Results of Renal Function Tests in Severely Dehydrated Children With Acute Gastroenteritis With and Without Hypertension

SHAHID A. MUJAWAR, JAYASHREE V. GANU AND VINAY W. PATEL

ABSTRACT

The present study was designed to determine excretion of microalbumin, total protein urea, and creatinine, and serum urea, creatinine, uric acid, sodium, and potassium in acute gastroenteritis (AGE) patients with and without hypertension. 30 children (mean age = 5.07 ± 1.70 years) with Acute gastroenteritis with severe dehydration (fourteen boys, sixteen girls) who had history of E. coli infection, who admitted to the pediatric ward were included in the study. Age and sex-matched 30 children, not having any acute illness and renal disease were taken as control. Urinary total proteins and microalbumin were estimated by pyrogallol red method and immunoturbidimetric method, respectively. Other renal function tests were determined by commercial kit. In our study, we observed all patients were microalbuminuric and suffering from E.coli infection. The alterations of serum urea, creatinine, uric acid, sodium, potassium and also urinary urea, creatinine, total proteins levels in AGE children as compared to that of control group. We, therefore, conclude that these investigations should be performed routinely in AGE of children. Otherwise lack of appropriate and early treatment can lead to acute renal failure (ARF) or chronic renal failure (CRF).

Key words: Acute gastroenteritis, Renal function tests, Microalbuminuria.

Pediatric acute gastroenteritis remains an important clinical illness commonly encountered by family physicians. Its attendant problems of vomiting, diarrhea and dehydration continue to present significant risks to children and are responsible for considerable health care expenditures.

Estimates of the overall incidence of acute gastroenteritis range from 1.3 to 2.3 episodes of diarrhea per year in children under five years of age. Each year, more than 300 U.S. children die from this illness. Direct costs for hospital and outpatient care are estimated to exceed $2 billion per year. Diarrheal diseases continue to be a major cause of morbidity and mortality in children in developing nations. In India too diarrhea has been identified as a major killer and cause of illness. Across the globe, there are an estimated 1.8 billion episodes of childhood diarrhea annually, mostly in developing countries, causing around 3 million childhood deaths in the developing world. About 80% of these deaths occur in the first two years of life. About 9% of all hospitalizations of children younger than 5 years were reported to be a result of diarrhea.

Acute bacterial dysentery with Escherichia coli O157:H7 infection may have long-term health consequences beyond the period of acute illness. Receptors for E. coli O157:H7 Shiga toxin are found in the kidney. Exposure to this pathogen may result in substantial loss of nephrons and subsequent hyperfiltration, which can lead to long-term systemic hypertension and reduced kidney function. The most toxic form of E. coli O157:H7 infection is hemolytic uremic syndrome, and the potential for long-term renal dysfunction and hypertension after this condition is well described. It is unknown whether bacterial gastroenteritis in the absence of recognized hemolytic uremic syndrome may lead to clinically important long-term renal sequelae.

In our present study, we have made an attempt to throw light on alteration of renal function in patients with acute gastroenteritis with severe dehydration with hypertension and correlate these biochemical parameters.

Materials and Methods

This prospective study was done from January 2006 to October 2006 in Department of Biochemistry, Government Medical College, Miraj. 30 hypertensive children (mean age = 5.07 ± 1.70 years) with Acute gastroenteritis (AGE) with severe dehydration (fourteen boys, sixteen girls) who had history of E. coli infection, loose motions, vomiting, fever, cough,
and cold. were admitted in pediatric ward, P.V. P. General Hospital, Sangli or General Hospital, Miraj and composed the study group. Pediatrician was assessed degree of dehydration by Mackenzie et al. (1989) in AGE patients. The control group consisted of 30 children matching in age and sex without a history of acute illness or renal disease.

Patients with Cardiac disease, Hepatic disease, Diabetes mellitus, Septicemia and Human Immunodeficiency Virus (HIV) infection were excluded from the study. The details such as history, treatment, report of routine investigations like Hb, CBC, ESR, blood pressure, blood sugar, stool examinations and urine report were recorded. The study was conducted as per approval of institutional ethical committee.

**Measurement of blood pressure:**

Blood pressure was measured by the standard sphygmomanometer technique. Patients were allowed to rest for 30 minutes. All measurements taken with the help of Pediatrician. Hypertension was defined as a systolic blood pressure reading greater than 140 mmHg and/or a diastolic reading greater than 90 mmHg.

**Blood sample collection:**

Venous blood samples were collected in test tube with aseptic precautions. After 2 hours of collections sample was centrifuged at 3000 rpm for 5 minutes. Serum was separated and collected in polythene tube with cork. The sera with no sign of hemolysis used for the analysis of urea, creatinine, uric acid and electrolytes.

**Urine collection:**

After collection of blood sample early morning urine sample was collected on the next day. To avoid contamination, morning urine sample was collected in sterile 10ml polythene wide mouth container. The fresh urine sample was collected and part of which diluted for urea and creatinine estimation. Remaining urine was taken into plane polythene tube with cork as well as sodium azide as a preservative, for estimation of total protein and Microalbumin. Also urine centrifuged and clear supernatant was used for estimation of Microalbumin.

Serum and urinary urea, creatinine were estimated by using commercial kits (Biolab Diagnostic Pvt. Ltd). Serum uric acid was estimated by the method of Uricase - PAP method. Serum electrolytes concentrations were measured by flame photometer. Urinary total proteins and microalbumin were estimated by pyrogallol red method and immunoturbidimetric method, respectively. The concentration of total proteins and microalbumin in urine were expressed as \( \mu g/mg \) urinary creatinine.

**Statistical analysis:**

Numerical variables were reported in terms of mean and standard deviation. Statistical analysis of results was done by ANOVA test. It was used to compare two subgroups within the disease group when sample size was less than 30. In this analysis, variables showing \( p \) value less than 0.05 and 0.001 were considered to be statistically significant and highly significant, respectively. Correlation between variables was found out with the help of Pearson’s correlation.

**RESULTS AND DISCUSSION**

On comparison, urea, creatinine, uric acid, potassium in sera sample and total proteins, microalbumin in urine were found to be significantly higher in patients with acute gastroenteritis with severe dehydration as compared to control (Table 1 and 2). 30 hypertensives of which 45% were males and 55% females. Serum uric acid was found to be positively correlated with serum urea, creatinine, urinary total proteins and negatively correlated with serum

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<th>Parameters</th>
<th>Acute gastroenteritis with severe dehydration</th>
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<tr>
<td></td>
<td>Without hypertension (n = 30)</td>
</tr>
<tr>
<td>Urea (mg/dL)</td>
<td>32.6 ± 9.43**</td>
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<tr>
<td>Creatinine (mg/dL)</td>
<td>0.99 ± 0.36*</td>
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<tr>
<td>Uric Acid (mg/dL)</td>
<td>5.58 ± 1.42**</td>
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<td>Na⁺ (mmol/L)</td>
<td>132 ± 1.36*</td>
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<td>K⁺ (mmol/L)</td>
<td>5.03 ± 0.29*</td>
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* and ** indicates significance of values at \( P < 0.05 \) and \( P < 0.01 \), respectively

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<tr>
<td></td>
<td>Without hypertension (n = 30)</td>
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<tr>
<td>Urea (Gm/dL)</td>
<td>11.4 ± 1.92**</td>
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<tr>
<td>Creatinine (mg/dL)</td>
<td>73.9 ± 9.45*</td>
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<td>Total Protein (g/mg creatinine)</td>
<td>151 ± 87.9*</td>
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<td>Microalbumin (g/mg creatinine)</td>
<td>61.2 ± 19.6**</td>
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</tbody>
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* and ** indicates significance of values at \( P < 0.05 \) and \( P < 0.01 \), respectively
The present study shows that there was significant change in renal function tests in hypertensives with AGE. Serum uric acid was positively correlated with urinary microalbumin (p<0.001). Hyperuricemia and microalbuminuria, in such hypertensives as found in our study might to be due to alteration of renal function tests which corroborates with the work of Garg et al., 7.

Urinary microalbumin level was significantly increased (p<0.001) in cases showing the presence of hypertension in patients with AGE with severe dehydration, which positively correlated with urea, creatinine, sodium in serum and urinary total proteins, alteration of concentration of these parameters suggest that the risk of overt renal disease is not clear. Given the protracted course of most cases of progressive renal disease, a longer follow-up of this cohort could clarify the risk of nephropathy after gastroenteritis due to E. coli O157 10,14,16,17.

There was increase creatinine (p<0.05) and uric acid (p<0.001) levels and significantly decrease urinary urea (p<0.001) and creatinine (p<0.05) in the hypertensives with AGE with severe dehydration in our study. This showed that there was mild impairment in renal functions. Uric acid is itself vasculotoxic and may be the cause of nephrosclerosis leading to hypertension 2.

Though, since 2002 Yilmaz et al. 19 have shown a relation between concentration of serum urea severity of dehydration. Our results suggest that serum urea concentration can predict severity of dehydration. Serum urea level may be considered to be adjunct to clinical evaluation in determining the degree of dehydration and in volume deficit therapy. All the patients of AGE with severe dehydration were hyponatremic (serum sodium = 136mmol/L). Burkhart (1999) has concluded that in the management of AGE in children, serum electrolyte level should be determined before rehydration therapy 4. Elevation of serum potassium may be due to acidosis by causing intracellular potassium to move into the extracellular space 19.

From the above discussion we can assume that, serum uric acid, urinary microalbumin, and other renal function tests, might be working towards the etiopathogenesis of essential hypertension even in its early stages and concentration of renal function parameters may be deciding factor for progression of the disease. However, this study being done on small population over a short period need further evaluation to stamp status of these parameters as independent risk factor for essential hypertension in AGE with severe dehydration.

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REFERENCES


