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An evaluation of clinical and biochemical profile in children with acute renal failure and their outcome

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Abstract
Acute kidney injury (AKI), formerly called acute renal failure, is a clinical syndrome in which a sudden deterioration in renal function results in the inability of the kidneys to maintain fluid and electrolyte homeostasis. AKI has been conventionally classified into 3 categories: prerenal, intrinsic renal, and postrenal depending on site of injury. The study was done in Upgraded Department of Paediatrics in Patna medical College and Hospital to know the prevalence, etiology and of acute kidney injury**.**

Keywords: AKI, oliguria, creatinine, glomerulonephritis

Introduction

Acute renal failure (ARF) is a clinical syndrome characterized by rapid decline in glomerular filtration rate(GFR), retention of nitrogenous waste products, and perturbation of extracellular fluid volume, electrolyte and acid-base homeostasis.

Patient is considered to have ARF if there is abrupt reduction in kidney function defined as either (i) an absolute increase in serum creatinine of more than or equal to 1.5 fold from baseline, or (ii) reduction in urine output of less than 0.5 ml/kg/hr for > 8 hrs. ARF has been traditionally classified in 3 categories: Prerenal, intrinsic renal and post renal.

ARF occurs in 2-3% of admitted patient in pediatric tertiary care centre, however recent trend in hospital admission shows an increase in the admission of ARF patients in pediatric emergency which has prompted the need for evaluation of this condition in present scenario. The study has been undertaken with following aims and objectives.

1. To study the clinical and biochemical profile of children admitted with ARF in our hospital
2. To identify factors associated with ARF in our hospital and the outcome
3. To evolve rational therapy, with special emphasis on fluid therapy, judicious use of electrolyte containing solutions.

Material and Method

This study was carried out in department of pediatrics, Patna Medical College, over a period of 2 years. Patient admitted in department of pediatrics were prospectively studied for development of or worsening of ARF. From October 2011 to September 2013, a study protocol was applied to 90 consecutive children from age 1month to 15 years who fulfilled the criteria of ARF detailed below.

ARF was defined as a sudden increase in serum creatinine (SCr) to more than 1.5 times the normal value in patient with previously normal renal function along with oliguria/anuria. Oliguria was defined as a urine output less than 0.5ml/kg/h for more than 8 hours. The base line value of creatinine was taken as the normal value appropriate for age of the patient. The study excluded patient whose baseline value of serum creatinine was previously raised. All the patient were followed upto discharge, death or return of the renal function to baseline level. Expert opinion and assistance was taken from department of Nephrology, Patna Medical College on an individualized basis during the course of study. The eventual outcome was recorded and analyzed. The influence of various factors like age, severity of ARF, presence of sepsis and/ or multi organ dysfunction, uremic complications were recorded and analyzed in all patients. Necessary laboratory investigation was also done on individual basis,

Results

Ninety children fulfilled the criteria of acute renal failure during this period were included in this study. Of the total 90 children included in this study, 60 were male and remaining was female. The age-wise distribution of children is shown in fig. 1. The maximum number of children (32.2%) was in age group of 1 year to 2 years, followed by 27.7% in age group of 2yrs to 5 yrs.

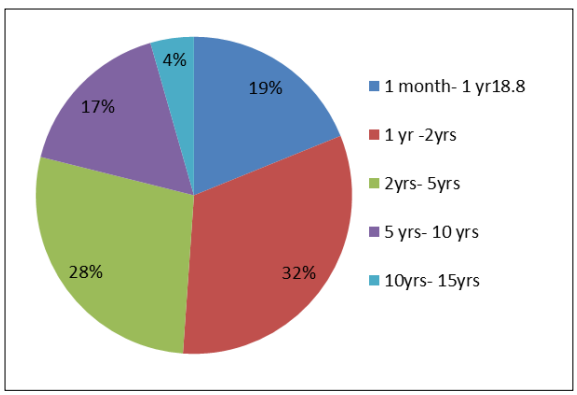

Fig1: Age-wise distribution of children

The most common type of ARF was intrinsic renal failure seen in 78.8% of cases followed by prerenal in 16.6% of

cases. Oliguria and azotemia was present in all the cases while edema and acidosis was present in 61 and 59% of cases respectively. Serum creatinine and BUN was increased in all the cases and hyperkalemia was present in about 18% of cases. Out of the 90 children included in this study 42 died during the course of illness and remaining 48 were managed successfully.

Discussion

The study included 90 children who either presented with acute renal failure or developed acute renal failure during the course of their stay in the hospital. All these children fulfilled the criteria for inclusion in the study as defined earlier. The age group of the patients in the study was 1 month to 15 years. The maximum number of cases was in the age group of 1 year to 2 years (32%), followed by 27.7% of children in age group 1yr-2yrs. About 80% of children were below 5 years of age. The number of cases declined as the age group advanced. The mean age of children admitted with ARF was 3 years and 7 months. Out of the 90 children, 60 were male and 30 were female. The male: female ratio was 2:1

Thus, in our study, the incidence of ARF in children was highest below 5 years of age, and the incidence decreased gradually as age advanced. The relatively high incidence of ARF in younger age group could be due to the fact that children suffer from diarrhea more during this period leading to ARF. The incidence of acute glomerulonephritis is also higher in younger age group. Congenital anomalies leading to postrenal ARF is usually diagnosed in younger age group. Higher incidence observed in male compared to female could be due to the fact that postrenal ARF is more common in male as is acute glomerulonephritis. The fact that male children are preferably brought to higher centre due to socioeconomic reason may also be responsible. Kandoth *et al*. (1994), at TNMC, Mumbai reported a mean age of 3 years 9 months and M: F ratio was 1.8:1, in their study on ARF in 48 children. Wong *et al* (1996) reported a mean age of 2yrs and 3 months in their study on ARF in children. Thus, this study also highlighted the fact that in children ARF is more common below 5 years of age and it is more common in males.

31 children (34.4%) presented to us with a history of acute diarrhea followed by severe dehydration, shock and oliguria/anuria. Most of these children were treated in rural areas and did not receive adequate rehydration therapy. The majority (75%) reported to us very late with oligoanuria of more than 24 hours. Thus, acute diarrhea with severe dehydration was the most common cause of acute renal failure in children in our study. The next most common cause of ARF in children was septicemia, seen in 22 children (24.4%).Counahan *et al* (1977) reported that the commonest causes were renal hypoperfusion followed by HUS, glomerulonephritis and septicemia. Shastry *et al* (1984), in a study at CMC Vellore, reported HUS as the most common cause of ARF in children. Chugh *et al* (1987) studied ARF in 223 children at PGI Chandigarh and reported that acute diarrhea was the commonest cause of ARF (49.8%) followed by acute glomerulonephritis in 34.1%. Pereira *et al* (1989), at PGI Chandigarh also found septicemia (88%) and acute gastroenteritis (55%) as the leading causes of acute renal failure in children followed by HUS.

All the children included in the study presented to us with oliguria or anuria and raised blood urea nitrogen and serum creatinine. 80% of these children presented with oligoanuria for more than 24 hours. More than 50% children had fluid overload, uremic encephalopathy, metabolic acidosis and hypotension. Severe anemia (Hb levels<4 mg/dl) was seen in 26% children. Pulmonary edema was not an uncommon finding (13.1%).The study by Kandoth *et al* (1994), reported that all patients with ARF had oligo anuria, fluid overload was present in 18.7%, hypertension in 23%, hypotension in 16.6%, neuropsychiatric manifestations in 20% and infections in 47%. The difference in percentage of patients with fluid overload compared to our study (67.7% vs. 18.7%) is probably due to excessive fluid therapy administered to the children in our study as a result of inadequate knowledge of the principles of fluid therapy of ARF in peripheral centers, who referred these cases to us. These children had been given large amounts of IV fluid therapy of ARF in peripheral centers, who referred these cases to us.

He noted hypertension in 27% children, which is similar to our observation (30%). However, in a study by Mandoth *et al* hypotension was noted in 53.3% children compared to 16.6% cases in our study, this difference can be accounted by the fact that there was a much higher incidence of septicemia with multiorgan dysfunction in our study, and hypotension was a common finding in these children. Respiratory complications, such as pulmonary edema and respiratory failure were seen in 31.1% and 14.3% children in our study, which is similar to that observed by Arora *et al*. Acute renal failure occurs as a complication of P. falciparum malaria in less than 1% of cases, but the mortality in these cases may be up to 45%. The main mechanism in malarial ARF is acute tubular necrosis due to microvascular occlusion (Mishra & Mohanty, 2002).

Out of the 90 children included in the study, 42 children (46.6%) died due to complications, either due to underlying disease or the complications arising thereof. Out of these, 16 children (38%) died within the first 48 hours after admission. 18 children (20%) were managed by peritoneal dialysis, out of which 8(44.4%) did not survive. The mortality was higher in male children with ARF. 48.3% of total males in the study did not survive, while 43.3% of the females in the study did not survive. The age of the children in the study also had a bearing on the morality, 42% of all deaths occured in children below the age of 1 year. Thus, ARF in infants was associated with increased risk of mortality. This has also been pointed by Oklada (1993), Kandoth *et al* (1994) and Gong *et al* (2001).

The most common cause of death was septicemia seen in 21 children (50%). These children died because infection was the cause of ARF or was acquired during the course of their illness. The next most common cause of death was circulatory failure, seen in 14 children (33.3%) Uncontrolled bleeding was responsible for death in 4 children and respiratory failure was seen in 3 cases. The mortality was higher when the duration of anuria was prolonged at the time of admission or afterwards. Presence of sepsis was confounding factor, and children with severe septic shock developing ARF had excess mortality compared to pediatric patients who did not have septicemia. Pascual *et al* (1996) [19, 6] noted that when acute renal failure occurs in the setting of multiorgan failure, especially in patients with severe hypotension or the acute respiratory distress syndrome, the mortality rate ranges from 50 to 80 percent. This has also

been corroborated by several other investigators, such as Cameron (1986), Mason *et al* (1994) and Thadani *et al* (1995).

Conclusion

ARF remains an important cause of morbidity and mortality in children despite of better understanding of pathophysiology of the disease and improved management strategies.

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