

Study of Acute Kidney Injury in Acute Gastroenteritis

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ABSTRACT

Introduction : Acute gastroenteritis is a common problem in developing countries. The most common complication of acute diarrhea is hypovolemia leading to acute kidney injury which is preventable complication.

Objective : To study acute kidney injury in patients with acute gastroenteritis.

Material and method : It is an observational study conducted in tertiary care hospital from October 2013 - November 2016. A total of 200 patients who presented with acute gastroenteritis (AGE) were included in this study as per inclusion criteria. Patients underwent detailed clinical examination and laboratory assessment. All patients were divided in two groups, group A (without acute renal injury) and group B (with acute renal injury). Various parameters were compared in between these two groups.

Results : Out of 200 patients, 57% were males. Out of 200 patients 34 (17%) patients (group B) were found to have acute kidney injury (AKI). Patients in group B were further classified according to RIFLE staging. On admission, out of these 34 patients, 11 patients were in risk (R) stage, 17 patients in injury (I) stage and 6 patients in failure (F) stage. Out of 34 patients only 4 patients progressed to further stage but with treatment three of them improved and one patient expired. It was observed that, patients with AKI were presented late and had more severe dehydration and had more chances of renal dysfunction as compared to those who had normal renal functions.

Conclusions : AGE is one of reversible cause of AKI and early referral and timely management with fluids reduces the risk of AKI in patients with AGE.

Key words : AGE : acute gastroenteritis; AKI : acute kidney injury; RIFLE : risk, injury, failure, loss, end stage kidney disease.

Introduction :

Acute gastroenteritis (AGE) is a common problem in developing countries. The most common complication of acute gastroenteritis is dehydration leading to acute kidney injury.¹ Incidence of acute kidney failure in acute gastroenteritis ranges from 18 to 55% of total incidence of acute renal failure.^{2,3} Failure to correct hypovolemia in time results in acute tubular necrosis and irreversible damage leading to the need of renal replacement therapy. If volume depletion is corrected before development of tubular injury, chances of acute renal failure can be minimized.¹ This study was conducted to evaluate incidence, clinical and biochemical aspects and outcome of AKI due to acute gastroenteritis.

Aims and Objectives :

- To study the clinical profile of patients of acute gastroenteritis.
- To study acute kidney injury in patients with acute gastroenteritis.

Material and method :

A total of 200 patients of acute gastroenteritis were studied. It was an observational study. Consecutive patients of AGE were taken.

Inclusion criteria :

All patients having acute gastroenteritis with

- age more than 12 years,
- who gave informed consent and
- who were hospitalised

Exclusion criteria : Patients with chronic kidney disease, hypertension, diabetes mellitus, diabetic nephropathy, obstructive uropathy, HIV and all patients with renal dysfunction with cause other than acute gastroenteritis were excluded from the study.

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All patients were divided into two groups, group A (without acute kidney injury) and group B (with acute kidney injury) and different parameters like severity of dehydration, Renal function test, Serum electrolytes, Glomerular filtration rate, Urine output, Random blood sugar and RIFLE staging and clinical outcome were compared between them.

Severity of dehydration is assessed by WHO guideline as follows:

Table 1 : WHO guidelines for severity of dehydration

Degree of Dehydration	Clinical Findings
None or mild, but diarrhea	Thirst in some cases, < 5% loss of total body weight
Moderate	Thirst, postural hypotension, weakness, tachy-cardia, decreased skin turgor, dry mouth / tongue, no tears; 5-10% loss of total body weight
Severe	Unconsciousness, lethargy, or "floppiness"; weak or absent pulse; inability to drink; sunken eyes (and, in infants, sunken fontanelles); > 10% loss of total body weight

RIFLE classification was used in order to define and stratify the severity of acute kidney injury (AKI). This system relies on changes in the serum creatinine (SCr) or glomerular filtration rates and/or urine output. Patients were classified using the criteria that support the most severe grade of renal injury, for instance, if a patient was in the Risk (R) class according to the urine output but in the Injury

(I). class according to SCr variation, then the worse criteria (SCr) was used for classifying the severity of AKI (**Table 2**).

Table 2 : Classification of AKI according to RIFLE criteria

Category	GFR Criteria	Urine Output (UO) Criteria	
Risk	Increased creatinine x1.5 or GFR decrease > 25%	UO < 0.5ml/kg/h x 6 hr	High Sensitivity
Injury	Increased creatinine x2 or GFR decrease > 50%	UO < 0.5ml/kg/h x 12 hr	High Specificity
Failure	Increase creatinine x3 or GFR decrease > 75%	UO < 0.3 ml/kg /h x 24 hr or Anuria x 12 hrs	
Loss	Persistent ARF = complete loss of kidney function > 4 weeks		
ESKD	End Stage Kidney Disease (> 3 months)		

GFR; Glomerular Filtration Rate

ARF; Acute Renal Failure

ESKD; End Stage Kidney Disease

Results:

Out of 200 patients of acute gastroenteritis, 166 (83%) patients had normal renal functions i.e. group A where as 34 (17%) patients were found to have acute kidney injury i.e group B.

Table 3 : Various clinical and laboratory parameters between two groups

Parameter	Mean		P- value
	Group A	Group B	
Age (years)	52.41 ± 15.18	49.62 ± 15.17	<0.234,NS
Severe dehydration	01 (0.6%)	11 (33.35%)	<0.0001,HS
Time interval (days)	1.78 ± 0.59	3.38 ± 1.32	<0.0001,HS
Urine output (ml)	1663.91 ± 149.52	1080.82 ± 394.85	<0.0001,HS
GFR on admission (ml/m ²)	107.82 ± 29.05	33.90 ± 16.03	<0.0001,HS
Blood urea on admission (mg/dl)	29.74 ± 6.24	105.26 ± 38.32	<0.0001,HS
Serum creatinine (mg/dl)	0.88 ± 0.22	3.08 ± 1.58	<0.0001,HS
Duration of hospital stay (days)	2.09 ± 0.31	4.32 ± 1.49	<0.0001,HS

Table 4 : RIFLE staging of patients with acute kidney injury

RIFLE Stage	On admission n = 34					
	Risk (R) n = 11		Injury (I) n = 17		Failure (F) n = 6	
	Maximum stage	On discharge	Maximum stage	On discharge	Maximum stage	On discharge
Normal (N))	-	11 (100%)	-	16 (94.1%)	-	02 (33.3%)
Risk (R)	10 (90.90%)	-	-	01 (5.9%)	-	03 (50%)
Injury (I)	01(09.10%)	-	14 (82.4%)	-	-	-
Failure (F)	-	-	03 (17.6%)	-	06 (100%)	01 (16.7%)

Table 5 : Outcome of patients with acute gastroenteritis

Outcome	Group-A n=166	Group-B n=34	Total n=200	p-value
Improved and Discharge	166 (100%)	33 (97.06%)	199 (99.5%)	0.127, NS*
Death	00	01 (2.94%)	01 (0.5%)	
Total	166	34	200	

Out of 200 patients, 114 (57%) were males and 86 (43%) were females. No statistically significant difference was found in incidence of AKI in both the sexes. (p=0.538). The severity of dehydration was more in Group B as compared to group A which was found to be statistically highly significant. Mean time interval between onset of symptoms and hospitalisation was more in group B (3.38 ± 1.32 days) as compared to those in group A (1.78 ± 0.59 days) and the difference was statistically significant (p<0.0001). Decrease in urine output and mean GFR was more in Group B as compared to group A which was statistically significant. (p<0.0001). Mean blood urea and creatinine levels were increased in Group B as compared to Group A which was significant. Mean duration of hospital stay was more in Group B (4.32 ± 1.49 days) as compared to Group A (2.09 ± 0.31 days) which was statistically significant (p<0.0001). Also duration of hospital stay goes on increasing as RIFLE stage increases which was found to be statistically significant (p<0.0001). (Table 3)

By RIFLE staging, at the time of admission, out of 34 patients with AKI, 11 patients were in Risk (R) stage, 17 patients in Injury (I) stage and 6 patients were in Failure (F) stage.

Out of 11 patients in Risk (R) stage, only 1 patient progressed to injury (I) stage who subsequently improved. Thus patients who were in risk stage on admission improved subsequently and on discharge they had normal renal functions.

Out of 17 patients who were in injury (I) stage, 3 patients progressed to Failure (F) stage but subsequently they also improved. Thus on discharge 16 (94.1%) patients had normal renal functions and only 1 patient was in Risk (R) stage.

Out of 6 patients who were in Failure (F) stage, 5 patients improved subsequently. Out of these 5 patients, 2 patients had normal renal functions and 3 patients were in Risk (R) stage on discharge. Only 1 patient remained in Failure (F) stage and expired. (Table 4)

Out of 200 patients 195 (97.5%) patients were treated conservatively and 05 (2.5%) patients required renal replacement therapy (RRT). It was found that out of 200 patients with gastroenteritis, 199 (99.5%) patients were improved and discharged. Only 01 (2.94%) patient from group B not responded and expired which was not statistically significant (p=0.127) (Table 5). The patient who died was in the failure stage and cause of death was uremic encephalopathy.

Discussion :

Acute diarrheal disease is a leading cause of illness globally. It is estimated that three to five billion cases of gastroenteritis resulting in 1.4 million deaths occur globally on an annual basis^{4,5} and those in the developing world being primarily affected.⁶ As acute gastroenteritis through volume depletion causes renal failure, failure to correct hypovolemia in time in acute gastroenteritis leads to acute tubular necrosis and renal failure. If hypovolemia persists, it results in tubular injury and irreversible damage leading to the need of renal replacement therapy¹. If volume depletion is corrected before development of tubular injury, chances of acute renal failure (ARF) can be minimized. Studies had been done which showed that acute gastroenteritis is the one of the common cause of acute renal dysfunction.^{1,7} In our study, out of 200 patients 34 (17%) had AKI which is similar to study done by **Baig MMI Net al**¹ also studied 200 patients of acute gastroenteritis and the incidence of renal dysfunction was 16% (32 patients). **PK Chhetri et al**⁷ studied 45 patients of acute renal failure and found that acute gastroenteritis was the leading cause of ARF found in 33 (73.33%) patients. It was found that degree of dehydration was more in patients with renal dysfunction.⁸ In our study it was found that as time interval between onset of symptoms and hospitalisation increases, risk of renal dysfunction increases. This is also proved in study conducted by **Baig MMI Net al**¹ who also inferred that early referral within 24 hours of onset of diarrhea can reduce the risk of development of acute renal failure. A new classification, the RIFLE (Risk, Injury, Failure, Loss of kidney function, and End stage kidney disease) classification, was proposed in order to define and stratify the severity of acute kidney injury (AKI). **Dinna N Cruz et al**⁹ and **Francesco Garzotto et al**¹⁰ studied that a worse RIFLE class is associated with higher mortality and with a longer ICU or hospital stay thus RIFLE staging is a prognostic marker. **Amit X.Garg et al**¹¹ study concluded that the acute gastroenteritis was associated with increased risk of hypertension and

reduced kidney function 4 years after infection. Maintaining safe drinking water remain essential to human health, as transient bacterial contaminations may have implications well beyond a period of acute self-limited illness.

Conclusion :

As severity and duration of dehydration increases, risk of AKI increases. Also as the stage of renal injury advances, duration of hospital stay increases and clinical outcome become poorer. Out of many causes of AKI, Acute diarrheal diseases are important cause of preventable AKI in India. So, early referral and adequate replacement of fluid and electrolyte can improve outcome in these patients.

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