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Original Research Article

A Prospective Observational Study Evaluating Acute Renal Failure in Pediatric Patients Admitted to our Institute

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Abstract

Aim: The aim of the present study was to perform a prospective study of acute renal failure in pediatric patients admitted to our institute.

Methods: All children with ARF in the age group from 0 to 14 years were included who were admitted to the Upgraded Department of Pediatrics, Patna Medical College and Hospital, Patna, Bihar, India. We studied 200 children admitted with ARF. All these patients were studied by obtaining a detailed history, a thorough physical examination and necessary investigations.

Results: Children less than one year of age were 17%. Children between one and five years comprised 30.5%, while children more than five years of age comprised the maximum 51%. 55% were females and 45% were male in the study. Only 10% of the cases were due to pre-renal cases because most of the pre-renal cases are treated at primary or secondary care centers. In the present study, acute tubular necrosis (40%) remains the major cause of ARF. Post- renal cases were 16%. Out of 200 patients, 140 patients had complete recovery, 16 patients had partial recovery, 7 had not recovered and 37 died. Mortality in the below one year age group was higher. This can be due to underlying septicemia, pre- maturity, feeding problems, associated congenital anomalies, etc. in neonates. Of 37 expired patients, ten patients were late arrivals for dialysis and were with severe pulmonary edema and acidosis, which could not be reverted, and those patients expired. Mortality in the present study was 18.5%.

Conclusion: In conclusion, ARF in pediatric nephrology is not uncommon. In our setup, peritoneal dialysis seems to be an effective and safe modality of renal replacement therapy in most of the cases. Delayed referral, malnutrition, infections, age less than one year and multiorgan involvement were all bad prognostic features.

Keywords: Acute Renal Failure, Paediatric Patients.

Introduction

Acute kidney injury (AKI) is a syndrome defined by a rapid increase in serum creatinine, decrease in urine output, or both.[1] It is currently classified by following the Kidney Disease Improving Global Outcomes (KDIGO classification).[2-5] It occurs frequently in hospitalized pediatric patients and in

greater numbers in critically ill patients. The disease is associated with morbidity, prolonged hospital stay, and high risk of mortality.[6-8] Incidence and prevalence of AKI in children are widely variable due to multiple factors that influence upon the development and the course of the disease. The AWARE study reported 26% (95% CI, 25.6 to 28.2) incidence of global AKI and 11% (95% CI, 10.7 to 12.5) of severe AKI developed during the first week of hospital stay in pediatric intensive care.[9]

Acute kidney injury (AKI) is characterised by a reversible loss of normal kidney function and is recognised by a reduction in urine output and/or an increase in serum creatinine, indicative of a reduction in glomerular filtration rate (GFR). It is also usually accompanied by an inability of the kidneys to maintain water, acid-base and electrolyte balance.[10,11] The definition of AKI has undergone several iterations[12] and to define and stratify the severity of AKI several classification systems have been proposed and include the RIFLE, AKIN, and KDIGO criteria.[13] In those admitted to paediatric ICU, recent data from the AWARE study highlights that AKI is common and is associated with poor outcome including increased mortality.[14] Early detection of AKI and implementation of strategies to minimize progression is therefore essential for acute management, but is also likely to improve long term outcomes, particularly in those with the most severe illness (e.g., those admitted to PICU, those undergoing cardiac surgery or those with prematurity), although further data are awaited to prove this.[15,16]

Potential causes of AKI in pediatric intensive care units (PICU) vary according to demographic or health characteristics and differ according to the level of complexity of care. Therefore, in highly complex PICU, the main characteristics described are sepsis, organ transplants, and cardiovascular surgery.[17-19] Sepsis is one the main causes of AKI in children and its incidence has been described between 9% and 34%.[20]

The aim of the present study was to perform a prospective study of acute renal failure in pediatric patients admitted to our institute.

Materials And Methods

All children with ARF in the age group from 0 to 14 years were included who were admitted to the Upgraded Department of Pediatrics, Patna Medical College and Hospital, Patna, Bihar, India. We studied 200 children admitted with ARF. All these patients were studied by obtaining a detailed history, a thorough physical examination and necessary investigations.

Acute glomerulonephritis was diagnosed when patients presented with acute nephritic syndrome, urine analysis showing red cells and protenuria of variable degrees with or without suggestive immunological parameters like low levels of complement (C3) and raised ASO titer. The diagnosis of HUS was based on the presence of clinical presentation with or without thrombocytopenia and microangiopathic hemolytic anemia. C-ANCA and P-ANCA were performed in patients with rapidly progressing glomerulonephritis (RPGN) and diagnosis was confirmed by histo-pathological examination when considered necessary. Acute tubular necrosis was diagnosed based on initial presentation of the disease with typical history and bland urinary sediment and exclusion of other causes. Kidney biopsy was performed in 30 patients in the following conditions:

1. Clinical presentation of acute glomerulonephritis (AGN but having s. creatinine >2 mg%, to rule out crescentic GN
2. Rapidly deteriorating renal function with or without oliguria.
3. Delayed recovery of renal function.
4. Prolonged hematuria.

5. Clinical suspicious of illness other than acute tubular necrosis.
6. Suspicious of systemic lupus erythematosus (SLE) with positive serological markers. Management of patients included correction of electrolyte balance, fluid management, anuria correction and control of hypertension. For indicated patients, IV steroids, cyclophosphamide and plasmapheresis were given. Dialysis was performed in situations like: Uremic symptoms, mainly vomiting, convulsions, drowsiness and coma along with biochemical changes.
7. Volume overload with pulmonary edema.
8. Uncontrolled metabolic acidosis. Blood Ph <7.3.
9. Hyperkalemia S.K. + >6.0 mEq/L.
10. Oligoanuria of more than 48 hours.
11. Complex electrolyte disturbances.
12. To plan renal biopsy in patients with rapidly deteriorating renal function.

Intermittent peritoneal dialysis was performed using a pediatric PD catheter or an infant feeding tube. Patients were followed and monitored for distension of abdomen, hydration status and hypothermia. Urine output, symptomatology, changes in renal function, progression of disease, time taken for recovery and outcome of the patient were monitored. An attempt was made to determine the prognostic factor for ultimate outcome. Statistical analysis was performed to deduce age, sex and demographic prevalence and other risk factors for occurrence of renal failure, and positive factors for recovery were studied.

Results

Table 1: Demographic details

Age groups	**N%**
Less than 1 year	34 (17)
1-5 years	64 (32)
More than 5 years	102 (51)
Gender	
Male	90 (45)
Female	110 (55)

Children less than one year of age were 17%. Children between one and five years comprised 30.5%, while children more than five years of age comprised the maximum 51%. 55% were females and 45% were male in the study.

Table 2: Etiological classification of ARF

Pre-renal causes	**No. of cases**	**%**
Hypovolemia	20	10
Intrinsic renal diseases		
Acute tubular necrosis	80	40
Post diarrhea/vomiting	36	18
Post-op/post-traumatic	12	6
Nephrotic syndrome	4	2
Sepsis	16	8
Post-infectious GN	32	16
Crescentic GN	10	5
Hemolyticuremic syndrome	6	3
Measles	4	2
Enteric fever	2	1

Diabetes	3	1.5
Others	3	1.5
Post-renal		
Posterior urethral valve	16	8
Stone disease	12	6
PUJ obstruction	1	0.5
Lymphoma with obstruction	3	1.5

Only 10% of the cases were due to pre-renal cases because most of the pre-renal cases are treated at primary or secondary care centers. In the present study, acute tubular necrosis (40%) remains the major cause of ARF. Post- renal cases were 16%.

Table 3: Extent of recovery and follow-up

Etiology	Complete recovery (n)	Partial recovery (n)	No recovery (n)	Death (n)	Total (n)
Pre-renal	22	-	-	02	24
Acute tubular necrosis					
Post-diarrhea	26	02	-	07	35
Post-traumatic/post-op	05	-	-	05	10
Nephrotic syndrome	01	1	-	-	02
P. falciparum	18	02	03	02	25
Sepsis	05	-	-	05	10
Acute glomerulonephritis	25	3	01	01	30
Crescentic GN	05	01	02	02	10
HUS	03	2	-	03	08
Measles	2	-	-	3	05
Enteric	1	-	-	-	01
Diabetes	5	-	-	-	05
Tumor lysis syndrome	2	3	-	-	05
Post-renal	20	02	1	07	30
Total	140	16	7	37	200

Out of 200 patients, 140 patients had complete recovery, 16 patients had partial recovery, 7 had not recovered and 37 died.

Table 4: Prognostic factors of ARF

Factors	Recovered(n=I63)	Expired/Dama(n=37)	*P* value
Age less than one year	20	14	0.05
Age more than one year	140	26	0.05
Altered sensorium	25	22	0.001
Anuria	28	14	< 0.001
Respiratory distress	15	14	0.05
Poor nutrition	17	13	0.001
Infection/septicemia	30	18	0.05
Time lag between need and institution of dialysis (days)	Within 10 days 15	After 10 days 16	0.001

Mortality in the below one year age group was higher. This can be due to underlying septicemia, pre- maturity, feeding problems, associated congenital anomalies, etc. in neonates. Of 37 expired patients, ten patients were late arrivals for dialysis and were with severe pulmonary edema and acidosis, which could not be reverted, and

those patients expired. Mortality in the present study was 18.5%.

Discussion

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.[21] It is a syndrome of diverse etiology characterized by rapid deterioration of renal function resulting in accumulation of harmful nitrogenous wastes in the body and perturbation of extracellular fluid volume as well as electrolyte and acid base homeostasis. Most of the ARF in this group were due to acute gastroenteritis or were infection related, as found in developing countries like India, while in the developed world, complications of surgery and hemolytic uremic syndrome (HUS) are important causes of ARF.[22]

Srivastav et al and Shah et al reported that AGE was responsible for 27% and 48% of ARF, respectively.[23,24] Sepsis was the most common cause of ARF in the pediatric population.[25,26] In the present study, 5% of the cases had sepsis leading to ARF. HUS and cardiovascular surgeries are prominent causes of ARF in high-income countries.[27,28]

In the Western countries, the incidence of post-infectious glomerulonephritis, like that which follows post-streptococcal infection, has considerably declined due to better hygienic conditions, but this still remains a common disorder in developing countries.[29] In our study, 16% of the cases had PIGN. Mortality in the below one year age group was higher. This can be due to underlying septicemia, pre-maturity, feeding problems, associated congenital anomalies, etc. in neonates. Of 37 expired patients, ten patients were late arrivals for dialysis and were with severe pulmonary edema and acidosis, which could not be reverted, and those patients expired. Mortality in the present study was 18.5%. Mortality rates of 17.3–73.2% have been reported in other studies depending on the underlying disorder.[30,31] Poor nutrition, infection, central nervous system complications and prolonged anuria were poor prognostic factors. In patients with glomerular disease, patients had rapidly progressive renal failure (RPRF) and, despite treatment with immunosuppression and plasma exchange, had either no recovery or partial recovery and, ultimately, became dialysis dependent.

Conclusion

In conclusion, ARF in pediatric nephrology is not uncommon. In our setup, peritoneal dialysis seems to be an effective and safe modality of renal replacement therapy in most of the cases. Delayed referral, malnutrition, infections, age less than one year and multiorgan involvement were all bad prognostic features. Aggressive approach in the form of early dialysis, early renal biopsy and prompt treatment with immunosuppression and plasma exchange when necessary can favorably affect the outcome.

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