Article original

Emergency Renal Replacement therapy in childhood

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ABSTRACT

Background : Acute kidney failure is a syndrome associated with a variety of diseases. It is a severe, life-threatening event.

Objective : We aimed to describe patients' characteristics, indications for renal replacement therapy (RRT), and outcomes in children requiring emergency RRT.

Patients and Methods : A retrospective cohort study of all patients with acute renal failure (ARF) receiving renal replacement therapy at the Pediatric Nephrology Unit in Charles Nicolle Hospital, Tunis from January 2012 to December 2017.

Results : thirty children received RRT. The median age was 5±4.7 years (9 days-15 years), sex ratio was 1.14. Oliguria and hypertension were the main physical signs. Indications for dialysis included severe criteria, the main ones being hyperuremia (77%), followed by anuria (60%) and hyperkalemia (33%). Peritoneal dialysis (PD) was performed in 18 children (60%), and intermittent hemodialysis (HDI) in 12 children (40%). Different complications were noted with hypokalemia (50%), catheter dysfunction (35%), and catheter related infections (29%). Hemolytic uremic syndrome (HUS) was diagnosed in 15 children (50%). Kidney recovery function (50%), chronic renal insufficiency (13%), end stage renal failure (27%) and death (10%) were the most evident.

Conclusion : In patients with severe ARF, renal replacement therapy (RRT) represents a cornerstone of treatment, it can prevent complications and improve the prognosis. The age and hemodynamic status of the patients are important when choosing treatment modality.

Key words: Acute renal failure, childhood, renal replacement therapy, hemodialysis, peritoneal dialysis.

INTRODUCTION :

Acute renal failure (ARF) is rare in children but can life-threatening. In patients with severe ARF, renal replacement therapy (RRT) represents a cornerstone of treatment, it can prevent complications and improve the prognosis. The choice of the RRT technique requires knowledge of the different RRT techniques as well as the clinical context. The aim of this study is to clarify the indications to the emergencies RRT in childhood and the modalities and complications of different dialysis techniques.

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PATIENTS AND METHODS :

A single center retrospective study that evaluated the clinical profile and survival outcomes of patients with ARF requiring RRT at the Pediatric Nephrology Unit in Charles Nicolle Hospital, Tunis. Data was collected on patients who received RRT for ARF from January 2012 to December 2017.

RESULTS :

During the study period, 30 patients required emergency RRT with an average of six cases per year. Median age was 5 years (9 days-15 years) and sex-ratio was 1.14.

parental consanguinity was found in 43% of cases. there was a peak of hospitalization during winter and summer (33% each). No family history of nephropathy was noted in our patients.

the most common presenting symptom was digestive disorders (vomiting, diarrhea) in 60% of cases. Oliguria was present in 20 cases, different presentation of ARF is graphically depicted in Figure 1.

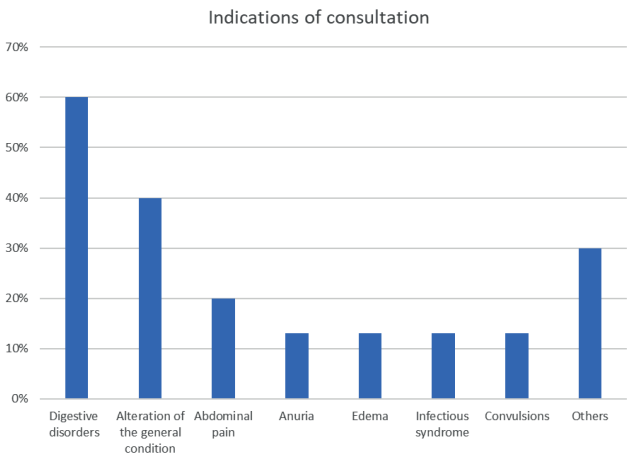

figure 1 : indications of consultation.

Median creatinine was 652 µmol/l (53–3606) at the start of RRT (table 1). Indications of emergency RRT were dominated by overt uremic manifestations in 23 cases, anuria in 18 cases, severe hyperkalemia in 10 cases, volume overload unresponsive to diuretic therapy in 12 cases. The other indications were severe metabolic acidosis in 2 cases and hypercalcemia in 1 case.

Tableau I : Serum creatinine level.

Creatinine µmol/l	[0-200[	[200-400[	[400-600[	[600-800[	≥800
Percentage	30%	20%	13%	17%	20%

Causes of ARF in children in our study were dominated by Hemolytic uremic syndrome (HUS) in 50% of cases. Typical HUS was found in 23% of cases and atypical one in 27% of cases. Acute tubular necrosis complicating septic shock, cardiopulmonary arrest or acute hemolysis was found in 13% of patients. Acute post-streptococcal glomerulonephritis (APSGN), and obstructive acute renal failure related to an obstructive megaureter in one case and renal lithiasis in the other case were found in 2 patients respectively. Acute decompensation of chronic interstitial nephropathy was found in 6 (20%) children hospitalized for ARF. Severe hypercalcemia was found in one child.

Various forms of continuous and prolonged intermittent RRT (CRRT) were used for the management of children with ARF. These techniques were dominated by peritoneal dialysis in 60% of cases. RRT was started on average of the 2nd day of hospitalization. As it was already said, peritoneal dialysis was the most used method (60%), using in all cases a Tenckhoff® peritoneal dialysis catheter. Continuous peritoneal dialysis over 24 hours was the method initially used with a progressive reduction in dialysis time.

Hemodialysis was used in 40% of cases used an age-appropriate femoral catheter. the hemodialysis session was started urgently and then continued for 2 to 3 days a week lasting from 2 to 4 hours. The mean duration of dialysis ranged from 13.7 days for peritoneal dialysis to 5.4 days for hemodialysis, mean age was 24.5 months in patients treated with peritoneal dialysis compared with 117.2 months for those treated with hemodialysis.

The occurrence of complications differed according to the dialysis method, hypokalemia was observed in 15 cases. Catheter dysfunction and Peritoneal dialysis-related peritonitis was noted in respectively 7 and 6 patients under peritoneal dialysis (Table 2).

Tableau II : Complications of RRT.

Complications	Peritoneal dialysis	Hemodialysis	Total (n=29)
Hypokalemia	10 (35%)	5 (15%)	15 (50%)
Catheter dysfunction	7 (25%)	3 (10%)	10 (35%)
Catheter related infection	6 (21%)	2 (8%)	8 (29%)
Seizure	3 (10%)	0	3 (10%)
Hemodynamic disorders	1 (3%)	0	1 (3%)
Hematological disorders	0	1 (3%)	1 (3%)

Among the thirty children who were included in our study, 14 recovered from ARF completely, and 4 children recovered partially with some persistent biochemical abnormality during discharge and follow-up. Eight children evolved towards the final renal insufficiency. Unfortunately, 3 patients died. One child with malignant hypercalcemia of neoplastic origin was transferred to oncology (table 3).

Tableau III : Complications of RRT.

Etiology	Typical HUS	Atypical HUS	Obstructive ARF	Acute glomerulonephritis	Acute tubular necrosis	Chronic interstitial nephropathy	Total
Favorable evolution	6	2	-	2	4	-	14
Chronic renal failure	-	2	2	-	-	-	4
End-stage renal failure	-	2	-	-	-	6	8
Death	1	2	-	-	-	-	3
Total	7	8	2	2	4	6	29

the three dead children were less than 12 months of age, the risk factors for mortality were: age <1-year, water-overload and neurological distress. the average length of stay was 33.8 ±17.5 days (11-75 days).

DISCUSSION :

ARF is associated with high mortality and morbidity [1,2,3], it has been used to describe an abrupt decline in renal function. currently there is a standardized definition given by the Pediatric RIFLE (pRIFLE) criteria [4], and the AKI Network (AKIN) criteria [5]. The most recent modification, the Kidney Disease Improving Global Outcomes (KDIGO) classification system, harmonized RIFLE, AKIN, and pRIFLE [6]. renal replacement therapy (RRT) represents a cornerstone of treatment. Although the precise incidence of acute renal failure in children is unknown, studies suggest that the incidence of acute renal failure in hospitalized children may be increasing. In a 22 years study conducted, the incidence rate of ARF among children admitted to hospital has dramatically increased from 0.5 – 3.3 cases for 1000 cases before 1995 to 4.6- 9.9 cases per 1000 after 1995 [7]. Even though other studies reported an incidence rate less than 1% in 2000, in this study, on average, 6 children were receiving emergency EER per year. This relatively high average could be explained by the recruitment bias presented by our pediatric nephrology department.

HUS was one of the common etiologies of ARF in children in many previous studies (12% to 24%), along with acute tubular necrosis and glomerulonephritis [8,9].

The timing of initiation of RRT remains controversial. It is clear that derangements of potassium, acid–base balance, pronounced azotemia, and fluid overload need correction [10].

Absolute indications for starting RRT :

(1) Uremic complications, for example encephalopathy, pericarditis, bleeding.

(2) Serum urea at least 36 mmol/l (100 mg/dl).

(3) K+ at least 6 mmol/l and/or ECG abnormalities.

(4) Mg at least 4 mmol/l and/or anuria/absent deep tendon reflexes.

(5) Serum pH 7.15 or less.

(6) Urine output less than 200 ml/12 h or anuria.

(7) Diuretic-resistant organ edema (pulmonary edema) in the presence of AKI. Nevertheless, although early initiation of RRT is not clearly associated with benefit, avoiding or delaying RRT is associated with higher mortality and increased hospital lengths of stay. All our patients were dialyzed on the 2nd day of hospitalization.

There is paucity of data on when to stop RRT, it can be stopped when there is sufficient improvement in renal function. Decisions to delay or stop the next RRT session may be easier for intermittent treatments. Observational studies have shown that the most significant predictor of successful termination of CRRT is urine output [11]. In our study, the duration of dialysis ranged from 5.4 to 13.7 days (1-50).

CONCLUSION :

The precise incidence of acute renal failure in the pediatric patient is difficult to define. Both peritoneal dialysis and hemodialysis are important renal replacement treatment modalities in patients with ARF. The age and hemodynamic status of the patients are important when choosing treatment modality; generally peritoneal dialysis is preferred in infants and toddler, while hemodialysis is preferred in older children. Many causes of ARF in our environment are preventable.

Our study was comparatively of short duration with the small number of cases. Therefore, it was very difficult to conclude an incidence, long-term mortality, morbidity and other variables from the present study. So, it is essential to conduct a large multi-centric long-term follow-up assessment of children's clinical condition and renal function study.

Conflicts of interest :

There are no conflicts of interest.

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