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# Clinical Profile and Management of Patients Admitted with Acute Kidney Injury Secondary to Gastroenteritis in a Tertiary Care Teaching Hospital

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## Abstract

**Aim:** To study clinical profile, laboratory features and importance of rehydration in patients admitted with acute kidney injury due to gastroenteritis. **Materials and Methods:** The study was carried out as a prospective observational study of 70 patients at medicine department of a medical college and tertiary health care center, over a period of two years that included cases of acute kidney injury due to gastroenteritis in the age group of 18-40 years. **Results:** Study showed male predominance (72.86%) in elderly age group. Prerenal type was more common (75.71%) as compared to acute tubular necrosis. Duration and frequency of diarrhea was associated with severity of the disease. Mortality was high (100%) in those who required more time (>12 hours) to achieve normal mean arterial pressure. Maximum deaths (93.33%) were observed in anuric patients. Most common complication observed was septicemia in 20% of patients. Overall mortality observed in our study was 21.43%, while 78.57% patients survived. Mortality was high in those having severe dehydration, high baseline creatinine, who received dialysis. **Conclusion:** Acute kidney injury due to gastroenteritis is preventable if presented early and adequate hydration can decrease mortality.

**Keywords:** Acute Kidney Injuries, Acute Tubular Necrosis Gastroenteritis, Mean Arterial Pressure

## 1. Introduction

Prevalence of Acute kidney Injury (AKI) is growing in developing countries and is linked with severe morbidity and mortality. Most etiologies of AKI are preventable by interventions at the individual, community, regional and in-hospital levels. Efforts should be focused on minimizing causes of AKI, rising awareness of the significance of sequential measurements of serum creatinine in high risk patients, and documenting urine volume in severely ill people to attain early diagnosis. Recent studies in the developed countries report AKI in 3.2-9.6% of admissions, with overall in-hospital mortality around 20%, and up to 50% in ICU patients[1,2]. The current

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KDIGO guidelines for management of AKI provide an helpful reference to assist clinicians for managing AKI, however the successful implementation of guidelines and their application to individual patients can be slow and requires concerted efforts[3,4]. Prevention of AKI starts in the community with prompt assessment of those at risk, for example in taking prompt action following effective evaluation of the severity of fluid depletion in acute diarrhea. Currently serum creatinine and urinary volume remain the clinical pointers to AKI diagnosis. In the hospital setting, AKI preventive measures include adequate hemodynamic control, hydration, hematocrit and oxygen profiling, avoidance of nephrotoxic drugs and preventive manoeuvres for particular diseases or conditions causing AKI. Prompt diagnosis, early treatment, timely haemodialysis and adequate supportive therapy are associated with improved outcome in AKI[5,6,7].

## 2. Materials and Methods

This was prospective observational study carried out in tertiary care teaching hospital with 70 patients included over period of two years.

### 2.1 Inclusion Criteria

- Diagnosed cases of acute kidney injury due to gastroenteritis of either sex in age group of 18-40 years in the in-patients department in tertiary care teaching hospital.

### 2.2 Exclusion Criteria

- Acute kidney injury due to causes other than gastroenteritis.
- Acute on chronic kidney disease due to diabetes, hypertension or other co-morbidities.

The KDIGO (Kidney Disease Improving Global Outcome) Clinical Practice Guideline for AKI, defines AKI as any of the following:[3]

- Increase in serum creatinine by ≥ 0.3 mg/dl (≥ 26.5 µmol/l) within 48 hours; or
- Increase in serum creatinine to ≥ 1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or
- Urine volume < 0.5 ml/kg/h for 6 hours.
- Each patient in the study was informed in detail about the aim of the study.
- A fully informed written consent was obtained from him/her prior to the study.

## 3. Results

**Table 1.** Gender wise distribution of patients included in study

| Sex | No. of patients | % |
|---|---|---|
| Male | 51 | 72.86 |
| Female | 19 | 27.14 |
| Total | 70 | 100 |

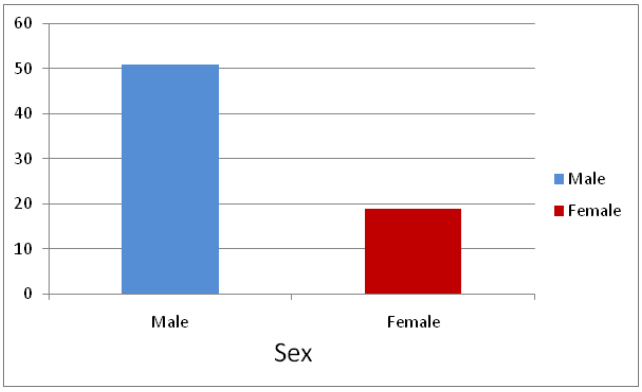


**Figure 1.** Bar diagram showing gender wise distribution of patients included in study

- There were 51 (72.86%) males and 19 (27.14%) females (Table -1, Figure - 1).
- With maximum number (54.29%) of patients belonging to age group of 31-40 years, i.e., elderly group.

**Table 2.** Mean age for male and female included in study

| | |
|---|---|
| Males | 30.96 ± 6.40 |
| Females | 30.84 ± 6.81 |

- The mean age for males included in our study was 30.96 ± 6.40. And mean age for females was 30.84±6.81 (Table - 2).
- Maximum patients presented with prerenal azotemia (75.71%) as compared to ATN (24.29%).
- Mean duration of diarrhea was 4.94±1.82 days, while mean frequency of diarrhea was 4.49±1.82 days (Table - 3).
- Mean duration of vomiting was 4.87±1.93 days, while mean frequency of vomiting was 4.23±1.81 days (Table - 4).

- Rate of non survivors was more in patients who had duration of diarrhea and vomiting ≥5 days as compared to those who had duration < 5 days
- Maximum number of patients (60%) presented with mild type of dehydration, 35.71% presented with moderate type of dehydration and 4.2% with severe type of dehydration. Mortality was highest (66.66%) in severely dehydrated group of patients followed by moderately dehydrated group of patients (52%).
- Majority of patients (78.57%) presented with Mean Arterial Pressure (MAP) ≥60mmHg, indicating good organ perfusion. And 21.43% presented with, mean arterial pressure (MAP) < 60mmHg.
- Mortality was high (100%) in those who required more time (>12 hours) to achieve normal MAP, as compared to those who required relatively less time (≤12 hours) to achieve normal MAP (66.66%).
- Maximum number of the patients (58.57%) presented with non oliguria with no mortality, followed by 21.43% anuric and 20% oliguric.
- Maximum deaths (93.33%) were observed in anuric patients followed by those who presented with oliguria (7.14%).
- Higher baseline serum creatinine level was observed in ATN group with high mortality.
- Serum urea at baseline was slightly higher in pre renal and non survivors group.
- Hyponatremia was observed in total 16 (22.85%) patients.
- Mortality was higher (55.55%) in patients with hyperkalemia.
- Majority of the patients (92.86%) showed normal urine analysis, with few showing pus cells and RBCs.
- Chest x ray of majority of patients (97.14%) was normal with only few (2.86%) having pulmonary edema.
- Majority of the patients (77.14%) responded to fluid therapy and were managed conservatively, while 22.86% patients did not respond and needed short term dialysis.
- Significant mortality (93.75%) was observed in group of patients who received dialysis.
- Majority of the patients (57.14%) had duration of stay for 5-7 days. And longer duration of stay was associated with more mortality.
- Most common complication observed was septicemia in 20% of patients, followed by uremic encephalopathy in 15.71% of patients.

**Table 3.** Mean duration and mean frequency of diarrhoea

| Diarrhoea | | Minimum | Maximum |
|---|---|---|---|
| Duration (days) | 4.94 ± 1.82 | 2 | 10 |
| Frequency (no. of episodes) | 4.49 ± 1.82 | 2 | 9 |

**Table 4.** Mean duration and mean frequency of vomiting

| Vomiting | | Minimum | Maximum |
|---|---|---|---|
| Duration (days) | 4.87 ± 1.93 | 1 | 9 |
| Frequency (no. of episodes) | 4.23 ±1.81 | 1 | 9 |

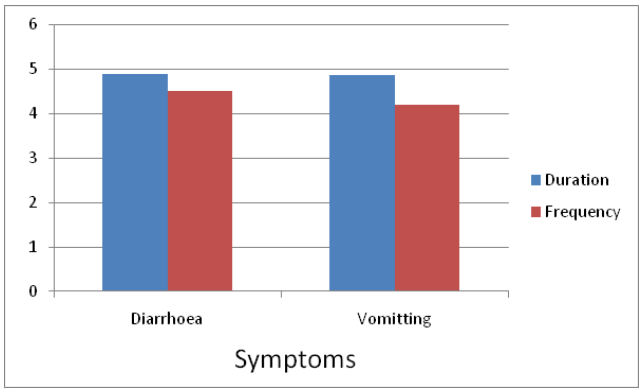


**Figure 2.** Bar diagram showing mean duration and frequency of diarrhea and vomiting

**Table 5.** Outcome

| | No. of patients | % |
|---|---|---|
| Survived | 55 (45 Pre-renal + 10 ATN) | 78.57 |
| Not Survived | 15 (8 Pre-renal + 7 ATN) | 21.43 |

- Overall mortality observed in our study was 21.43%, while 78.57% patients survived.
- Mortality rate was much higher (41.17%) (Table - 5) in ATN group as compared to pre renal group (15.09%).

## 4. Discussion

- Incidence of AKI due to gastroenteritis was greater in males. Males were 72.86% and females

were 27.14%. In J inbanathan *et al.,* study[8] males were 54% and females were 46%. Our study correlates with above described studies. Probable reason behind male predominance is the higher exposure of contaminated food due to their outside occupation.

- Maximum patients were from age group of 31-40, contributing about 54.29% of total. In J inbanathan *et al.,* study[8] majority of patients were from fifth decade with peak incidence in 51-60 years contributing 28% of total. In Rakesh *et al.,* study majority of cases of AKI were in age group of 21-40 years[9] above findings shows that elderly population is affected the most.
- Mean age for the study population was 30.96±6.40 years for males and 30.84±6.81 years for females in our study. While in J inbanathan *et al.,* study[8] mean age was 53.50 years, with sample study ranging from 18-80 years. And in Rakesh *et al.,* study[9] mean age was 42.64 years. Difference in mean age as compared to these studies is probably because of different age group studied in respective study. In our study age group of 18-40 was considered. This finding again shows that elderly populations are more prone for development of AKI.
- In our study ATN was the pathology behind 24.29% of patients, while prerenal azotemia was responsible in maximum i.e., 75.71% of patients. In Fouda H *et al.,*[10] study ATN contributed around 25% of all mechanisms and prerenal contributed around 26.9%. Our finding for ATN matches with above described study. For prerenal cause, higher percentage in our study was probably because we have studied only AKI due to gastroenteritis population.
- Patients with diarrhea for <5 days were 48.57% and 51.43% had diarrhea of for ≥ 5 days. ATN and Non survivors were more in patients with duration of diarrhea for ≥5 days. Mean duration for diarrhea was 4.94 ± 1.82 days and mean frequency was 4.49±1.82 days.
- Patients with vomiting < 5 days were 42.86% and 57.14% had vomiting for ≥5 days. ATN and Non survivors were more in patients with duration of diarrhea for ≥5 days. Mean duration for diarrhea was 4.87±1.93 days and mean frequency was 4.23±1.81 days.
- According to the POAC (primary option for acute care) clinical guidelines[11,] dehydration status was assessed. Majority of patients (60%) presented with mild form of dehydration, Followed by moderate dehydration in 35.71% and then severe dehydration in 4.2% patients. Percentage of Non survivors in those who presented with severe dehydration was 66.66% and in moderately dehydrated patients, it was 52%.
- Mean Arterial Pressure (MAP) indicates organ perfusion. MAP <60mmHg is prone to develop acute kidney injury[12,13]. MAP is also a parameter to assess the adequacy of volume resuscitation[14]. MAP of 21.43% of patients was < 60mm Hg, suggesting poor organ perfusion and further deterioration of kidney function. Average time taken to achieve normal MAP (≥60 mmHg) by these patients was 14.13±2.50 hours. More prompt rehydration was needed for this group of patient as compared to those who had normal MAP.
- Majority of patients presented in our study as non oliguric (58.57%), followed by anuric and oliguric (21.43% and 20% respectively).
- In J inbanathan *et al.,* study[8], oliguria was present in 30% and anuria was present in 2% patients.
- Higher serum creatinine, serum potassium was associated with poor outcome.
- Hyponatremia is one of the common complications of acute kidney injury. It is because of relative or absolute rise in free water intake.
- In our study 77.14% patients were managed conservatively. While 22.86% patients required dialysis. In Rakesh et al., study[9]. Renal Replacement Therapy (RRT) (Dialysis) required by 29.43% of patients. In Cruz DN study[15,16] renal replacement therapy was required by 30.3% of patients. These finding are very close to observations in our study.
- In our study, out of 16 patients who got dialyzed, 6.25% survived and 93.75% did not. According to various studies. Those who required renal replacement therapy, have high mortality (50-90%) as compared to those who were managed conservatively[16–18]. This finding matches with our study. Probable cause for this can be various complications occurring in dialysis.

- In our study 57.14% patients had duration of stay for 5-7 days, 12.86% patients required hospitalization for 8-10 days, and 30% required stay for 2-4 days. In J inbanathan *et al.,* study[8], 52% patients got discharged within 1st week and 37% in 1-3 weeks and 11% required hospitalization for more than 3 weeks. Majority of findings matches with above mentioned study for 1st week of stay.
- In our study, 66.66% mortality was observed in patients who required ≤12 hours to achieve normal MAP as compared to 100% mortality in patients who required >12 hours to achieve normal MAP. This shows that more time required to achieve organ perfusion (indicated by MAP in our study) is associated with increased mortality.
- In Rakesh *et al.,* study[9], average MAP observed in survivors was 81.65mmHg and in Non survivor group, it was 75.74mmHg, showing that less MAP is associated with more mortality.
- In our study, 70 patients were studied, out of which 78.57% patients survived and 21.43% patients were Non survivors. In Shivakumar *et al.,*[19] mortality rate was 53.7%. In Rakesh *et al.,* study[9], mortality rate was 51.9%. Other studies mortality ranges from 37-63%[20, 21]. Mortality was almost same in all the studies referred above. Cause of death in our study was septicemia, pulmonary edema, and uremic encephalopathy.
- Mortality in ATN group was 41.17% as compared with the mortality in pre renal group which was 15.09%. Which showed that prognosis was good in pre renal group of patients.
- Probable cause for relatively low mortality in our study as compared to other studies described above was the age group we studied. In our study we have included patients from 18-40 years of age with no other co morbidities. Other studies described above also included patients with age more than 40 and patients with co morbidities like diabetes and hypertension which also contributes to mortality.

## 5. Conclusion

Acute kidney injury due to gastroenteritis is very common in developing countries like India. Most probable cause behind this must be unhygienic conditions, low socio-economic standard of living, poor access to health care facilities in right time.

This study was prospective observational study which was aimed at clinical profile, laboratory features and rehydration of acute kidney injury due to gastroenteritis. This study was conducted at tertiary heath care teaching hospital.

Early detection of AKI due to gastroenteritis and starting fluid therapy in time is very important to avoid further deterioration of kidney function. Preventive measure to reduced community acquired diseases like gastroenteritis can reduce burden over the health care system.

Study showed that males and elderly group was more common as compared to females and young population, mostly due to more exposure for community acquired diseases like gastroenteritis in our case. This concludes that special care should be taken in this group of patients to avoid acute kidney injury.

A Central tenet of the "World Kidney Day" message since 2006 has been that "kidney disease is common, harmful and treatable"

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