Evaluation of Acute Kidney Injury in Cases of Acute Gastroenteritis in a Tertiary Care Centre at Kolkata

Abhishek Mukherjee*, Indraneel Dasgupta**, Indranil Mitra***

Author's Affiliation: *Post–Graduate Trainee (Year 3), **Clinical Director and Head, ***Attending Consultant, Department of Emergency Medicine, Peerless Hospitex Hospital and & B.K.Roy Research Center, Kolkata, India.

Corresponding Author:
Abhishek Mukherjee, Post–Graduate Trainee (Year 3), Department of Emergency Medicine, Peerless Hospitex Hospital and & B.K.Roy Research Center, Kolkata - 700 094, West Bengal, India .
E-mail:
abhishek_mukherjee83@yahoo.com

Abstract

Background: Acute gastroenteritis is a common problem in developing countries like India. The most common complication of acute diarrhoea is dehydration leading to hypovolemia and further complications like acute kidney injury or acute renal failure due to loss of fluid and electrolytes and antimicrobials injury. Acute renal failure occurs due to quick volume depletion in diarrhoea and is even accelerated in the hot environment. Acute renal failure secondary to acute gastroenteritis is still a common problem in our country. So early referral and adequate replacement of fluid and electrolytes and antimicrobials can improve outcome in these patients. *Aims and objectives:* To find out the following: 1. Percentage of acute kidney injury in diarrhoea patients. 2. Associated conditions leading to increased acute kidney injury in diarrhoea patient. 3. Outcome of acute kidney injury in patients with diarrhoea. 4. Secondary aim of the study is to evaluate the adequacy of the treatment. *Material and Methods:* Patient parameters, like the time from the onset and time of attending the hospital, severity of diarrhoea, stool culture report (to identify causative organism) will be collected by the primary investigator. Associated factors like age, sex, co morbidities like Hypertension, Diabetes will be looked upon to link the percentage of occurrence relation with these factors. Creatinine will be evaluated at the time of admission and again re-evaluated after 48 hours. Patients with an increased serum Creatinine will be evaluated by the KDIGO criteria to be diagnosed as Acute Kidney injury. The percentage of patients developing acute kidney injury and started on treatment was regularly observed during their hospital stay by the principal researcher. *Results and Discussion:* It was noted that the incidence of acute kidney injury is 22% in the study which is pretty significant. The number of deaths that occurred during the study is only 2%. It was seen that earlier referral to a tertiary care hospital and timely replacement of fluids can decrease incidence of renal failure.

Keywords: Gastroenteritis; Acute Renal Failure.

Introduction

Acute gastroenteritis is a common problem in developing countries like India. It is one of the common causes of mortality and morbidity worldwide (Khalil et al 2009). The most common complication of acute diarrhoea is dehydration leading to hypovolemia and further complications like acute kidney injury or acute renal failure due to loss of fluid and electrolytes and antimicrobials injury. Acute Renal Failure (ARF) is defined as rapid (over hours to weeks) and usually at least partially reversible decline in glomerular filtration rate(GFR) that may occur either in the setting of pre-existing normal renal function(classic ARF) or in someone with pre-existing renal disease (acute on chronic renal failure) (Lameire et al (1995). Acute renal failure is usually due to quick volume depletion which occurs in diarrhoea and even accelerated in the hot environment like India. Acute renal failure secondary to acute gastroenteritis is still a common problem in our country. So early referral and adequate replacement of fluid and electrolytes and antimicrobials can improve outcome in these patients

(CMAJ 2005).

Wig et al (2001) in their study, concluded that rhabdomyolysis caused by electrolyte imbalance in acute gastroenteritis was a significant contributory factor for the development of Acute Renal Failure. However, Van Doom et al (2006) in their study of acute renal failure in salmonella gastroenteritis concluded that salmonella gastroenteritis in adults is frequently accompanied by renal dysfunctions that is caused by mechanism other then dehydration or rhabdomyolysis. This theory has been supported by Hideo et al (2005) in their study where they found that the infecting agent was also a significant contributing factor for acute renal failure.

Peirera et al (1989) studied 40 infants who developed acute renal failure in tropical environment over a period of 2 years. Acute Gastroenteritis was responsible in 55 % cases and the mortality was 75%. Naqvi et al (1996) analyzed the factors that leading to acute renal failure in 376 patients. Diarrhea was responsible in 30% cases. In another study, Rahid et al (1983) studied about 120 adult acute renal failure patients in Bangladesh. Of the 94 medical cases in their study, Gastroenteritis was responsible in 42 cases (35% of total). Several other previous studies done by Anderson et al (1977), Feest et al (1993) and Liano et al (1990) showed gastroenteritis is one of the major causes of acute renal failure in tropical countries.

Thus after reviewing all the studies it can easily be concluded that gastroenteritis is a leading cause of acute renal failure in developing countries. However, our literature search did not reveal any study done in India to look at incidence of acute kidney injury in diarrhoea.

Aim of the Study

1. Percentage of acute kidney injury in diarrhoea patients

2. Associated conditions leading to increased acute kidney injury in diarrhoea patient

3. Outcome of acute kidney injury in patients with diarrhoea.

4. Secondary aim of the study is to evaluate the adequacy of the treatment

Materials and Methods

This is a prospective observational study on all diarrhoea patients admitted in Peerless Hospital during the study period with clinical manifestations of acute gastro enteritis. For the purpose of this study, acute kidney injury was defined when one of the following criteria is me

5. Serum creatinine rises by $\geq 26\mu mol/L$ within 48 hours or

6. Serum creatinine rises ≥ 1.5 fold from the reference value, which is known or

7. Presumed to have occurred within one week or

8. Urine output is $< 0.5ml/kg/hr$ for >6 consecutive hours

The reference serum creatinine should be the lowest creatinine value recorded within 3 months of the event. This is in accordance to the Improving Global Outcomes (KDIGO) staging classification of acute kidney injury (AKI).

The study was conducted in the Department of Emergency Medicine of Peerless Hospital and B.K. Roy Research Centre, Kolkata from April 2014 to September 2014. Data was collected, from all participants fulfilling the inclusion criteria from Peerless Hospital and B.K. Roy Research Centre, Kolkata.

Inclusion Criterion

1. Presence of clinical manifestation of gastro enteritis.

2. All patients above 16 years of age.

Exclusion Criterion

1. Previous Chronic Kidney disease patients

2. Presence of any underlying Nephropathy

Patient parameters like the time from the onset and attending the hospital, severity of diarrhoea, stool culture report (to identify causative organism) was collected by the primary investigator. Associated factors like age, sex, co morbidities like Hypertension, Diabetes will be looked upon to link the percentage of occurrence relation with these factors. Follow up of the patient as long as the patient is admitted in the hospital. Demographic and socioeconomic data of these patients will be collected.

Creatinine was evaluated at the time of admission and again re-evaluated after 48 hours. Patients with an increased serum Creatinine will be evaluated by the KDIGO criteria to be diagnosed as Acute Kidney injury. The percentage of patients developing acute kidney injury and started on treatment will be regularly observed during their hospital stay by the principal researcher to see:

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1. Percentage of cases responding to medical treatment,

2. Percentage requiring Dialysis,

3. Percentage of self regression of the disease without any active intervention,

4. Percentage of patients dying on account of Acute Renal Failure.

5. If the patient required dialysis whether it was short term or long term.

6. Percentage of patients requiring long term dialysis gradually turned to chronic renal failure from acute renal failure.

Crude data was recorded in Microsoft Excel 8.0 and statistical analysis was done by our medical statistician.

Results

The purpose of this study was to find the incidence of acute kidney injury in cases of acute gastroenteritis in Kolkata. The secondary aim of our study was to find whether early referral to a tertiary care hospital and timely replacement of fluids can decrease incidence of renal failure.

A lot of interesting facts cropped up during the course of the study e.g. It was noted that the incidence of acute kidney injury is 22% in the study which is pretty significant. The number of deaths that occurred during the study is only 2% that is very low indicating good outcome.

Demographical & Clinical Feature of Enrolled Patients

Variable	Frequency N (%)
Sex	
Male	27 (54.0%)
Female	23 (46.0%)
Age Group(in yrs.)	
16-20	5 (10.0%)
20-30	6 (12.0%)
31-40	2 (4.0%)
41-50	5 (10.0%)
51-60	10 (20.0%)
61-70	7 (14.0%)
>70	15 (30.0%)
Body Weight (kg)	
41-50	7 (14.0%)
51-60	24 (48.0%)
61-70	15 (30.0%)
71-80	4 (8.0%)
No. of Stool /day	
1-5	10 (20.0%)
6-10	27 (54.0%)
10-15	8 (16.0%)
16-20	4 (8.0%)
21-25	1 (2.0%)
Heart Rate	
61-70	7 (14.0%)
71-80	7 (14.0%)
81-100	20 (40.0%)
100-120	8 (16.0%)
120-140	3 (6.0%)
Systolic Blood Pressure	
81-100	6 (12.0%)
101-120	19 (38.0%)
121-150	18 (36.0%)
>150	7 (14.0%)
Urine Output	
<0.5 ml/kg/hr for >6hr	4 (8.0%)
<0.5 ml/kg/hr for >12 hr	1 (2.0%)
0.5 -1 ml/kg/hr	21 (42.0%)
>1 ml/kg/hr	24 (48.0%)
Dehydration Status	
No	9 (18.0%)
Mild	21 (42.0%)
Moderate	19 (38.0%)

Variable	Frequency N(%)
Severe	1 (2.0%)
Duration of Diarrhoea	
12-24 hr.	3 (6.0%)
1-2 days	31 (62.0%)
2-4 days	13 (26.0%)
5-7 days	3 (6.0%)
Diabetes Mellitus	
Yes	19(38.0%)
No	31(62.0%)
Hypertension	
Yes	19(38.0%)
No	31(62.0%)
History of chronic kidney disease	
No	50(100%)
Assessed risk of AKI on admission	
Yes	17(34.0%)
No	33(66.0%)
Identified as being risk of AKI on admission	
Yes	17(34.0%)
No	33(66.0%)

Maximum Kidney Injury at the time of presentation occurred with normal sodium level but maximum kidney injury occurred after 48 hours were in the range of Sodium was 120 -129 Meq/L that is mild hyponatremia.

It was also found that lower the urine output the higher are the chances of acute kidney injury. Hence the more is the dehydration, the severe is the kidney injury.

Increased incidences of AKI were noted in patients with pre-existing coronary artery disease, Diabetes Mellitus but Hypertension and AKI could not linked as maximum subjects were normotensive in my study.

It was found that stool frequency had no direct effect on kidney injury. However the duration of diarrhoea had significant impact on the sample size. The highest incidence of AKI was seen in patients suffering in duration of more than one day with a p value of 0.19.
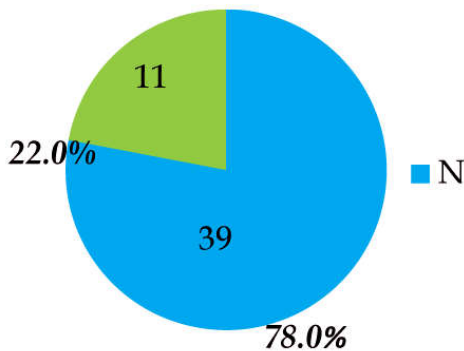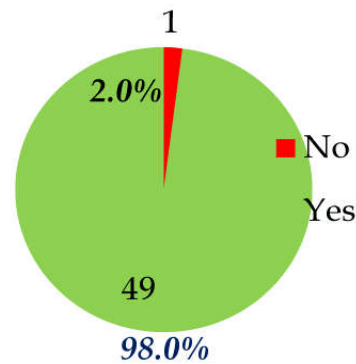

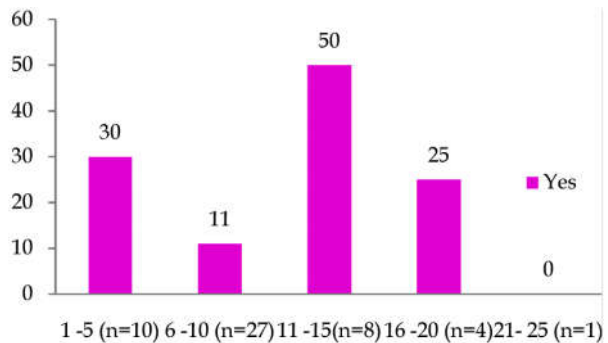Fig 2: Number of patients that survived

Fig 3: Association of kidney injury with frequency of loose motion

The population also had patients from various age groups ranging from more than sixteen to geriatric population. In fact seventeen patients were more than 70 years of age. This wide range added to the advantage of the study.

Hence if we go through the study we would see that the secondary aim was also fulfilled and it was seen that earlier referral to a tertiary care hospital and

Fig. 1: Presence of acute kidney injury

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timely replacement of fluids can decrease incidence of renal failure. It was seen that early intervention did not require Nephrologists consultation in more than 70% of patients, but there were increased incidences or renal replacement therapy in patients who already developed AKI. It was noted that the incidence of acute kidney injury is 22% in the study. The good thing was that most patients responded to medical therapy.
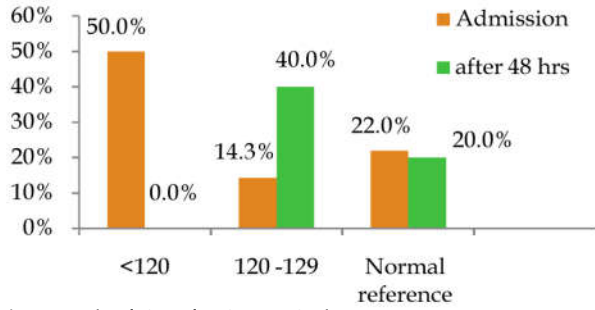
Fig. 4: Risk of AKI for Serum Sodium
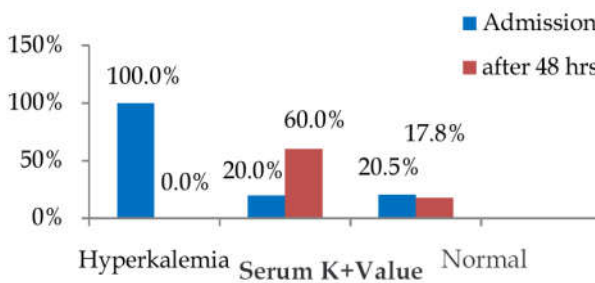
Fig. 5: The Risk Factor of Acute Kidney Injury for Serum Potassium
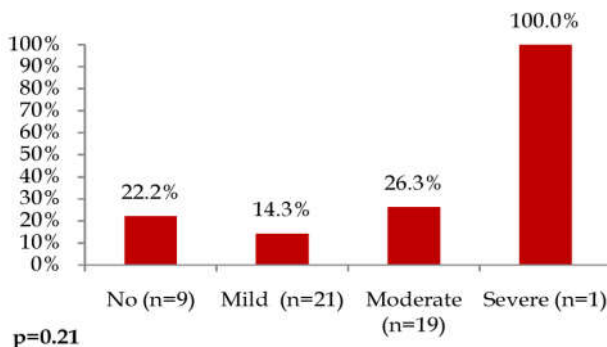

p=0.01
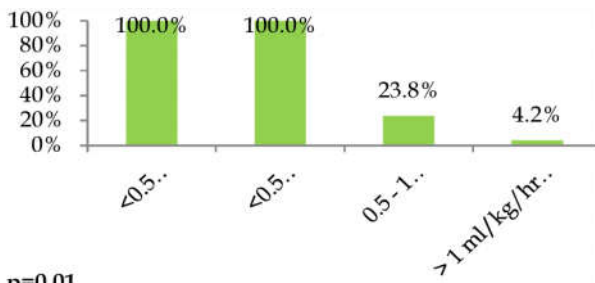
Fig. 6: Aassociation of urine output with AKI

p=0.21

Fig. 7: Association of dehydration status with AKI
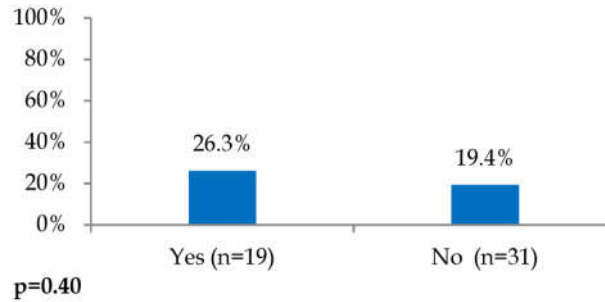

p=0.40

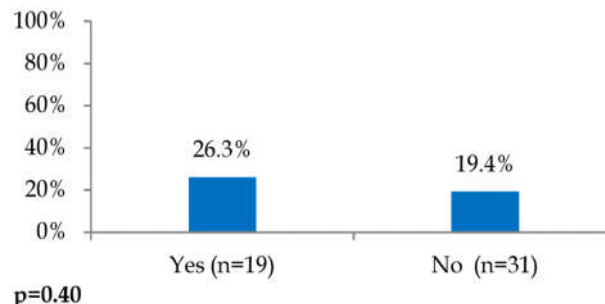**Fig. 8:** Association of loose motion with AKI

p=0.40

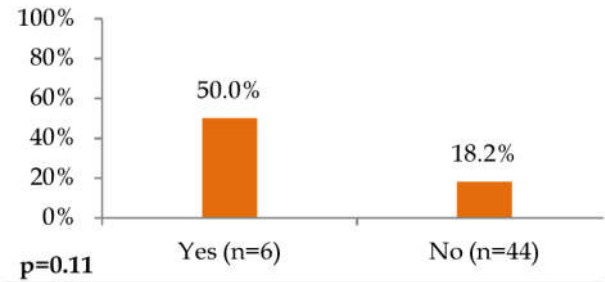**Fig. 9:** Association of diabetes mellitus with AKI

p=0.11

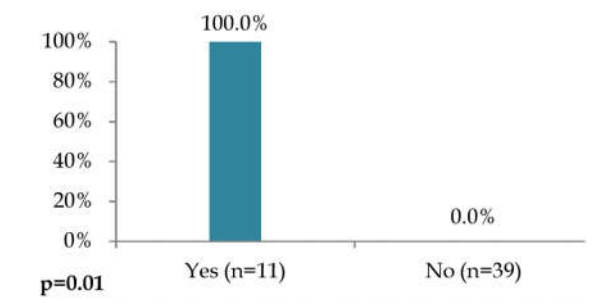**Fig. 10:** Increased incidence of CAD is noted in patients with AKI or kidney injury

p=0.01

Fig. 11: All patients responded to medical therapy
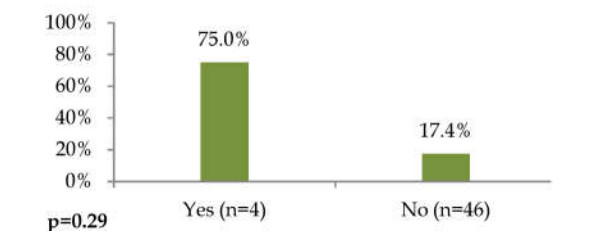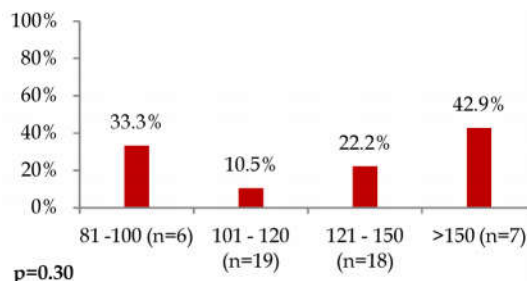

p=0.29

Fig. 12: Dialysis and AKI

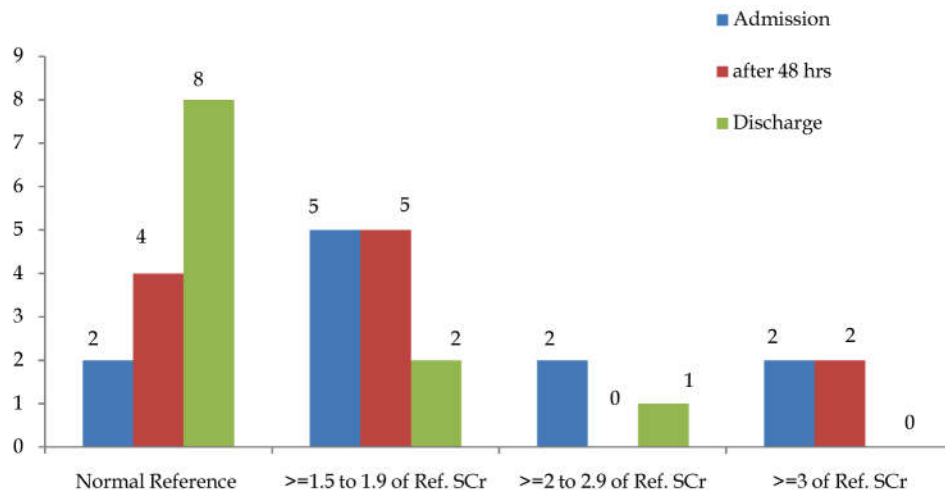**Fig. 13:** Association of systolic blood pressure with AKI

Fig. 14: Bar Diagram showing the changes of Serum Creatinine of AKI patients

Discussion

It was noted that the incidence of acute kidney injury is 22% in the study which is pretty significant. The number of deaths that occurred during the study is only 2% that is very low indicating good outcome. Maximum Kidney Injury at the time of presentation occurred with normal sodium level but maximum kidney injury occurred after 48 hours were in the range of Sodium was 120-129 Meq/L that is mild hyponatremia. The relationship between acute kidney injury and the number of loose stools was very erratic. The maximum number of cases of AKI, occurred with stool frequencies 11-15 followed by 1-5. Majority of enrolled patients had heart rate of more than eighty. Patients who satisfied KDIGO grade 1 were discharged (n=2).A significant risk factor existed for AKI in severe hyponatremia patients i.e. in the range of <120. But after 48 hours a significant number of patients with hyponatremia improved in the range of 120-129 which was mild. It is noted that the hyperkalemia also increase the incidence of kidney injury. But after 48 hours a significant number of patients had hypokalemia as well. It was also found that lower the urine output the higher are the chances

of acute kidney injury. Hence the more is the dehydration, the severe is the kidney injury. Increased incidences of AKI were noted in patients with pre-existing coronary artery disease, Diabetes Mellitus and Hypertension It was found that stool frequency had no direct effect on kidney injury. However the duration of diarrhea had significant impact on the sample size. The highest incidence of AKI was seen in patients suffering in duration of more than one day with a p value of 0.19.The population also had patients from various age groups ranging from more than sixteen to geriatric population. In fact seventeen patients were more than 70 years of age. This wide range added to the advantage of the study

Limitations of Study

Though there are several methods of calculating acute kidney injuries, this study will use only the KDIGO criterion. Thus the study will not be able to evaluate whether the results could be variable if the other formulas (sodium (Na) in urine, BLOOD UREA NITROGEN-TO-CREATININE RATIO (BUN: CREATININE), creatinine measurement, 24 hour urine, estimation of glomeruler filtration rate or creatinine clearance test, rifle criterion) were used. Also, the study does not look

into the long term prognosis and follow up of these patients.

Conclusion

The study concludes that there is significant incidence of Acute Renal Failure in patients presenting with Acute gastroenteritis in Kolkata. It was also found that the mortality was also decreased with early intervention.

The secondary aim was also fulfilled and it was seen that earlier referral to a tertiary care hospital and timely replacement of fluids can decrease incidence of renal failure. It was seen that early intervention did not require Nephrologists consultation in more than 70% of patients, but there were increased incidences or renal replacement therapy in patients who already developed AKI. It was noted that the incidence of acute kidney injury is 22% in the study. The good thing was that most patients responded to medical therapy.

The study paves a pathway for further bigger studies to occur so that we can overcome the limitation of confining ourselves to only one centre of Kolkata.

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