Brief Reports

Outcome of Dialysed Patients with Acute Renal Failure

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Acute renal failure (ARF) is one of the common emergencies in pediatric practice. In the Indian subcontinent, its etiology, clinical features and outcome vary from other parts of the world(l). Although dialysis therapy has made some difference in the outcome of ARF patients, mortality in children remains very high(2,3). The present study was undertaken to find out the etiology of ARF in children at a major hospital and evaluate the factors affecting the prognosis.

Subjects and Methods

The present study was conducted over a period of 13 months and comprised 41 children, aged 15 days to 11 years, with ARF diagnosed on the basis of rapidly rising blood urea (>20 mg/dl/24 h) and serum creatinine levels (>0.5 mg/dl/24 h) with or without oligo-anuria. During this period, a total of 42 cases of ARF were admitted and all required peritoneal dialysis. One patient was excluded from the study as he was a case of acute on chronic renal failure. A detailed history and clinical examination were recorded in every patient. Their nutritional status was assessed according to the Indian Academy of Pediatrics classification(4). Investigations done were hemoglobin, total and differential leukocyte count, peripheral blood smear, and levels of blood urea, creatinine, electrolytes, calcium and phosphorus, ECG and X-ray chest. Urinalysis and culture were performed in those patients who passed urine. Investigations including ASO titer, absolute platelet count, serum bilirubin, reticulocyte count, blood culture, stool examination, stool culture, renal ultrasound and voiding cystourethrogram were done wherever required. Postmortem renal biopsy was performed in 20 patients. Acute tubular necrosis (ATN) was diagnosed in those patients who had preceding acute gastroenteritis with hypovolemia leading to ARF in absence of glomerular or arterial lesions. Acute glomerulonephritis (AGN) was diagnosed when patients presented with acute nephritic syndrome with or without raised ASO titer. The diagnosis of acute interstitial nephritis (AIN) was based on characteristic histopathological findings.

The patients were managed for fluid and electrolyte imbalance, correction of anemia and control of hypertension. All the patients needed peritoneal dialysis which was carried out in the Division of Nephrology. The clinical and biochemical monitoring were done daily. Factors contributing to mortality were evaluated

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Received for publication: May 23,1995;
Accepted: September 4,1995

and statistical significance tested by Student's 't' test

Results

Of 41 patients, 28 were boys. The age ranged between 15 days to 11 years, mean being 2.9 ± 0.3 years. There were 9 (21.9%) infants, 21 (51.2%) cases between 1-4 years of age group and the remaining 11 (26.8%) were above 4 years.

The presenting features in children with ARF are given in *Table I.* Anuria of more than 24 h was the commonest finding (95.1%). Anemia (80.5%) and protein energy malnutrition (PEM) (70.7%) were the other common associated features. Acute gastroenteritis was a predisposing factor in 58.5% of patients. The etiology of ARF and their outcome are presented in *Table II.* The common causes of ARF were ATN in 24(58.5%), AGN in 7(17.1%) and AIN in 4(9.8%) patients.

A total of 85 sessions of peritoneal dialysis ranging from 14 to 180 h with a mean duration of 34.2 ± 6.8 h were carried out. Thirty of 41 (73.2%) patients expired during the hospital stay. The patients of ARF who died had significantly higher ($p < 0.001$) levels of blood urea (292.3 ± 81.7 *vs* 204.5 ± 40.5), serum creatinine (10.7 ± 2.1 *vs* 73 ± 2.0) and potassium (6.8 ± 0.5 *vs* 4.8 ± 1.6) in comparison to those who recovered. Oligo-anuria of >72 h was found in 32 cases; of these 28 (87.5%) died. Mortality was 100% in children with PEM. Two of 11 (18.2%) survivors progressed to chronic renal failure over a period of one year; of these one was having crescentic glomerulonephritis and another had sickle cell anemia with frequent sequestration crises.

Postmortem renal biopsy, performed in 20 cases, revealed ATN in 8 (40%), AIN in 4 (20%) and endocapillary proliferative glomerulonephritis, cortical necrosis and fibrinoid necrosis in 2 cases each. Crescentic glomerulonephritis and cloudy swelling with vacuolar degeneration were found in one patient each.

TABLE I-*Clinical Features in Children with Acute Renal Failure at Admission (n = 41)*

Features	n	%
Anuria	39	95.1
Oliguria	2	4.9
Anemia	33	80.5
PEM	—	—
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II	9	21.9
III	12	29.3
IV	8	19.5
Acute gastroenteritis	24	58.5
Peripheral edema	20	48.8
Dehydration	16	39.0
Septicemia	12	29.3
Hypotension	11	26.8
Encephalopathy	8	19.5
Hypertension	5	12.2
Gastrointestinal hemorrhage	3	7.3

TABLE II-*Etiology and Mortality in Children with Acute Renal Failure*

Causes	Patients (n=41)	Died (n=30)	%
Acute tubular necrosi?	24	17	70.8
Acute glomerulo-nephritis	7	6	85.7
Acute interstitial nephritis (following measles)	4	4	100.0
Cortical necrosis (following septicemia)	2	2	100.0
Hemolytic uremic syndrome	1	1	100.0
Sickle cell anemia	1	—	—
Aminoglycoside toxicity	1	—	—
Meatal stenosis	1	—	—

Discussion

In the present study, majority of children (73.1%) were below the age of 4 years; of these 21.9% were infants. This is due to higher incidence of predisposing factors like acute gastroenteritis and infections in this age group leading to ARF. Anuria of more than 24 h was observed in 95.1% of our patients as they were referred quite late for treatment from different nearby hospitals landing into moribund state.

It is quite obvious that etiology of ARF in children varies not only in different parts of the world but also within the different regions of our country(l). We found that acute gastroenteritis was responsible for 58.5% of ARF cases, which is similar to the observations of Choudhry *et al*.(5). However, recent reports(6,7) from different tertiary centers in the country have shown a change in etiology and hemolytic uremic syndrome (HUS) was the commonest cause of ARF in children. AGN (17.1%) was the next common etiology in the present series. However, Kandoth *et al*.(8) found it to be the most common cause of ARF accounting for 27.1% of their patients. Recently, Mehta(l) has reported that ATN followed by HUS were the predominant causes in ARF in children in India.

We have encountered a high mortality (73.2%). Mortality in ARF has varied from 20-77%(l,6,8). The causes of high mortality in our patients include late referral and severe ARF as evidenced by significantly higher levels of blood urea, creatinine and potassium in patients who died. In contrast, Kandoth *et al*.(8) found no difference in these parameters between survivors and those who died. We found 100% mortality in patients who were malnourished. Choudhry *et al*.(5) also showed a poorer outcome in malnourished patients with ARF. The unusual high mortality (85-100%) observed in AGN and AIN patients is not easily explained. Of 7 AGN, one survived who had acute post streptococcal glomerulonephritis and amongst 6 deaths, exact histology could be known in 3 patients in postmortem renal biopsy. All AIN cases had ARF during measles and characteristic histopathological lesions were found in renal biopsy. Both the groups of patients were in terminal renal failure and they did not show recovery inspite of repeated sessions of dialysis. It has been observed that the need for dialysis(9) due to severe azotemia and intractable hyperkalemia and severe initial ARF with diffuse histologic damage in AIN(I0) itself carry poor prognosis in ARF patients. Of the 11 survivors, 2 children progressed to chronic renal failure. Kandoth *et al.*(8) have observed that only one out of 19 survivors went into chronic renal failure subsequently. The progression to chronic renal failure mainly depends upon the underlying cause of ARF.

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