



Management of Acute Renal Failure in Iraqi Children below 3 years

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Abstract

Background: 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.

Objective: To study cases of acute renal failure in children below three years of age in respect to etiology, presentation, laboratory findings and management.

Patients and Methods: A study of patients below 3 years of age with acute renal failure admitted at Al-No'man teaching hospital and were followed up in Pediatric Nephrology department in Al-Zahrawee hospital during the period from the 1st of October 2013 to the 1st of October 2015.

Results: Forty patients with acute renal failure aging below three years old were included in this study. There were 29 (72.5%) male and 11(27.5%) female children giving male to female ratio of 2.6:1. Most common presentation was decreased urine output and acidotic breathing. Most common complication was seizure in 6(50%) cases. About 14(65.6%) cases needed peritoneal dialysis, 8(34.4%) cases responded to medical management, while 8(15%) cases died.

Conclusion: Acute renal failure in infants and young children below 3 years of age is not uncommon. It is a preventable disease because most cases are due to pre-renal causes. Prevention and rapid correction of severe dehydration may prevent acute renal failure and consequent complications and death.

Key words: Renal failure, children infection

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Introduction

Acute renal failure (ARF) 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 [1].

Accurate measurement of glomerular filtration rate (GFR) is problematic in the emergency settings, therefore clinical definitions of ARF based on alterations of indirect measures of GFR i.e. (serum

creatinine, blood urea nitrogen (BUN) and urine output) are commonly used [1,2]. Kidney function is dependent on the adequacy of blood supply of the kidney and the integrity of renal parenchyma and the patency of the urinary tract. Because of this, the well-established approach for classification of ARF as pre-renal, renal and/or post-renal ARF [2, 3].



Clinical manifestations are pallor (anemia), diminished urine output, edema (salt and water overload), hypertension, vomiting and lethargy (in infants), acidotic breathing and dehydration [2, 3].

On examination of these children; Skin; (lividoreticularis: digital ischemia, butterfly rash, palpable purpura, systemic vasculitis, maculopapular rash, allergic interstitial nephritis [3]. Eye; (Keratitis, iritis, uveitis, dry conjunctiva, autoimmune vasculitis [13]. Ears; (hearing loss (alpert syndrome), aminoglycoside toxicity, mucosal or cartilage ulceration, wegner granulomatosis [14]. Cardiac; (irregular rhythm, atheroemboli, murmur, endocarditis, increase jugulovenous distension, rales, S3(third heart sound), congestive heart failure [13]. Pulmonary; (rales, goodpasture-syndrome, hemoptysis, wegner granulomatosis [1]. Abdomen; (pulsatile mass (i.e. aneurysm) atheroemboli, costovertebral angle tenderness- nephrolithiasis, papillary necrosis, pelvic (rectal mass, distended bladder, urinary obstruction), limb ischemia, edema and rhabdomyolysis [12, 15].

Indications for dialysis in ARF included the following. Volume overload with evidence of hypertension and / or pulmonary edema refractory to diuretic therapy, persistent hyperkalemia, severe metabolic acidosis not responded to medical management, neurologic symptoms (seizures, altered mental status). BUN

Results

Among 40 patients included in the study with acute renal failure, there were 29(72.5%) male and 11(27.5%) female with

greater than 100-150 mg/dl calcium/phosphorus imbalance, with hypocalcemic tetany [2].

So the present work aim to study acute renal failure in children below three years of age in respect to etiology, presentation, laboratory findings and management

Patients and Methods

A cross sectioned study was carried out on forty patients below 3 years of age presented with acute renal failure, admitted at Al-Zahrawee Teaching Hospital during the period from the 1st of October 2013 to the 1st of October 2015. A detailed history was taken from their parents and complete physical examination was done to all the patients involved in the study. Laboratory investigations included blood urea, serum creatinine, serum electrolytes (potassium, sodium, and calcium), CBP, general urine examination (GUE) in addition to abdominal ultrasound were done. We classified the etiology of renal failure into prerenal, renal, postrenal causes depending on history, physical examination and laboratory data.

Statistical analysis

Data analysis was performed by using SSPS v. 17 when the data presented as percentages. Chi-square test (Yates correction) was used to determine the relationship between each variable and development of renal failure and when the expected value in each cell was less than 5. P-value more than 0.05 was considered to be not statistically of significance (NS).

M/F ratio (2.6: 1). This finding was not statistically of significant ($p > 0.05$) as shown in table (1).



Table (1): Age and gender distribution.

Age group	Male	Female	M:F	Total	%	P.value
1day-6months	18	6	3:1	24	60	0.96 X ² = 0.2926
6months-12months	6	3	2:1	9	22.5	
12months-24months	3	1	3:1	4	10	
24months-36months	2	1	2:1	3	7.5	
total	29	11	2.6:1	40	100%	

$\chi^2 = 0.2926$, **P-value** = 0.96 (Non-significant)

In this study, mostly prerenal causes in 28(70%) of cases with 20(50%)male and 8(20%) female while renal causes in 20% (male 15%, female 5%)

and post renal causes in 10% (male 7.5%, female 2.5%). This finding was not statistically of significant ($p > 0.05$) as shown in table (2).

Table (2): Causes of acute renal failure in relation with gender.

Causes	Male		Female		Total	%	P value
	No.	%	No.	%			
Pre-renal	20	50	8	20	28	70	0.9735 X ² = 0.0537
Renal	6	15	2	5	8	20	
Post-renal	3	7.5	1	2.5	4	10	
Total	29	72.5	11	27.5	40	100	

$\chi^2 = 0.0537$, **P-value** = 0.9735 (Non-significant)

Hypovolemia due to gastrointestinal loss of fluid (moderate to severe dehydration) found to be the main causes

about 22(78.5 %) cases while other causes were in less frequency.

Table (3): Percentage of pre-renal causes of ARF

Cause	No.	%
Gastroenteritis	22	78.5
Septicemia	5	17.8
Disseminated intravascular coagulopathy	1	3.7
total	28	100%

In this study hemolytic uremic syndrome was most common renal cause 6 (75 %)cases followed by acute tubular

necrosis 1 (12.5%) case and developmental anomalies 1(12.5%) case as shown in table (4).

**Table (4):** Percentage of renal causes of ARF

Cause	No.	%
Hemolytic Uremic Syndrome	6	75
Acute tubular necrosis	1	12.5
Developmental anomalies	1	12.5
total	8	100%

The most common cause of post-renal causes was ureteropelvic junction obstruction in 2 (50 %) cases as shown in table (5).

Table (5): Percentage of post-renal causes of ARF.

Cause	No.	%
Ureteropelvic junction obstruction	2	50
Urethral value	1	25
Vesicoureteric reflux	1	25
Total	4	100%

Table (6): Percentage of the study group according to their clinical presentation of ARF on admission

Clinical presentation	No.	%
Decreased urine output	18	45
Acidotic breathing	7	17.5
Dehydration	5	12.5
Lethargy and vomiting	5	12.5
Edema	2	5
Pallor	1	2.5
Coma	1	2.5
GIT bleeding	1	2.5
total	40	100

Number of patients developed complications from ARF was twelve. The most common complication was seizure in 6(50%) cases and gastrointestinal bleeding in 4 (33.4 %) cases as shown in the table (7).

Table (7): Percentage of the study group according to their complications of ARF.

Cause	No.	%
Seizure	6	50
GIT bleeding	4	33.4
Coma	1	8.3
Heart failure	1	8.3
Total	12	100%

This study showed that the most common cause of seizure was uremic encephalopathy (4 cases), while other (1 case) was due to hypocalcemia and (1 case) was due to intracranial hemorrhage. Those patients who developed GIT

bleeding had either, hematemesis (stress ulcer), melena or profuse bleeding with DIC. Regarding comatose patients, two of them were presented with coma on admission and diagnosed as uremic encephalopathy while the third one



developed coma after few hours from admission due to central nervous system bleeding.

The study showed that higher level of blood urea and serum creatinine with renal and postrenal causes of ARF. While

serum potassium was extremely high level in (22.5%) of cases including prerenal causes, in spite of gastrointestinal loss. Serum calcium decreased in (25 %) of cases and (3 cases) of them developed tetany.

Table (8): Percentage of the study group according to their biochemistry findings in this study group

Patient's value	No. of cases	%	Normal value
B.urea 85-150 mg/dl	33	82.5	20-45 mg/dl
More than 150 mg/dl	7	17.35	
S.creatinine 0.3-4.5 mg/dl	33	83.3	0.2-0.3 mg/dl
More than 4.5 mg/dl	7	16.7	
S. Potassium 5-6 mmol/L	31	77.5	3.5-5.3 mmol/L
Extremely high S.K	9	22.5	
S. sodium 125-135 mmol/L	23	57.5	136-145 mmol/L
More than 135mmol/L	17	42.5	
S. calcium 8-11 mg/dl	30	75	8-11 mg/dl
Less than 8 mg/dl	10	25	

The cases treated according to the cause, in hypovolemia start with rehydration and diuretic testing does if needed, correction of serum electrolytes like hyperkalemia or hypocalcemia in addition to other medical treatment parameters like blood transfusion

when hemoglobin level was 7 g/dl or less. In spite that some cases responded to medical management (34.4%) but more cases needed dialysis 64.6%. This finding was not statistically of significant ($p > 0.05$) as shown in Table (9).

Table (8): Percentage of the study group according to their biochemistry findings in this

Method	Prerenal	Renal	post renal	total	%
Medical	8	2	1	11	34.4
Peritoneal Dilaysis	14	4	3	21	65.6
total	22	6	4	32	100%

$\chi^2=0.1973$, $P=0.906$ (Non-significant)

Those patients with dialysis, total (21 cases), 14(66.6%) cases of them had prerenal cause of ARF while 7(33.4%) cases have renal and

post-renal cause. Death occur in 8 patients (15%), the majority of them (72.2%) had ARF due to prerenal causes.



Discussion

This study, which include 40 patients, male /female ratio was 2.6:1. It is higher than ratio (1:1) found in study done by Richard [3] and (1.7:1) in study done by Dr. BushraJalilSalih in Iraq [24], but agreement with study done by, Wejdan (2.3:1) in Iraq [25] and Jamal et al [26] and lower than 3.5:1 in study done by Srivastava RN [27]. Regarding etiology of ARF, in this study, 70% were due to prerenal causes which is similar to 71.6% in Wejdan study [25] but higher than 60% reported in study by Richard [3] in England and this may be explained by the fact that Iraq is developing country and most cases seen in daily work and in this study are cases of gastroenteritis and sepsis which regarded as pre-renal causes. The most common cause is GIT fluid loss (78.5%) which is in agreement with study done by Mark [1]. Bushra (54%) [24] and Wejdan A. Sabty (66.7%) may be due to the small sample size collected in this study.

Renal causes found (20%) in this study which is higher than (16%) found in study done by Richard [3], (13.6%) in Wejdan [25]. In this study, 45% of patients presented with decrease urine output which is lower than 85% in a study done by John [16]. Vomiting and lethargy were present in 12.5% of cases which is lower than 30% , in previous study done by Richard [3] and (20%) in Wejdan [25] but agreement with study done by Srivastava [27]. Regarding complications, seizure in this study was most common complication 6 cases (50%) which is higher than 30% of previous study done by Morrell Micheal [12] and lower than (55%) in Wejdan [25]. Other common complication was gastrointestinal bleeding (4cases) (33.4%) which is comparable to the (30%) found by McDonald and Craig [28] and (31%) in Wejdan [25]. We found in this study 1 case (8.3%) developed heart failure

while 25% in study done by McDonald and Craig [28] . These findings were not statistically significant.

This study showed extremely higher level of serum potassium in 9cases (22.5%), which is much less than (90%) in study done by Morell [10] and (91.6%) in Wejdan [25]. Those patients either presented initially with high serum potassium or within few hours when renal function was deteriorated, showed increase in the serum potassium level in spite of that many of them had gastrointestinal potassium loss. In this study, hypocalcemia was found in 10 patients (25%) of cases, which is much less than (66%) given in study done by Thadhani and Pascial [29] and (75%) in Wejdan study [25] and (45%) in Bushra study [24].

Regarding treatment, we found in this study that 34.4% of patients had responded to medical management which is much less than 60% in study done by Richard [3] and less than 40.3% in Wejdan study [25] and this may be due to either delay referral (so the patient deteriorated) or early referral once investigation show high blood urea before proper correction of dehydration and . In this study, 14 cases reported prerenal causes of ARF needed peritoneal dialysis (nine of them had history of delayed rehydration) so probably they developed acute tubular necrosis. The total number not responding to medical management (21 cases) (65.6%), which is higher than (30%) in study done by Thadhani and Pascial [22] and this due to the same reason mentioned above (i.e. timing of referral) .15% of cases died in this study which was higher than 4% in previous study done by Thadhani and Pascial [22] and this explained by either the age of the patients which is an important and significant risk factor for mortality and the youngest patients showed a higher mortality rate, or the underlying disease in some patients (as malignancy, meningitis and severe developmental abnormalities) which



complicated with renal failure; meanwhile there was no significant findings was detected in our study.

In conclusion, acute renal failure in infants and young children below 3 years of age is not uncommon. It is a preventable disease because most cases are due to pre-renal causes. Prevention and rapid correction of severe dehydration may prevent acute renal failure and consequent complications and death

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