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Cystatin C Levels as a Prognostic Index in Acute Kidney Injury in Intensive Care Unit Patients

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ABSTRACT

Objectives: To study correlation of cystatin C levels in prognosis of AKI. Assessment of relation of cystatin C levels with outcome, severity of AKI.

Materials and methods: Single centre, Prospective, Observational Study done in patients admitted in ICU at Sree Balaji Medical College and Hospital, Chennai. 60 Patients who fulfilled the inclusion and exclusion criteria were included in study.

Results: At the end of study, 25 patients were dead (non survivors) and 35 patients were alive (survivors). We observed that there is no significant difference (p value > 0.05) in mean age of survivors and mean age of non survivors in our study. We observed that there is no significant difference (p value > 0.05) in gender wise mortality rates in AKI patients admitted in ICU.

Conclusion: Serum cystatin C levels have prognostic value in terms of mortality in Acute Kidney Injury patients admitted in Intensive Care Unit.

Key words: Acute kidney injury, Cystatin C, Intensive care unit

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INTRODUCTION

Acute kidney injury, earlier called as acute renal failure, results from sudden impairment of renal function which causes retention waste products in body. AKI is group of conditions which share common features like an increase in concentration of the BUN and/or an increase in concentration of creatinine in the plasma or serum, often associated with a reduction in urine volume. AKI is associated with a markedly increased mortality, particularly in ICU admitted patients. The poor outcome in AKI is due to delay in diagnosis and initiation of dialysis. The delay in dialysis initiation is partly due to the lack of a timely and accurate biomarker to predict the AKI and its severity. Even though they have limitations, still at present SCr and UO are used as a standard indicator to give clue about the kidney functions. The specificity and sensitivity of SCr and UO is limited [1-4].

Newer biomarkers like neutrophil gelatinase associated lipocalin, kidney injury molecule -1, interleukin -18 and cystatin C are being studied in many studies for their use in AKI in early diagnosis and to predict the severity of AKI. Out of them the one which is considered as a good biomarker for the reflection of kidney function is CysC. This is because of its properties like, there are many studies done in relation to role of CysC in AKI. Studies have shown that CysC is a better marker for early diagnosis of AKI than Serum Creatinine. AKI if not treated properly and timely affects the prognosis and have complications which can be avoided by timely measures and treatment. There are no standard markers which can give clue about the prognosis of AKI. Very few studies are done

to know the standard marker which can detect prognosis of AKI, duration of ICU stay in case of AKI patients and need for haemodialysis in AKI [5,6].

Hence it is important to find out the standard marker which gives clue about the prognosis of AKI to take proper and required steps to improve the outcome of AKI. In this study we compared the correlation of CysC level with severity of AKI and outcome of AKI is studied.

MATERIALS AND METHODS

Source of data

Patients admitted in ICU at SBMCH, Chennai.

Type of study

Single centre, prospective, observational study.

Inclusion criteria

Patients admitted in ICU and diagnosed with AKI.

Exclusion criteria

Known and newly diagnosed case of chronic kidney disease.

Sample size

60 patients.

Methodology

Patients who were admitted in ICU at SBMCH, Chennai and who fulfilled the inclusion criteria were included in study after getting consent. Already known and new diagnosed cases of CKD were excluded from study. History was taken and detailed clinical examination with vitals was done. Baseline investigations were done. USG abdomen was done for all patients to assess the renal size and texture to rule out CKD. Cystatin C levels were checked once patient was diagnosed to have AKI. Patients were be followed during their ICU stay for duration of ICU stay and patients who needed dialysis were noted. Following discharge from hospital patients were be followed up for the period of 1 month and mortality rates were compared with cystatin C levels.

RESULTS

Our study population was 60 which included 26 male patients (43.3 % of the study population) with the remainder 34 being female patients (56.7% of the study population) (Figure 1). In our study, out of the total 60 patients, 2 patients underwent haemodialysis during the study period i.e 3.3% of the total study population (Table 1).

In this study, the patients were monitored throughout the ICU stay and followed up till 1 month after discharge. At the end of follow up out of the 60 patients, 25 were dead (41.7% of the study population) and 35 patients were alive (58.3% of the study population). We have denoted those who were dead at the end of follow up as non survivors and those who were alive at the end of follow up as survivors (Figure 2).

In our study out of total 34 female participants, 14 were no survivors at the end of follow up which is 41.17 % of the total female population and 20 were survivors at the end of follow up which is 58.82% of the total female population. After applying chi-square test there is no significant difference (p value > 0.05) between outcome (survivor and non-survivor) and gender at the end of follow up (Table 2).

The mean Serum cystatin C levels in non-survivors (population dead at the end of follow up) was 2.50 mg/l while that in survivors (population alive at the end of follow up) it was 1.50 mg/l (Figure 3).

In our study mean ICU stay for survivors (population alive at the end of follow up) was 8 days while mean ICU stay for non survivors (population dead at the end of follow up) was 7 days (Figure 4). In our study it was seen that there is no significant correlation (p Value > 0.05) between Serum cystatin C levels and duration of ICU stay (Figure 5).

Area under the curve

The test result variable(s): SERUM CYSTATIN C has at least one t ie between the positive actual state group and the negative actual state group. Statistics may be biased. a. Under the nonparametric assumption b. Null hypothesis: true area=0.5 Area under the curve=0.879 and p vaule is 0.0005, which is statistically highly significant. This shows the cut off value of serum cystatin C for outcome at the end of follow up is 1.79, with sensitivity of 84% and specificity of 88% (Table 3).

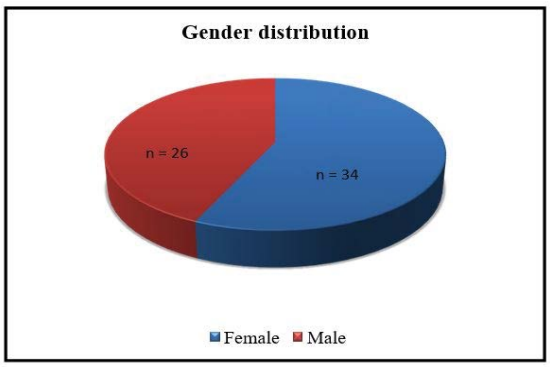

Figure 1: Distribution of patients according to their gender.

Table 1: Distribution of the patients according to Haemodialysis.

	Frequency	Percent
No	58	96.7
Yes	2	3.3
Total	60	100

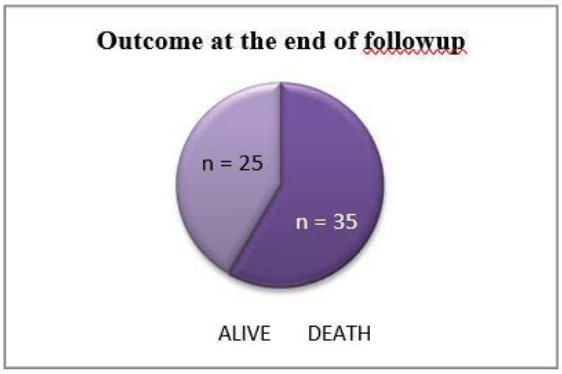

Figure 2: Outcome at the end of follow-up.

Table 2: Gender wise outcome.

Crosstab					
			Outcome at the end of follow up		Total
			Dead	Alive	
Sex	F	Count	14	20	34
		%	56.00%	57.10%	
	M	Count	11	15	26
		%	44.00%	42.90%	
Total		Count	25	35	60
		%	100.00%	100.00%	

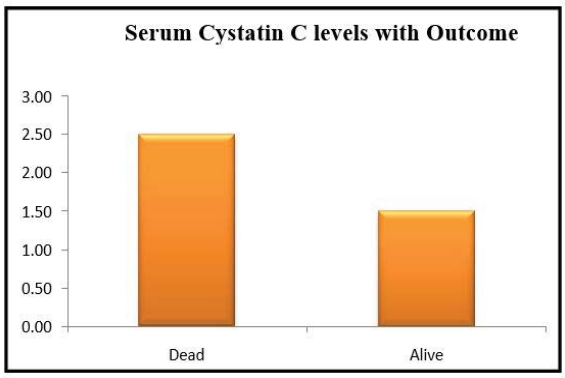

Figure 3: Serum cystatin C levels and outcome.

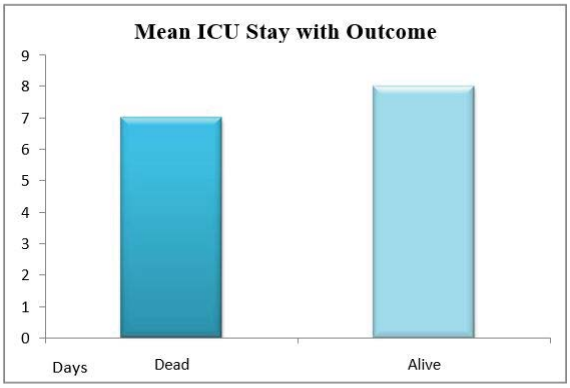

Figure 4: Mean ICU stay with outcome.

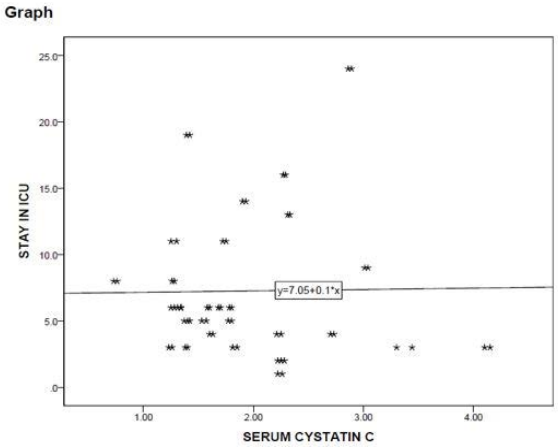

Figure 5: Serum cystatin C levels and ICU stay.

Table 3: ROC curve.

Area	P value	Asymptotic 95% Confidence Interval	
		Lower Bound	Upper Bound
0.879	0.0005	0.766	0.992

DISCUSSION

Serum cystatin C is better marker than SCr for the earlier diagnosis of AKI. The role of CysC in the early diagnosis of AKI is well known and many studies have proved that CysC diagnoses AKI about 48 hours earlier than serum creatinine. In our study we have put a null hypothesis that serum cystatin C levels can be used for prognosis in AKI in ICU patients. Our aim was to find out whether serum cystatin C levels are related to outcome in terms of mortality at the end of 1 month of follow up i n AKI patients admitted in ICU. Also, our aim was to find out whether duration of ICU stay, need for haemodialysis in AKI patients admitted in ICU is related to serum cystatin C levels. Our study included 60 patients who were admitted in ICU and diagnosed as AKI at SBMCH, Chennai. Out of 60 patients 26 were male patients i.e 43.3% of the study population and 34 were female patients i.e., 56.7% of the study population [7,8].

At the end of study i.e., at the end of follow up of 1 month, 25 patients were dead (non survivors) i.e 41.7% of the study population were no survivors. 35 patients were alive (survivors) at the end of follow up i.e 58.3% of the study population. We have denoted those who were dead at the end of follow up as non survivors and those who were alive at the end of follow up as survivors [9]. The mean age of the survivors in our study was 63 years and the mean age of non survivors in our study was 69 years. On applying Student T test for independent samples, there is no significant difference (p value > 0.05) in mean age of survivors and mean age of non survivors in our study.

Out of the total 25 non survivors, 14 patients were female (56% of non survivors) and 11

patients were male (44% of survivors). Out of the total 35 survivors, 20 patients were female (57.1% of survivors) and 15 patients were male (42.9% of survivors). After applying chi-squre test there is no significant difference (p value > 0.05) in gender wise outcome in terms of mortality at the end of the follow up period. We observed that there is no gender wise difference in mortality rates in AKI patients admited in ICU [10,11].

In our study out of the 60 patients only 2 patients underwent hemodialysis i.e 3.3% study population. Out of the 35 survivors at the end of the study only 2 patients underwent haemodialysis i.e 5.7% of the survivor population while none of the non survivors underwent haemodialysis. Since sufficient data is not available to compare CysC levels and need for haemodialysis, the comparison of CysC levels with need for haemodialysis in AKI patients admitted in ICU, cannot be done conclusively [12,13].

The mean serum CysC levels in survivors were 1.50 mg/l and mean serum CysC levels were 2.50 mg/l in non survivors. On applying Student T test for independent samples, there is highly significant difference (p value < 0.01) in mean CysC (2.50 mg/l) of non survivors and mean CysC (1.50 mg/l) of survivors. There is relation between CysC levels and 1 month mortality in AKI patients admitted in ICU. We found that serum CysC has prognostic value in terms of mortality in AKI patients admitted in ICU and it can be used as a prognostic index for mortality in AKI patients admitted in ICU [9]. There was no significant difference (p value > 0.05) between ICU stay of the patients as per CysC levels in study population. We found that there is no relation between CysC levels and duration of ICU stay in case of AKI patients admitted in ICU. In addition to what is known that CysC diagnoses AKI earlier than SCr, this study adds that CysC levels give clue about prognosis in terms of mortality in AKI patients admitted in ICU. This shows that the cystatin C acts as a combined marker for both early diagnosis and prognosis of AKI patients admitted in ICU. So early diagnosis of AKI can be done and if poor prognosis is suspected as indicated by cystatin C levels, then aggressive, adequate, proper measures can be taken to treat AKI in these patients to improve outcome [14,15].

We found that serum cystatin C levels have prognostic value in terms of mortality in AKI patients admitted in ICU and it can be used as a prognostic index for mortality in AKI patients admitted in ICU. We observed that Serum cystatin C levels does not predict duration of ICU stay in AKI patients admitted in ICU. We observed that there is no gender wise difference in mortality rates in AKI patients admitted in ICU.

CONCLUSION

Serum cystatin C levels have prognostic value in terms of mortality in Acute Kidney Injury patients admitted in Intensive Care Unit. Serum cystatin C levels can be used as a prognostic index for mortality in Acute Kidney Injury patients admitted in Intensive Care Unit.

FUNDING

No funding sources.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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