Original Article

Acute renal failure in children under two years of age

Nariman Fahmi Ahmed ,CABP,FICMS *

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Summary:

Background: Acute renal failure (ARF) in children is a catastrophic, life -threatening event

Aim of the study: the aim of the present study is to find out the etiology and outcome of patients with acute renal failure below two years of age admitted to the hospital.

Patients and methods: A prospective study was carried out on children below 2 years of age (with exclusion of neonatal period) presented with acute renal shut down admitted to Children Welfare Teaching Hospital during the period from Jan. 1st, 2007tojan30th,2008.

Results: the study group included 100 patients with acute renal failure, 69 males and 31 females with M/F ratio 2.2:1.Age range was between (2 months - 2 years).

Prerenal ARF was the commonest type seen in 67(67%) patients and hypovolemia due to (gastrointestinal loss) was the prominent etiology it was found in 53(53%) cases. ARF due to renal and post-renal causes found in 21(21%) and 12(12%) cases respectively, six (6%) patients only presented with non-Oligouria.

Forty four patients (44%) required peritoneal dialysis, while(56)patients improved on conservative management only and most of them (53 %) were the pre-renal group.

Ninety two (92%) patients had either complete or partial recovery of their renal function, eight (8%) patients died from ARF.

Conclusion: prerenal ARF particularly hypovolemia secondary to gastrointestinal loss was the most common causative group of ARF in our patients, with good prognosis for the recovery of renal function in most patients. To evaluate and validate markers of acute kidney injury more prospective clinical studies required.

Key words : Acute renal failure, children

Introduction:

Acute renal failure is a sudden deterioration of renal function, with significantly increased morbidity and mortality rates. ARF occurs in 2-3% of children admitted to pediatric tertiary care centers. Early detection and appropriate treatment can provide complete recovery, a major goal of ARFtherapy.(l)

Causes of ARF can be pre-renal(as hypovolemia) which is the most common cause of ARF in infants and childhood, Renal causes include Glomerulonephritis, Henoch Schonlein purpura, Hemolytic uremic syndrome and others, post renal causes include Obstructive uropathy , vesicoureteric reflux (1,2) .

**pediatric nephrologist Dep. Of pediatrics, coll.of Medicine.Univ. of Baghdad, children welfare teaching hospital*

The mortality rate in children with ARF is variable and depends entirely on the nature of the underlying disease process rather than on the renal failure itself .children with ARF caused by renal limited condition such as post infectious GN have a very low mortality rate less than 1%: those with multiorgan failure have high mortality rate more than 90%.(1)

Aims of the study:

In this study we evaluate prospectively cases of ARF in children welfare teaching hospital regarding etiology and outcome.

Patients and methods:

A prospective study was carried out on children below 2 years of age (with exclusion of neonatal period) presented with acute renal shut down admitted to Children Welfare Teaching Hospital during the period from Jan 1st, 2007to jan30th, 2008.

A detailed history was taken and complete physical examination was done to all patients enrolled in the study.
Laboratory investigations included blood urea, serum creatinine, serum electrolytes (potassium, sodium, calcium), capillary blood for (PH ,Hco3),complete blood picture, general urine examination, abdominal ultrasound and others as indicated.
Indications for peritoneal dialysis comprised various combinations of the following :
1 -Volume over load with evidence of hypertension and or oedema refractory to diuretic therapy
2-Persistent Hyperkalemia (serum potassium rises above 7 mEq/L).
3-Severe metabolic acidosis not responding to medical management (serum acids, arterial pH less than 7.15, serum bicarbonate less than 8 mEq/L)
4-Neurological symptoms (altered mental status, seizures)
5- Severe hypertension not responding to drug therapy.
6-Uremic pericarditis.
7-Congestive heart failure.
8-Blood urea above (250 mg /dl) or lower if rapidly rising
Regarding causes of renal failure will be divided to prerenal, renal, post renal depending on history, physical examination and laboratory data whenever available in our lab. .Fractional excretion of sodium couldn't be done for our patients because the urinary sodium was not available in our laboratories.
- Abnormal renal function considered when patient has serum creatinine (> Img/dl) (Normal serum creatinine level in children (0.2-0.9 mg/dl) (1)
- Oligouria considered when urine output < 400 ml/m^2/day or < 1 ml /Kg /hr[(1)].

RESULTS

Sex and age:

Among 100 patients with acute renal failure, there are 69males and 31 females with M/F ratio 2.2:1. Age range was between 2 months - 2 year

Table (1): Age and sex distribution

Age	Male	Female	M:F	Total	%
2 mo - 6 mo	49	17	2.8:1	66	66
> 6 mo- 12 mo	16	9	1.7:1	25	25
> 12 mo - 24 mo	4	5	0.8:1	9	9
Total	69	31	2.2:1	100	100

Causes:

Eighty six (86) patients were admitted primarily with acute renal failure while 14 patients acquired ARF during their hospitalization for other cause.

Table (2): Causes of acute renal failure

Cause	Total	%
Pre-renal	67	70
1 -Gastroenteritis	53	53
2-septic shock	8	8
3- nephrotic syndrome	2	2
4-diabetic keto acidosis	1	1
5-addison disease	1	1
6-heart failure	2	2
Renal	21	21
1 -Hemolytic uremic syndrome	9	9
3 -acute glomerulonephritis	1	1
4-hypoplastic kidneys	2	2
5-infantile polycystic disease	2	2
6-cystinosis	2	2
7-disseminated intravascular Coagulation (DIG)	4	4
8-thalium poisoning (heavy metal)	1	1
Post-renal	12	12
1 -renal stone	5	5
2-urethral stricture	3	3
3-urethral valve	4	4

Pre-renal ARF:
Seventy (70%) patients were found to have pre-renal ARF of which (53) patients had gastroenteritis (GI-loss) to be the prominent etiology while ARF due to renal hypo perfusion were found in eight(8%) patients with septic shock (septicemia) , two patients with heart failure ,one patient with Addison disease and in one patient with diabetic ketoacidosis.
ARF secondary to massive reduction in colloid oncotic pressure due to severe hypoalbunemia found in two patients with nephrotic syndrome .
Renal ARF:
A total of 21 patients (21%) were included in this group, hemolytic uremic syndrome was the cause in 9 patients followed by disseminated intravascular coagulation in 4 cases, developmental anomalies of the kidneys in 4 patients two with bilateral hypo plastic kidneys and two with infantile polycystic kidneys, tubular disorders (cystinosis) found in two cases, and poisoning with the heavy metal (Thallium found in one patient). **Post renal causes:**
This group included seven patients with acute obstructive uropathy. Stone was seen in five patients, posterior urethral valve in four patients and urethral stricture in three patients.
Urine output:
Oligouric was found in 79 patients and 15 patients had anuria while non Oligouric ARF was found only in 6 patients and those patients were cases of diabetic ketoacidosis, cystinosis and patients with posterior urethral valve. Table (3).

Table (3): frequency distribution of patients according to urine output

Urinary output	No.	%
Oligouric	79	79
anuric	15	15
Non -Oligouric	6	6

Treatment:

We tried to treat our cases according to the cause, in hypovolemia we started with rehydration, Correction of serum electrolytes like hyperkaleamia and hypocalcemia in addition to other medical treatment parameters like giving blood transfusion when hemoglobin levels 7g/dl or less.

In spite of many cases responding to medical management (56%) other patients needed dialysis one time or more as shown in the following table (10).

Table (4): Relation between causes and treatment method

Treatment modality	Prerenal	Renal	Post renal	Total	%
Conservative treatment	53	1	2	56	56
Peritoneal dialysis 1 time	14	17	8	39	39
Peritoneal dialysis > 1 time	0	3	2	5	5

Those patients with dialysis total 44 cases, 14 of them with prerenal cause of ARF while 30 cases have renal or post renal cause.

Out come of patients with ARF:

Number of cases that had recovery of renal function is 92patients ,78 patients had complete recovery of the renal function, 14 patients their renal function remained above normal level ,but general condition of the patients improved and eight patients died .

Table (5): outcome of patients

Cause	No.	%
complete recovery	78	78
partial recovery	14	14
death	8	8

DISCUSSION

Acute renal failure is characterized by an increase in blood concentration of creatinine and nitrogenous waste products and by the inability of the kidney to appropriately regulate fluid and electrolyte hemostasis [(1)].

Nearly half of the cases of ARF in children were reported to have occurred in the first year of life .The most common causes were renal ischemia, nephrotoxic medications and sepsis (3)

In this study which included 100 patients, male/female ratio was 2.2:1. It is higher than equal ratio (1:1) found in study done Richard Sinert[(4)].

Causes of ARF in different countries are usually determined by geographical, environmental, and socioeconomic conditions (5) .

Hypovolemia was the most common cause of ARF in our study it is found in (67%). The causes of hypovolemia included gastroenteritis with inadequate fluid therapy in (51%). Fortunately, early detection and proper management in our hospital produced favorable outcomes in such cases, prerenal causes was higher than 60% reported in study done by Richard Sinert [(4)].but it was in agreement with study done by Mark R. Benfield [(2)].

Renal causes found in (21%) in this study which is lower than that found in other studies (6,7)

Post renal causes found in (12%) patients which is also lower than (20%) in the study done by Richard Sinert[(4)].

Decrease in urine output is the alarming symptom that makes family seeking medical advice.

In our study (92%) of patients presented with decrease in urine out put which is higher than(85%) figure given in a study done abroad by Guest Eiditor[(8)].

Regarding treatment, Forty four (44%) cases, required dialysis, and this was in consistent with the study done by Mirja Wedekin et.al. in Hannover, Germany (9) but it is higher than 30% figure given in the study done by Thadhani R and Pascial[(IO)].

Fifty six(56%)patients responded to medical management, most of them (53patients) were the pre-renal causative group of ARF.

ARF is a significant factor of morbidity in critically ill children .

The acute dialysis quality initiative and nephrology and critical care societies has established the acute injury network, focused on staging acute kidney injury .changes in serum creatinine levels and urine output were used to define and stage levels of renal dysfunction, RIFLE classification (Risk ,Injury ,Failure ,Loss ,End stage renal disease).(11)

Some studies (12,13)have applied the RIFLE criteria in hospitalized patients to predict outcome, particularly in ICU patients, But the clinical ability of these criteria to predict outcome has not yet been assessed.

Among 100 patients in this study only eight patients (8%)died ,one of them was a 1.5 years old male diagnosed as Thallium poisoning among other members of his family ,while the other cases were presented with septicemia (septic shock) or disseminated intravascular coagulation. And this figure is lower than 27% reported by Debra M. Williams et.al.,and 26% in the study donkey Mirja Wedekin et.al.(14,9)

CONCLUSIONS

In this study prerenal ARF particularly hypovolemia secondary to gastrointestinal loss was the most common causative group of ARF. With good prognosis for the recovery of renal function in most patients. To evaluate and validate markers of acute kidney injury more prospective clinical studies required.

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