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Original Research Article**DOI: <http://dx.doi.org/10.22192/ijcrbm.2018.03.04.008>****Clinical Profile and Outcome of Cases of Acute Kidney Injury
in a Tertiary Care Centre requiring Continuous Renal
Replacement therapy****Maj (Dr) Anup Kanwar¹, Lt Col (Dr) Ashutosh Ojha²,
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Abstract

Acute kidney injury is defined as a significant decline in renal excretory function occurring over hours to days. In a teaching hospital study over period of 3 years for patients admitted for more than 24hrs 18% of patients had AKI. 9.1% were of class Risk, 5.2% were of class Injury & 3.7% were of class failure. (1). There are very few guidelines on management of AKI critically ill patients. There is limited availability of CRRT worldwide and hence very few study on patient profile, complication profile and survival outcome has been done in the country. We did the observational study on the patients undergoing the CRRT at our tertiary care teaching hospital in western India. We carried out the study for around 19 months and studied all the patient on CRRT who have not been previously received Renal replacement therapy of any kind. We found that in our study Male patient were of mean age 58.6 with APACHE score of 30.67, while female patients were of 45.13 yrs and APACHE score of 28.72. All the patients had 77 hypotension, dyselectrolytemia and acidosis as indication of CRRT. Most common comorbidities were Type 2 Diabetes, Hypertension or their combination. 67.23% patients were in Class FAILURE of RIFLE classification. 100% required CRRT. The outcome analysis was done as survivor or fatality. In subgroup analysis of survivors, it was noted that they had less severe complications as acidosis, dyselectrolytemia, better APACHE score. There was no difference in male to female survival, but most probably due better age profile and better APACHE score. No benefit on survival was noted with early institution of CRRT.

Keywords: CRRT . Survival analysis on CCRT, Timing of CCRT and Survival .

Introduction

Acute kidney injury is defined as a significant decline in renal excretory function occurring over hours to days. Usually is detected by a rise in serum creatinine usually along with oliguria which is defined as urine output less than 400ml/day (arbitrarily selected value).AKI is very common in critically ill patients. In a teaching hospital study over period of 3 years for patients admitted for more than 24hrs 18% of patients had AKI. 9.1% were of class Risk, 5.2% were of class Injury& 3.7% were of class failure. Mortality increases as RIFLE class increases(Uchino, Bellomo, Goldsmith, Bates, & Ronco, 2006). Similar study earlier done from 1989 to 1999 revealed presence of AKI increases hospital mortality & renal replacement therapy is not an independent risk factor(Ostermann& Chang, 2007).

Mortality among ICU patients with acute kidney injury and multiorgan failure has been reported to be more than 50%. If renal-replacement therapy is required, mortality may be as high as 80%.(Tolwani, 2012).Severity of AKI is assessed as per RIFLE and AKIN criteria.Though most patients recover from AKI spontaneously however some people require RRT support temporarily & some become RRT dependent.

Urgent RRT is required in cases of:-

Fluid overload
Hyperkalemia
Uremic encephalopathy
Uremic pericarditis
Metabolic acidosis unresponsive to medical measures.

There are very limited options of renal replacement therapy in very sick patient who are mostly hemodynamically unstable and hence require renal replacement therapy in form of Continuous Renal Replacement therapy. The CRRT has very limited availability and very few study are available regarding the profile of the patient and complication profile and outcome. Hence, this study was planned at the tertiary care teaching hospital.



CRRT Machine-Low Volume

Aim and Objective

To study the clinical profile & complications profile of patients on continuous renal replacement therapy and factors affecting outcome in patients on continuous renal replacement therapy.

Materials and Methods

A Prospective observational study of 1.5 yrs duration (November 2013 to June 2015) at tertiary care teaching hospital was done

Sample size

90 patients getting Continuous Renal Replacement Therapy in ICU of a tertiary care hospital.

Inclusion criteria

- All patients admitted in ICU & on CRRT above the age of 18 yrs.

Exclusion criteria

- Patients who have already received sessions of Hemodialysis previously.
- Pregnancy
- Age <18 yr
- Treating physician or NOK did not give consent
- **Outcome:** Survival / Mortality

Methodology

All patients admitted to ICU & on Continuous Renal Replacement Therapy, as per inclusion & exclusion criteria were included in the study. History, clinical examination findings & investigations were recorded as per the Performa. Outcome was documented after completion of the therapy & discharge from ICU. Analysis of the various parameters was done so as to determine their influence on the outcome. Only external observation was done no interference in patient management were done.

Analysis

The data was analysed using SPSS- 18 statistical software.

Results

Mean Age-The mean age of the patients enrolled in study in case of males was 58.57yrs & females was 45.13yrs. Those who survived with normal renal function was 53.5yr, those with abnormal renal function was 47.25yrs & those who died was 51.83yr.

APACHE -2 Score-The mean Apache-2 score at outset was 30.67 in case of males & 28.72 in females. Those who survived with normal renal function was 29.23, those with abnormal renal function was 28.57 & those who died was 29.93.

Duration of CRRT-Mean duration of CRRT in males was 79.49 & females 72.65 hrs. Those who survived with normal renal function was 85.69, those with abnormal renal function was 80.85hr.

Showing differences between sexes with reference to APACHE-2, Age, Duration of CRRT & GCS Descriptive Statistics-Table 1

Statistic	Age		APACHE- 2 Score		Duration of CRRT		GCS		
	Female	Male	Female	Male	Female	Male	Female	Male	
Mean	45.13	58.57	28.72	30.67	72.65	79.49	9.74	9.12	
Std. Error of Mean	2.79	2.15	0.67	0.67	2.88	2.78	0.28	0.31	
95% Confidence Interval for Mean	Lower Bound	39.50	54.26	27.37	29.32	66.85	73.91	9.17	8.50
	Upper Bound	50.76	62.88	30.07	32.02	78.46	85.07	10.31	9.73
5% Trimmed Mean	45.03	58.74	28.64	30.75	72.26	79.08	9.60	9.14	
Median	46.00	68.00	28.00	32.00	74.00	76.00	9.00	9.00	
Variance	358.87	235.01	20.65	22.99	382.32	393.85	3.66	4.79	
Std. Deviation	18.94	15.33	4.54	4.79	19.55	19.85	1.91	2.19	
Minimum	16.00	32.00	20.00	22.00	44.00	50.00	7.00	4.00	
Maximum	76.00	83.00	38.00	38.00	108.00	118.00	15.00	14.00	
Range	60.00	51.00	18.00	16.00	64.00	68.00	8.00	10.00	
Interquartile Range	29.75	26.00	6.00	6.00	38.00	26.00	1.00	2.00	
Skewness	-0.04	-0.30	0.22	-0.22	0.21	0.10	1.30	-0.13	
Std. Error	0.35	0.33	0.35	0.33	0.35	0.33	0.35	0.33	
Kurtosis	-1.13	-1.33	-0.62	-1.02	-1.09	-0.88	1.84	0.60	
Std. Error	0.69	0.66	0.69	0.66	0.69	0.66	0.69	0.66	

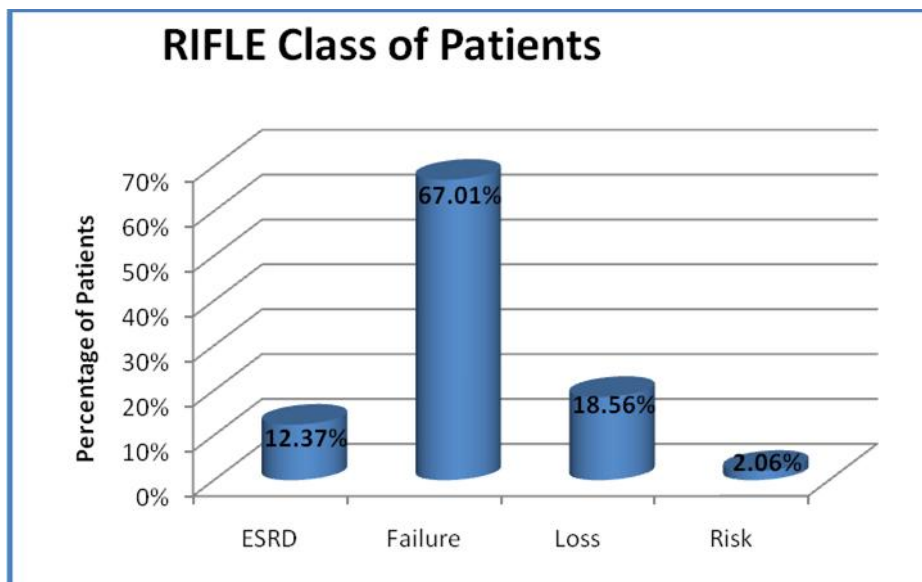
Patient profile -Mean GCS in males was 9.12 & females was 9.74. Those who survived with normal renal function were 7.8, those with abnormal renal function were 9.28 & those who died were 9.68. T-test for equality of mean showed statistical significance in case of distribution of sex & Apache-2 score distribution. In case of distribution of GCS & CRRT duration no statistical significance was found. We had 52.58% of our patients as males & 47.42% as females. The age group distribution of our patients was 25.77% (44-57yrs), 24.74%(58-71yrs),22.68%(30-43yrs),15.46%(72-85yrs) & 11.34% (16-29yrs).

Co-morbidity profile revealed maximum patients were having Hypertension & Type-2 Diabetes Mellitus (30.93%) followed by only hypertension (20.62%) & only Type-2 Diabetes Mellitus (16.49%). The primary diagnosis at admission in maximum patients was Bilateral pneumonia (15.46%), Urosepsis (10.31%) followed by Rt lower lobe pneumonia (6.19%). Maximum patients had temperature distribution 56.80% (38.5 – 38.9 F) & 29.9%(36-38.5 F). Amongst all the patients 61.86% had mean arterial pressure between 50 – 69mm Hg, 32.99% had

between 70 – 109 mm Hg. 67.01 % patients had heart rate between 110 – 139 bpm, 20.62% had between 140 to 179bpm & 8.25% had between 70 to 109 bpm.

Respiratory Complications & Hemodynamic Instability-91.75% patients had respiratory rate between 25 to 34/min. 62.89% patients at presentation had PaO2 between 70 & 200 mmHg, 28.87% had between 61 & 70mmHg. 67.01% patients had pH between 7.25 & 7.32, 18.56% had between 7.15 & 7.24. At presentation 52.58% patients had serum sodium levels between 130 to 149mEq/L, 21.80% had between 120 to 129mEq/L, 13.40% had between 111 to 119mEq/L. 56.70% patients had serum potassium between 3.5 to 5.4 mEq/L, 40.21% had between 5.5 to 5.9mEq/L. 46.39% patients had serum creatinine between 2- 3.4mg/dl & were in ARF, 35.05% had between 1.5 – 1.9 mg/dl & in ARF & 15.46% had >3.5 mg/dl with ARF. 60.82% patients at presentation had a hematocrit of 30 – 45.9 & 26.80% had between 20 – 29.9. 43.30% had TLC between 15000 to 19900, 36.08% had between 20000 to 39900& 16.49% had between 300 to 14900.

Figure 1



Considering individually, 22.68% had GCS of 9 at presentation, 21.65% had 10, 20.62% had 8, 9.28% had 7 , 8.25% had 11 & 12 respectively. 73.20% patients had a non-surgical problem, 14.43% were requiring emergency surgery & 10.31% required elective surgery. 67.01% patients were in RIFLE class of failure, 18.56% were in loss & 12.37% were ESRD. 40.27% patients were admitted to ICU due to

dys electrolytemia, hypotension, sepsis & uremia, 34.02% due to hypotension, sepsis & uremia. CRRT was started in 30.93% patients due to encephalopathy, hyperkalemia, metabolic acidosis & uremia, 22.68% due to hyperkalemia, metabolic acidosis & uremia, 16.49% due to metabolic acidosis & uremia, 11.34% due to hyperkalemia, metabolic acidosis & uremia.

Co-morbidities-Table 2

	Frequency	Percent
Chronic liver disease, Chronic lung disease	3	3.09%
Chronic liver disease, Hypertension	2	2.06%
Chronic liver disease, Hypertension, Stroke	2	2.06%
Chronic lung disease, Hypertension, Type-2 Diabetes Mellitus	12	12.37%
Hypertension	20	20.62%
Hypertension, Stroke, Type-2 Diabetes Mellitus	8	8.25%
Hypertension, Type-2 Diabetes Mellitus	30	30.93%
None	1	1.03%
Stroke	3	3.09%
Type-2 Diabetes Mellitus	16	16.49%
Total	97	100.00%

CRRT-100% patients received low flow CVVHD. 85.57% receiving heparin as anticoagulant, 2.06% receiving heparin free dialysis, 12.37% received nothing in view of deranged coagulation profile. During therapy 43.30% developed hypothermia, 17.53% developed hypothermia & thrombosis of access, 12.37% developed only access thrombosis & 16.49% had no complications. 79.38% patients succumbed to their illness, 13.40% survived with a normal RFT & 7.22% survived with a abnormal RFT. 29.90% patients a APACHE-2 score between 28-31, 25.77% had between 32-35, 19.59% had between 24-27, 14.43% had between 36-39 & 10.31 had between 20-23. 26.80% received CRRT for 44-58 hrs, 23.7% received for 74- 88 hrs, 18.56% received for 59-73hrs & 89-103hrs, 12.37% received it for 104 -118 hrs.

Comorbidities-21.6% male patients had hypertension compared to 19.6% on female side, 13.7% male patients had only Type-2 Diabetes mellitus compared to 19.6% females, a combination of hypertension & Type-2 Diabetes mellitus was seen in 31.4% males compared to 30.4% females, 11.8% males had chronic lung disease in addition to hypertension & Type-2 Diabetes mellitus compared to 13% in females. Pearson chisquare test revealed these differences among sex to be insignificant. The primary diagnosis in case of males was acute cerebellar infarct(5.9%), Acute kidney injury(3.9%), AIDP (7.8%), MI(3.9%), dissection of dissection of aorta (3.9%), b/l pneumonia 21.6%, operated carcinoma caecum (3.9%), carcinoma colon (3.9%), stroke (3.9%), perforated duodenal ulcer (3.9%), bleeding gastric ulcer (3.9%), Rt lower lobe

pneumonia (15.6%), sepsis & stills disease (3.9%) & urosepsis (9.8%). In case of females primary diagnosis were AML (8.6%), adeno carcinoma stomach (4.3%), b/l pneumonia (8.7%), carcinoma gall bladder (4.3%), carcinoma ovary (8.7%), CCF (4.3%) , colonic carcinoma (4.3%), ludwigs angina (4.3%), lupus nephritis (10.9%), poly trauma, peritonitis & post tubercular bronchiectasis (4.3%), gangrene lower limbs (4.3%) & urosepsis (10.9%). Pearson chi square test revealed these differences to be significant.

Temperature, MAP, heart rate, respiratory rate, PaO₂, pH, S.potassium, S.creatinine, TLC, type of treatment required, APACHE-2, duration of CRRT, RIFLE class, final outcome were not affected by sex distribution.

S.sodium , hematocrit, GCS, age , indication of ICU admission, indication for CRRT, complications of CRRT, had significant differences in sex distribution .

Age revealed in case of 72-85yrs 19.6% were males & 10.9% females, 58-71yrs 31.4% were males & 17.4% were females. 44-57yrs 25.5% were males & 26.1% were females. 30-43 yrs 23.5% were males & 21.7% were females. ICU admission in case of males was due to sepsis, uremia, hypotension, fluid overload. In case of females was due to dyselectrolytemia ,uremia, hypotension, sepsis, fluid overload. In males CRRT was started due to encephalopathy, metabolic acidosis, fluid overload, uremia, hyperkalemia. In case of females was due to hyperkalemia, encephalopathy, metabolic acidosis & uremia.

Table 3 Independent Samples t-Test (t-test for Equality of Means)

	t	df	P-Value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Age	-3.856	95	<0.0001	-13.438	3.485	-20.356	-6.520
GCS	1.482	95	0.142	.621	.419	-.211	1.454
APACHE- 2 Score	-2.049	95	0.043	-1.949	.951	-3.838	-.061
Duration of CRRT	-1.706	95	0.091	-6.838	4.007	-14.794	1.118

Indication of CRRT-Table 4

	Frequency	Percent
Encephalopathy, Hyperkalemia, Metabolic Acidosis, Uremia	30	30.93%
Encephalopathy, Hyperkalemia, Uremia	2	2.06%
Encephalopathy, Metabolic Acidosis	4	4.12%
Encephalopathy, Metabolic Acidosis, Uremia	22	22.68%
Fluid overload	2	2.06%
Fluid overload, Hyperkalemia, Metabolic Acidosis, Uremia	2	2.06%
Fluid overload, Metabolic Acidosis, Uremia	4	4.12%
Hyperkalemia, Metabolic Acidosis, Uremia	11	11.34%
Metabolic Acidosis	4	4.12%
Metabolic Acidosis, Uremia	16	16.49%
Total	97	100.00%

SUB Group Analysis-A sub group analysis showed that those patients who survived with a normal renal function had average APACHE-2 score of 29.23 compared to 28.57 & 29.93 who had abnormal renal function & fatalities. Survivors with a normal renal function had an average GCS of 7.8 compared with 9.28 & 9.41 of survivors with abnormal renal function & fatalities. Survivors with normal renal function had average duration of CRRT as 16.61hrs compared to 80.85 & 70.05 hrs of survivors with abnormal renal function & fatalities. Normal recovery of renal function group had hypothermia & thrombosis as chief

complaints compared to abnormal recovery group who had bleeding in addition & fatalities who had infection also. Normal recovery group were primarily admitted in ICU for sepsis compared with abnormal recovery & fatality group who had hypotension & uremia as majority cause of admission. CRRT was given for hyperkalemia in addition to acidosis & uremia in normal recovery group compared to fatality & abnormal recovery group where acidosis & uremia was primary cause. At presentation normal recovery group had less severe acidosis compared to other two groups.

Complications during CRRT –Table 5

	Frequency	Percent
Bleeding, Hypothermia	2	2.06%
Bleeding, Hypothermia, Infection	2	2.06%
Bleeding, Thrombosis	2	2.06%
Hypothermia	42	43.30%
Hypothermia, Infection	4	4.12%
Hypothermia, Thrombosis	17	17.53%
Nil	16	16.49%
Thrombosis	12	12.37%
Total	97	100.00%

Both sexes had significant difference in age at presentation with younger females getting more affected & older males getting affected.

Table 6 Age * Sex

		Sex		Total	
		Female	Male		
16 - 29	Count	11	0	11	
	% within Sex	23.9%	0.0%	11.3%	
30 - 43	Count	10	12	22	
	% within Sex	21.7%	23.5%	22.7%	
44 - 57	Count	12	13	25	
	% within Sex	26.1%	25.5%	25.8%	
58 - 71	Count	8	16	24	
	% within Sex	17.4%	31.4%	24.7%	
72 - 85	Count	5	10	15	
	% within Sex	10.9%	19.6%	15.5%	
		Count	46	51	97
		% within Sex	100.0%	100.0%	100.0%

	Value	df	P-Value
Pearson Chi-Square	15.338 ^a	4	.004

There was no significant difference in outcome between the two sexes.

Table 7 Outcome * Sex

		Sex		Total
		Female	Male	
Fatality	Count	37	40	77
	% within Sex	80.4%	78.4%	79.4%
Survival with abnormal RFT	Count	3	4	7
	% within Sex	6.5%	7.8%	7.2%
Survival with normal RFT	Count	6	7	13
	% within Sex	13.0%	13.7%	13.4%
Total	Count	46	51	97
	% within Sex	100.0%	100.0%	100.0%

	Value	df	P-Value
Pearson Chi-Square	0.079	2	0.961

Discussion

In view of the background, we tried to study the profile of patients undergoing CRRT in ICU of a tertiary care facility & tried to correlate various baseline variables along with treatment decisions taken with the outcome. Throughout the study we were an external observer only & we did not interfered in any of the treatment decisions.

Patients were enrolled into the study after detailed explanation about the aim, objectives & methodology of the study. During the study period 138 patients were put on CRRT in the ICU being studied. However amongst them 36 were excluded from the study in view of them having received RRT in past, 2 were unwilling for the study. Hence we studied 96 patients after excluding patients as per exclusion criteria.

These patients were assessed historically, clinically & lab investigations wise along with previous medical documents. A time line of disease was made wrt initiation, progression & treatment administered. Assessment at onset of disease was done & after discharge from ICU was done. At completion of ICU stay patient was classified as fatality, recovery with normal renal function & abnormal renal function.

The baseline variables along with time of injury & initiation of CCRT were considered with reference to the outcome.

A detailed statistical analysis was done & following findings were found.

- Females in the study were younger than males by 13 yrs with statistical significance. Males had a higher APACHE-2 score than females by 2 with statistical significance. GCS were same in both males & females.
- Mean duration of CRRT in males was higher than females by 7 hrs but statistically insignificant.
- Hypertension, Type-2 Diabetes mellitus or combination was the most common co-morbidity.
- Primary diagnosis was bilateral pneumonia & urosepsis. Maximum patients were febrile, tachypnoeic & hypotensive and many were not hypoxemia but were acidotic with Majority were anemic with raised TLC. Majority had normal Serum Sodium and Potassium also were in ARF with s.creatinine between 2- 3.4mg/dl (Injury and Failure Group of RIFLE)
- Temperature, MAP, heart rate, respiratory rate, PaO₂, pH, S.potassium, S.creatinine, TLC, type of treatment required, APACHE-2, duration of CRRT, RIFLE class, final outcome were not affected by sex distribution.
- S.sodium, hematocrit, GCS, age, indication of ICU admission, indication for CRRT, complications of CRRT, had significant differences in sex distribution.
- No statistically significant difference in time of initiation of CRRT after insult.
- No statistically significant difference was found among survivors & those who died with reference to GCS & duration of CRRT
- Significant statistical difference was there among those who survived & those who died with reference to APACHE-2 score distribution with those surviving having a better score.
- No effects on outcome by time of initiation of CRRT.

- A subgroup analysis showed that those who survived with a normal renal function were primarily infection induced AKI with no surgical procedure having been performed.

- Those who survived with a normal renal function had hyperkalemia and normal pH as one of the indications of CRRT in addition to acidosis, encephalopathy & uremia compared with those who had abnormal renal function.

- Those whose renal function recovered had less of hypotensive & uremic patients and had less requirement of CRRT rather more of sepsis induced AKI ones however those with abnormal renal function had more of uremic & hypotensive patients. This difference could have been due to less severe injury in case of survivors, in view of small sample size of study hence needs to be confirmed by other studies. However on the basis this study we can say that timing of CRRT has got no advantage with reference to survival.

Conclusion

In this study finally, we have concluded that AKI can only be prevented, once it occur it follows its complete course. Treatment in form of modalities like CRRT can only supplement renal function. These modalities have no impact on the recovery of the patients' kidney from insult. So ,early initiation of CRRT has no benefit when compared to later initiation. Patients requiring less duration of CRRT fare better with reference to survival & preservation of renal function. Similarly those who have a less severe injury have better outcome as made evident by the fact that those who had better APACHE-2, less hypotension, less uremia, less alteration of blood pH & more of electrolyte disturbance had more chances of recovery with a normal renal function. we found there are significant differences in many baseline parameters with reference to sex which might have ultimately influence the outcome . However, to follow results of this study more similar studies have to be done to confirm results of this study.

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