Research Article

Acute Kidney Injury in Preterm Neonates Admitted at El-minia Neonatal Intensive Care Unit

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Abstract
Background: The factors that contribute to the development of acute kidney injury (AKI) and treatment outcome among prematurely born neonates are not clearly understood. AKI is fairly common in newborn population and is a major contributor of neonatal mortality and morbidity. **Aim Of The Work:** The aim of our study is to determine the incidence and outcome of acute kidney injury (AKI) in preterm neonates admitted at EL MINIA neonatal intensive care unit. **Patients and Methods:** This prospective study included of 100 pretenn neonate admitted to El Minia neonatal intensive care unit of El Minia university hospital. During the period of 10 months frorr (February 2016 to December 2016). AKI was defined as an increase of serum creatinine levels -0.3 mg/d1 compared to basal values . **Results:** There was no statistically significant difference between AKI and No AKI regarding gestional age, birth weight gender, apgar score 1 min and 5 min. **Discussion: T**he mortality rate in the group of newborns with AKI was high (70.9) In our study, 100% of neonates with AKI had BW<1,500g and 54.8%were born before the 28th week of gestation. Logistic regression analysis showed that the Apgar score in the 5th minute <5, >5 on the first day of life, occurrence of sepsis and necrotizing enterocolitis, were independent risk factors for the development of AKI. **Conclusions:** AKI is associated with high mortality in preterm neonates. It is very important to identify, as quickly as possible, all infants who are at high risk of developing AKI.
Keywords: acute kidney injury, neonates, mortality rate

Introduction
Acute kidney injury (AKI) is a clinical condition often seen in the neonatal intensive care unit (NICU). Until the third day of life, serum creatinine levels in neonates are a reflection of maternal serum creatinine levels. Thereafter, creatinine levels gradually drop and within the next 2-3 weeks are normalized in 93% of neonates[(I)]. Use Of serum creatinine is the simplest method for diagnosing AKI, but it is not the most accurate. During the first 14 days of life, plasma creatinine concentration drops from 1.1 mg/dl at birth (for preteen neonate: 1.3 mg/di) to 0.4 mg/di[(2)] Acute Kidney Injury Network (AKIN) and modified pediatric RIFLE (pRIFLE) classification recommend criteria for diagnosis of AKI based on the increase in SCr levels and/or reduction of urine output [(3).] The incidence of AKI in neonates treated at the NICU ranges from 3.4 to 24%[(4)]. Many etiological factors predispose development of AKI in neonates. These factors include a low Apgar score, sepsis, hypothermia, nephrotoxic drugs, various therapeutic interventions (catheterization, intubation, mechanical ventilation, dehydration, and severe intracranial hemorrhage[(1)] AKI has a significant impact on survival rates, especially in preterm infants. Neonates with AKI have very high mortality rates (4.5-78%) [(5).]

Aim of the work
The aim of our study is to determinethe incidence and outcome of acute kidney injury (AKI) in preterm neonates admitted at El-Minia neonatal intensive care unit .

Patients and Methods
This prospective study included of 100 preterm admitted to El-Minia neonatal intensive care unit of El-Minia university hospital. During the period of 10 months

from (February 2016 to December 2016). Parental consent was obtained from all patients included in the study.

Inclusion criteria:
Preterm neonates admitted in the neonatal intensive care unit of El-Minia university hospital for any medical condition fulfilling these criteria of AKI.

- Serum creatinine level >0.3mg/dl.
- Urine production <0.5ml/kg/hour for preterm

Exclusion criteria:
Any preterm neonates admitted to neonatal intensive care unit but didn't fulfill this criteria.

- Renal function

Basic serum creatinine levels were determined in all neonates included in the study on the third day of life. After that, serum creatinine values were analyzed on the fivth day AKI, vas diagnosed using the modified AKIN staging system (Table 1)[6]. An increase in SCr levels of >0.3 mg/dl above the basal values on the third day of life or, if bas1 values was not determined, an increase in the SCr levels of >0.3 mg/dl within 48h. Using the modified modified AKIN staging system, patients with AKI were stratified in three categories (stages) according to the severity of the disease.

Table (1): Neonatal acute kidney injury classification definition

Stage	Serum creatinine
0	No change or rise <0.3 mg/dl
1	Increase of SCr 0.3 mg/di or increase of SCr 150-200 % from previous through value
2	Increase of SCr 200-300 % from previous through value
3	3 Increase of SCr of 300% from previous through value or 2.5 mg/di or receiving dialysis

Results

Table (2): Demographic Characteristics of neonates with and without acute Kidney injury (AKI)

	AKI N=31	No AKI N=69	P-value
	Mean ±SD Freq. (%) #	Mean ±SD Freq. (%) #	
Gestational age (weeks)	30.4±2.1	30.3±1.9	0.828
Birth weight (kg)	1.2±0.16	1.2±0.24	0.537
Gender (male/female)	13/18(41.9/58.1%)	26/43(37.7/62.3%)	0.687
APGAR score l min.	3.4±1.1	3.2±1.1	0.220
APGAR score 5 min.	7.1±1.4	6.7±1.5	0.267

This table shows no statistically significant difference between AKI and No AKI regarding gestational age, birth weight, gender, apgar score 1 min and 5 min .

Table (3): Clinical and laboratory difference between AKI and No AKI

	AKI N=31	No AKI N=69	P-value
	Mean ±SD Freq. (%) #	Mean ±SD Freq. (%) #	
Max. FiO_2	89.9+14.5	78.7+18.3	0.001**
MV	31/31(100%) #	14/69(20.2%) #	<0.001**
Number of days of MV	5.1+3.1	3.4+3.4	0.012*
Serum pH at first day	7.32+0.02	7.31+0.03	0.160
Serum pH at third day	6.9+0.04	7.3+0.05	<0.001**
SepsiS	23/31(74.2%) #	35/69(50.7%) #	0.04*
NEC	10/31(32.3%) #	4/69(5.8%) #	<0.001**

and there were statistically significant differences between both groups as regard maximal FiO_2, mechanical ventilation, number of days of MV, serum ph at third day, sepsis and NEC.

This table show statically significant differences between AKI and NOAKI as regard Maximal FiO_2, Mechanical ventilation (MV), number of days of MV, Serum PH at first day, serum PH at third day, Sepsis and necrotizing enter colitis (NEC)

Table (4): Mortality rates in neonates with acute kidney injury (AKI) stratified by gestational age

	<26 weeks (deaths/total)	26-28 weeks (deaths/total)	28-32 weeks (deaths/total)	>32 weeks (deaths/total)
AKI: 1 N=20	2/2 (100%)	4/5 (80%)	9/12 (75%)	0/1 (0%)
AKI: 2 N= 7	0/0	4/7 (57.1%)	0/0	0/0
AKI: 3 N=4	0/0	2/3 (66.7%)	1/1 (100%)	0/0
No AKI N=69	0/0	6/8 (75%)	19/51 (37.3%)	5/10 (50%)
Total, mortality	2/2 (100%)	16/23(69.5%)	29/64 (49.3%)	5/11(45.5%)

This table show total mortality rates according to gestational age, there was high mortality In neonates of gestational age <26 weeks mainly in AKI:1 100% In neonates of gestational age 26-28weeks, total mortality was 69.5% In AKI:1 80%, in AKI:2 57.1%, in AKI:3 66.7%and No AKI 75%. In neonates of gestational age 28-32weeks, total mortality was 49.3% In AKI:1 75% , in AKI:3 100% and No AKI mortality rates was 37.3%. In neonates of gestational age >32weeks there was no mortality in AKI And in No AKI 50%, total mortality was 45% .

Table (5): Mortality rates in neonates with acute kidney injury (AM) stratified by body weight

	≤750 g (deaths/total)	750-1000 g (deaths/total)	1000- 1500 g (deaths/total)	>1,500 g (deaths/total)
AKI: 1 N=20	2/2 (100%)	4/5 (80%)	9/12 (75%)	0/1 (0%)
AKI: 2 N= 7	0/0	6/7 (85.7%)	0/0	0/0
AKI: 3 N=4	0/0	2/2 (100%)	2/2 (1000/0)	0/0
No AKI N=69	1/1 (100%)	6/7 (85.7%)	21/54 (38.9%)	2/7(28.6%)
Total, mortality	3/3 (100%)	18/21(85.7%)	32/69 (46.4%)	2/7(28.6%)

This table show total mortality rates according to body weight .In neonates of body 'weight <750g there was high mortality 100% mainly in AKI :1 and No AKI mortality was 100%. In neonates of body weight 750-1000g total mortality was 85.7% ,in AKI:1 mortality was 80%, in AKI:2 mortality was 85.7% and in AKI:3 Mortality was 100% ,In No AKI neonates mortality was 85.7%. In neonates of body weight 1000-1500g g total mortality was 46.4% ,in AKI:1 mortality was 69.2%, in AKI:2 no mortality In AKI:3 mortality was 100 % and in No AKI neonates mortality was 38.9% In neonates of body weight >1,500g total mortality was 28.6% .

Discussion

the mortality rate in the group of newborns with AKI was high (70.9) In our study, 100%of neonates with AKI had BW <1,500gm and 54,8% were born before the 28th week of gestation In Stojanovie V., et al., 94.8% of neonates with AKI had BW < 1.500gm, and 64.1%were born before the 28th week of gestation.[7] Cataldi et al., found that VLBW infants are at specific risk for AKI (79% of neonates with AKI had BW < 1,500gm)[8] In our study patients with AKI 64.5% developed stage l disease, 22.5% met the thresholds for stage 2, and 12.9% developed stage 3.Most of the patients had stage [1]disease, which is in , concordance with the findings of Askenazi et al., 2009. In the study of Koralkar et al., 2011 the majority of patients had AKI stage[3] disease 52%, this because in our NICU we routinely determine SCr levels of all neonates.[9,6]

In our study occurrence of sepsis and NEC were identified as independent risk factors for the development of AKI. This has also been shown in other studies as Askenazi et al., 2009, Koralkar et al., 2011 and Stojanovie . V, et al., (2014).[9,6,7]
In our study we found that the incidence of AKI was 31% in study of Youssef et al., 2015 the incidence was 59.3%.[10]

Conclusions

AKI is associated with high mortality in preterm neonates. It is very important to identify, as quickly as possible, all infants who are at high risk 'of developing AKI.

Recmmendation

1- Recording of the baseline and follow up of kidney function tests during the NICU stay period is essential.
2- Close monitoring of kidney function tests, and urine output in all patients who develop AKI.
3- Perfect documentation is required in patient files in NICUs of El Mina university hospital.

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