed by the shortfalls in the management of geriatric patients. In an Indian study, age more than 60years was associated with increased mortality (p<0.01).[7] In a study on critically ill patients on dialysis, adjusted Odds ratio for age 60years & above was 3.7.[8] This probably might have reflected the severity of the disease also.

Aetiology

Of the different aetiologies, snake envenomation had the best prognosis with Odds ratio for survival OR=3.00 (95% CI 0.95 to 10.10) p=0.037, which is statistically significant (Table 1). Sepsis syndrome had the worst prognosis with odds ratio for mortality OR=10.37 (95%CI 1.85 to 75.99) p=0.0008, which is statistically significant. In a study in Melbourne, septic shock was associated with mortality with odds ratio for mortality OR=1.36 (95%CI 1.03 to 1.79) p=0.03.14 in the present study, sepsis syndrome had 80% mortality. In an Indian study, there was 95% mortality which is in line with the present study.[9] 15 In these entire studies sepsis syndrome was associated with increased risk of mortality. So septicaemia should be prevented and if it occurs it should be detected early and effectively managed. As snake envenomation and Hepatorenal syndrome were the commonest causes in our part of the country, we compared them and found that snake envenomation had better prognosis with Odds ratio for survival OR=1.80 (95% CI 0.39 to 8.43) p=0.388, but is statistically not significant.[10–13]

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Table 1 Determinants of ARF and statistical significance

Determinants	Mortality OR	95% CI	P
Age ≥45Years	3.24	1.27–8.35	0.006
Women Gender	1.36	0.52–3.52	0.49
Sepsis Syndrome	10.37	1.85–75.99	0.0008
Pre-Morbidity	2.15	0.83–5.62	0.079
Only 1 Co-Morbidity	1.15	0.40–3.36	0.769
>1 Co-Morbidities	3.09	0.96–10.15	0.031
Oliguria before RRT	1.29	0.51–3.27	0.549
Oliguria after 24hours	1.52	0.56–4.16	0.363
S.Cr Level ≥6mg/Dl before RRT	1	0.41–2.42	0.996
Liano's Score ≥0.3 before RRT	2.19	0.87–5.54	0.065
Liano's Score ≥0.3 after 24hours	2.8	1.02–7.74	0.024

About 29% had anyone of the pre-morbidities studied. The pre-morbidity pattern in any community reflects the overall prevalence of the non-communicable diseases of the place presence of any pre morbidity is associated with increased mortality with Odds ratio for mortality OR=2.15 (95% CI 0.83 to 5.62) with p=0.079, but is statistically not significant. It is quite natural to have higher mortality for patients with pre-morbidities than compared with others.[14–17]

Co-morbidities and outcome

In the present study, presence of at least one co-morbidity was associated with increased mortality with odds ratio for mortality OR=1.15 (95% CI 0.40 to 3.36) with p=0.769, which is statistically not significant. But the presence of more than one co-morbidity was associated with significant increase in mortality with Odds ratio for mortality OR=3.09 (95% CI 0.96 to 10.15) with p=0.031, which is statistically significant. In a study organ system failures were associated with significantly increased mortality.[3]

Urine output on the day of first dialysis and outcome

In the present study, 61.7% were oliguric before dialysis. In an Indian study, 62.2% were oliguric. 8 this correlates with our study. In the present study, there is an increased mortality with oliguria with Odds ratio for mortality OR=1.29 (95% CI 0.51 to 3.27) with p=0.549, which is statistically not significant. Also there was 34.8% mortality with oliguria and 29.3% mortality with non-oliguria (p=0.549), which is statistically not significant. In a Portuguese study, the mortality was 62.9% with oliguria and 34.5% with non-oliguria (p<0.05).16 the disparity in mortality pattern in the oliguric group may be due to the severity of co-morbid diseases.[18,19]

Urine output on the next day of first dialysis and outcome

Oliguria was associated with mortality with Odds ratio for mortality OR=1.52 (95% CI 0.56 to 4.16) with p=0.363, but is statistically not significant. In studies in India and Pakistan, presence of oliguria was the only significant independent predictor of mortality (p<0.001). 17, 11 the present study was also in favour of these studies but appeared insignificant statistically.

Liano's score on the day of first dialysis and outcome

The average Liano's score was 0.279±0.132 and the mortality was 32.7%. There was increased mortality in patients with score 0.3 and above i.e. 44.4% against 26.8% OR=2.19 (95% CI 0.87 to 5.54) with p=0.065, which is not statistically significant. In the Madrid study, Liano's score for dialyzed and non dialyzed patients were 0.575±0.23 and 0.35±0.19 respectively and the associated mortality were 65.9 % and 33.2% respectively.[2] The present study also proves the good relationship between Liano's score and the prediction of outcome.

Liano's score on the next day after first dialysis and outcome

There was a slight reduction in the severity of patients on the next day after the initial dialysis. Liano's score 0.3 and above was associated with increased mortality OR=2.80 (95% CI 1.02 to 7.74) with p=0.024, which is statistically significant. So Liano's score on the day after the first dialysis is a good predictor of outcome. In a Portuguese study and Indian study, Liano's score showed good confidence level with high discriminatory power and good accuracy and was a good predictor of mortality.[6,19] which are in terms with the present study. However in a study in Melbourne, none of the scoring systems had a high level of discrimination or calibration to predict mortality for patients with acute renal failure (Table 2). 20 This might be related to the management of patients and the inherent factors which are yet to be found out.[20]

Table 2 Clinical conditions precipitating Acute Renal failure

Aetiology	Outcome			
	Expired		Survived	
	n	%	n	%
Snake Envenomation	5	17.2	24	82.8
Hepatorenal Syndrome	6	27.3	16	72.7
Sepsis Syndrome	8	80	2	20
Obstructive Uropathy	2	25	6	75
*Others	14	36.8	24	63.2

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Conclusion

The study consists of 107 subjects with acute renal failure requiring renal replacement therapy in Government Medical College, Thiruvananthapuram between 28/12/2003 and 20/12/2004. It brings to light the following conclusions.

The average age of the patients was 43.1±16.4years. Men contributed 70.1% of the total study population. Snake envenomation and Hepatorenal syndrome accounted for 47.7% of the total cases. Pre-morbidity was present in 29% of patients while 57% had anyone of the co-morbidities. Before dialysis 61.7% of patients were oliguric. The mean serum creatinine level was 6.6±3.3 mg/dl. The patients had mean Liano's score of 0.279±0.132 with 32.7% mortality.

Significant association

Ages of 45years and above, Liano's score of 0.3 and above on the day after the first dialysis and Sepsis syndrome were associated with bad outcome. Snake envenomation was associated with favourable outcome.

Association

Women gender, pre-morbidities and one co-morbidity and oliguria were associated with bad outcome. Liano's score of 0.3 and above was a poor prognostic indicator.

Weak association

Serum creatinine level had weak association in the prediction of outcome.

Recommendations

Younger patients with age less than 45years should be given preference for renal replacement therapy. Snake envenomation cases should be the first priority for renal replacement therapy.

Appendix I

Pre- Morbidities & Co-morbidities: The pre-morbidities are defined as those diseases which were present in the patient long before the present disease had manifested. The pre-morbidities under study were Type 2 Diabetes Mellitus, systemic hypertension, coronary artery disease and chronic obstructive pulmonary airway disease. The co-morbidities have been classified into six on the basis of the systems affected (Figure 1). They are as follows

a) Cardiovascular system (defined as acute myocardial infarction, infective or inflammatory conditions of Heart, sustained hypotension i.e. less than 100 mm of Hg for at least 10 hours).

b) Pulmonary system (defined as acute lung injury or Adult Respiratory Distress Syndrome, mechanical ventilation, pulmonary oedema, and chest injury).

c) Hepatic (defined as clinical jaundice of any type).

d) Neurological system (defined as Glasgow Coma Scale 5 or less, Encephalopathy of any aetiology).

e) Gastrointestinal system (defined as acute pancreatitis, peritonitis, severe diarrhea with hypovolemic shock).

f) Haematological (defined as coagulopathy requiring more than 10units of Fresh Frozen Plasma or Platelet Rich Plasma).

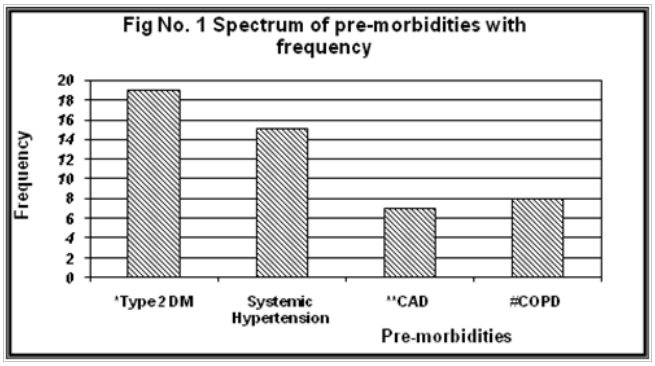

Figure 1 Others include formic acid poisoning, acute diarrhoeal diseases, Rhabdomyolysis, drugs, acute pyelonephritis, cardiac failure, rapidly progressive glomerulonephritis, acute interstitial nephritis, malaria, transfusion reaction, myocarditis etc.

Appendix II

Liano's score: Liano's Acute Tubular Necrosis Individual Severity Index is a severity scoring system used to predict the mortality of acute renal failure patients. It was developed by Liano et al.[2] It is calculated by the formula; Individual Severity Index=0.032* (age in decades) -0.086* (male)-0.109* (pure nephrotoxin in acute tubular necrosis) +0.109* (Oliguria) +0.116* (hypotension) + 0.122* (jaundice) +0.150* (coma) -0.154* (consciousness) +0.182* (assisted respiration) +0.210; where Oliguria is urine output of less than 400ml/24hours. Hypotension is systolic blood pressure less than 100mm of Hg for at least 10 hours/day independent of use of vaso active drugs. Jaundice is serum bilirubin more than 2mg/dl. Coma is Glasgow Coma Scale is 5 or less.

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Conflict of interest

Author declares that there is no conflict of interest.

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