Acute lower respiratory tract infections are a leading cause of mortality and a common cause of morbidity in children below 5 years of age. In developing countries pneumonia alone kills around 4 million children every year. It accounts for 20-24 per cent of childhood death in India.

The World Health Organization term “acute respiratory infection” is regarded as synonymous in describing lower respiratory infections and may be more useful to general practitioners. It also recognizes that there is a significant overlap in infants between the clinical pictures of bronchiolitis and viral pneumonia. The guidelines should help to inform primary care management of any child with signs of an acute lower respiratory infection.

The formidable problem is complicated by the profusion and heterogeneity of the etiologic agents—viral, bacterial, fungal and others. More than 150 nonbacterial agents etiologically related to acute respiratory infections (ARI) have been identified and more than 90 per cent of ARI are primarily caused by nonbacterial agents.

Since only few etiologic agents are susceptible to antimicrobial treatment, where as others (mostly viral), are not, precision in diagnosis and treatment is necessary.

Materials and Methods

30 children (mean age = 2.68 ± 1.52 years) with acute lower respiratory tract infections (twenty boys, ten girls) were admitted in pediatric ward, P.V. P. General Hospital, Sangli or General Hospital, Miraj and composed the study group. 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. A radiological evidence of pneumonia was present in all patients. The details such as history, treatment, report of routine investigations like Hb, CBC, ESR, blood pressure, blood sugar and urine report were recorded. The study was
conducted as per approval of institutional ethical committee.

**Blood sample collection:**

Venous blood samples were collected in test tube with aseptic precautions. After 2 hours of collections sample was centrifuged at 3000rpm 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 were collected on the next day. To avoid contamination, morning urine samples were 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 urea was estimated by DAM method. The concentration of creatinine was measured by Jaffe’s colorimetric method. 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 µg/mg urinary creatinine.

**Statistical analysis:**

Numerical variables were reported in terms of mean and standard deviation. Statistical analysis of results was done by normal ‘z’ test. In this analysis, variables showing p value less than 0.05 and 0.001 were considered to be statistically significant and highly significant respectively.

**RESULTS AND DISCUSSION**

Table 1 depicts changes in serum profile when 30 controls were compared with an equal number of acute lower respiratory tract infection children shown in Table 2. Urinary urea excretion was decreased (p < 0.001) significantly high. On the other hand creatinine excretion was significantly increased (p < 0.05). Excretion of total proteins, and microalbumin levels indicated highly significant increase (p < 0.001).

**Serum urea:**

In the present study, serum urea level in lower respiratory tract infections (LRTI) patients showed highly significant increase (p<0.001) when compared with those of control group. The mean serum urea level of LRTI patients was 31.2 ± 8.53 mg/dL and that of control group was 20.5 ± 2.22 mg/dL (Table 1, Fig.1).

Insufficient antidiuretic hormone (ADH) secretion is reported in children with pneumonia. This can lead to excessive water excretion thereby causing reduced plasma volume and increase in concentration of serum urea.

<table>
<thead>
<tr>
<th>Table 1: Serum profile: renal function tests in controls and children with lower respiratory tract infection (LRTI)</th>
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<tr>
<td>Parameters</td>
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<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Urea (mg/dL)</td>
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<tr>
<td>Creatinine (mg/dL)</td>
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<tr>
<td>Uric Acid (mg/dL)</td>
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<tr>
<td>Sodium (mmol/L)</td>
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<td>Potassium (mmol/L)</td>
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</tbody>
</table>

* and ** indicates significance of values at 0.05 and 0.001, respectively ns = not significant

Fig. 1: Serum profile: renal function tests in controls and children with lower respiratory tract infection (LRTI)

**Serum creatinine:**

Serum creatinine concentration showed highly significant increase (p<0.001) in LRTI patients when compared with that of controls. The mean serum creatinine
level of LRTI patients was 1.01 ± 0.406 mg/dL whereas in control it was 0.67 ± 0.07 mg/dL (Table 1, Fig.1).

**Serum uric acid:**

Highly significant increase (p<0.001) in serum uric acid level was observed in patients with LRTI as compared to that of control group. The mean serum uric acid concentration in LRTI was 6.06 ± 1.03 mg/dL and that of control it was 4.42 ± 0.28 mg/dL (Table 1, Fig.1).

Hypoxemia was reported in 90% patients with acute phase pneumonia in the study of Singhi et al. (2005) \(^{14}\). Thus hypoxemia is an important causative factor which can increase serum uric acid level. Organic academia due to lactic acidosis may interfere with tubular secretion of urate and can cause elevation of serum uric acid concentration \(^{10}\).

**Serum sodium:**

The mean serum sodium level of LRTI patients was 142 ± 12.31 mmol/L and that of control group was 141 ± 2.02 mmol/L suggesting no significant difference in serum sodium levels in LRTI as compared to control (Table 1 and Fig. 1). However, 12 patients with LRTI were hyponatremic (serum Na\(^+\) = 136) and 13 patients had hypernatremia (serum Na\(^+\) = 150 mmol/L). Electrolyte disturbances especially hyponatremia were reported in pneumonia. Water retention, increase in plasma volume and hyponatremia were seen in association with pneumonia \(^{5}\). Similar to our results Singhi et al. (1992) also observed disturbances in electrolyte levels in children with LRTI \(^{13}\).

**Serum potassium:**

In LRTI patients mean of serum potassium showed significant decrease (p<0.05) as compared to that of control group. The mean serum potassium level in patients with LRTI was 3.79 ± 0.73 mmol/L and that of control it was 4.1 ± 0.25 mmol/L (Table 1, Fig.1).

Out of 30 children with LRTI, 14 patients were hypokalemic (K\(^+\) = 3.5 mmol/L). Hypokalemia can cause deleterious effects on membrane potentials. Severe hypokalemia can cause cardiac arrhythmia, cardiac arrest, and respiratory failure \(^{13}\). Hence, serum electrolyte is important in LRTI.

**Urinary urea:**

Highly significant decrease (p<0.001) in urinary urea level was observed in patients with LRTI as compared to the control group. The mean urinary urea concentration in LRTI was 9.24 ± 1.98 Gm/dl and that of control was 14.5 ± 1.74 Gm/dl (Table 2, Fig.2).

**Urinary creatinine:**

The mean urinary creatinine concentration in LRTI patients was 113.3 ± 31.7 mg/dL and that of control was 79.8 ± 11.4 mg/ (Table 2, Fig.2), indicating significant rise (p<0.05) in the mean urinary creatinine level in LRTI patients.

**Table 2: Urine profile: renal function tests in controls and children with lower respiratory tract infection (LRTI)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control</th>
<th>LRTI children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea (Gm/dL)</td>
<td>14.5 ± 1.61</td>
<td>9.24 ± 1.98**</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>79.88 ± 11.4</td>
<td>113.3 ± 31.7*</td>
</tr>
<tr>
<td>Total Protein (g/mg creatinine)</td>
<td>85.48 ± 26.28</td>
<td>596.7 ± 208.3*</td>
</tr>
<tr>
<td>Microalbumin (µg/mg creatinine)</td>
<td>26.37 ± 4.16</td>
<td>113.5 ± 41.94**</td>
</tr>
</tbody>
</table>

* and ** indicates significance of values at P<0.05 and 0.001, respectively

Increase in excretion of creatinine may be due to acute infection \(^{11}\). The injury by cellular destruction of respiratory epithelium and inflammatory response in the submucosa may also cause increased creatinine excretion \(^{12}\). Measurement of 24 hour creatinine excretion is required for definite conclusion. After collection of blood sample, early morning urine sample was collected on the next day. So, increased excretion may be observed due to this fact.

**Urinary total proteins:**

In the present study, the urinary total proteins level in LRTI patients was seen to increase (highly significant p<0.001) as compared to that of control group (Table 2, Fig.2). The mean urinary total proteins of LRTI patients was 596 ± 208.3 µg/mg creatinine and that of control.
was 85.48 ± 26.28 µg/mg creatinine. All the patients were proteinuric by dipstick method also.

**Urinary microalbumin:**

Urinary microalbumin the present study showed highly significant increase (p<0.001) in LRTI patients when compared with the controls (Table 2, Fig.2). The mean urinary microalbumin level in LRTI patients was 113.5 ± 41.94 µg/mg creatinine and that of control it was 26.37 ± 4.16 µg/mg creatinine.

It was observed that all 30 patients of LRTI were microalbuminuric. This preliminary study demonstrates the importance of determining total proteins and microalbumin excretion in LRTI. Follow up studies will be able to ascertain the relationship between proteinuria and development of nephropathy.

Due to unavailability of the data regarding urinary microalbumin and total protein in children with LRTI, we are unable to compare our results with those of other Indian studies.

**Conclusion:**

In this preliminary study, it was observed that the renal function tests and some allied test altered in acute illness of childhood; particularly lower respiratory tract infection. Changes in these biochemical parameters may affect the physiological processes like acid-base balance, electrolyte balance, maintenance of plasma volume and functions of kidney. In the management of hospitalized sick child, if the pediatrician gets information about abnormalities of these biochemical parameters; it will not only help him for rapid diagnosis and immediate treatment but also for preventing the life threatening complications. We conclude that these biochemical tests are of paramount importance in the treatment of lower respiratory tract infection. Further study in more number of patients and follow up experiments will confirm this. Hence, it is necessary to perform these tests routinely to avoid progression of disease like end stage renal disease through the lower respiratory tract infection of children.

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