

Azotemia in neonates with hyperbilirubinemia

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Abstract

Introduction:

Increased level of indirect bilirubin causes neurologic symptoms. Some of these symptoms may be subclinical starting with decreased feeding and dehydration. The aim of the present study was to evaluate the prevalence of prerenal azotemia in neonates with jaundice and determine its relationship with other variables.

Materials and Methods:

In a cross-sectional study, 199 neonates admitted with hyperbilirubinemia were included. They had no other complaints. Data about gestational age, age at the onset of jaundice and age of admission were recorded. At the time of admission, blood samples for measurement of BUN, Cr, and bilirubin level were collected. Neonates with prerenal azotemia were detected. Correlation between azotemia, level of bilirubin and other variables was evaluated.

Results:

Mean gestational age of the neonates in the present study was 38.2 ± 1.8 weeks. 58.7% of them were male and 10.9% were premature. Mean age at the onset of jaundice and age at the time of admission were 4.2 ± 2.9 and 6.1 ± 3.5 days, respectively. Mean bilirubin level at the time of admission was 17.5 ± 3.1 mg/dl. Based on BUN level at the time of admission, 10.7% of the neonates had prerenal azotemia. There was a significant correlation between age at the onset of jaundice and age of admission, bilirubin level and BUN level and prevalence of azotemia.

Conclusion:

Neonates with hyperbilirubinemia may have subclinical symptoms and low appetite causing dehydration. We suggest evaluating the neonates with high bilirubin level for hydration status and possibility of prerenal azotemia especially in younger neonates.

Keywords: Azotemia, Neonates, Hyperbilirubinemia

Introduction

A common problem in newborns is elevated blood bilirubin level in the first few days after birth. Ten to twenty percent of infants are affected by increasing levels of serum bilirubin and require phototherapy (1). The elevated bilirubin is the indirect type, which can easily be deposited in different tissues, including in

the brain, and depending on its elevation, it can cause neurological signs. In such situations, a critical strategy for these newborns is timely diagnosis and treatment (2-4). These neurological signs range from lethargy and diminishing reflexes of the infant to seizures and neurological damage. Reduced reflexes and decreased breastfeeding may be mild

and subclinical, with no particular sign in the appearance of the baby. Poor feeding further increases bilirubin levels, and also leads to rapid dehydration, hypernatremia, and azotemia (5-6).

Acute renal failure occurs in 3.4-24 percent of babies in the intensive care units (7-9). This type of failure in premature babies is as much as 25%, causing their increased mortality (10-11). The most common renal failure in infants is pre-renal failure. Body surface area to weight ratio is higher than the amount of subcutaneous fat in infants. Also, retention of water and sodium in infant's kidneys is lower. Thus, being in a situation of receiving low amounts of liquids leads to rapid dehydration, hypernatremia, and prerenal azotemia. In newborns, kidney is very sensitive to dehydration and decline in blood flow (12). Since neonates with elevated bilirubin may develop loss of reflexes and poor feeding due to the toxic effects of bilirubin, therefore, they may be prone to dehydration and azotemia.

This study aimed to investigate the incidence of pre-renal azotemia in neonates with hyperbilirubinemia.

Materials and Methods

This descriptive cross-sectional study was conducted over six months on 199 neonates with hyperbilirubinemia admitted to the neonatal ward in Jahrom's Motahari Hospital in 2010. Study inclusion criterion was hyperbilirubinemia only, and exclusion criteria were having any signs of infection, anemia, hemolysis, fever, liver and kidney problems, and a serum creatinine of more than 1.5 mg/dl. First, demographic information of the neonates was collected including gestational age at birth, gender, age at the onset of jaundice, and age at admission. Neonates with gestational age less than 37 weeks were defined as premature babies. Newborns were screened for any signs of infection, and blood samples were taken to determine blood urea, serum creatinine, and bilirubin. Bilirubin, creatinine, and blood urea were

measured by a spectrophotometer and recorded in mg percent. Those infants with blood urea over 20 mg percent and creatinine less than 1.5 mg percent, and also loss of blood urea after liquid intake was considered to be with pre-renal azotemia. Also, infants with creatinine over 1.5 mg percent were excluded. Accordingly, the prevalence of pre-renal azotemia was calculated.

Two groups of infants with and without azotemia were compared in terms of gender, gestational age, age at onset of jaundice, age at admission, and serum bilirubin using chi-square and student tests. Correlation between blood urea and serum bilirubin levels was analyzed by Pearson test.

Results

A total of 199 neonates were investigated over six months, with mean weight 3157 ± 688 grams, gestational age 38.2 ± 1.8 weeks, age at onset of jaundice 4.2 ± 2.4 days, and age at hospitalization 6 ± 3.5 days. Mean blood creatinine and urea values were 0.59 ± 11 and 12.2 ± 9.3 % mg. 58.7% of infants were boys, 10.9% were premature, and 8.1% had low birth weight. According to the definition, 10.7% had pre-renal azotemia, with higher prevalence seen in girls (23.3% against 7.7%, $P=0.007$). There was no significant difference in mean weight and gestational age in neonates with and without azotemia. Neonates were divided into two groups of preterm and term in terms of gestational age. Pre-renal azotemia was more prevalent among premature infants than in term infants (31.6% against 9.1%, $P=0.013$). Mean age at onset of jaundice and age at hospitalization in infants with azotemia were significantly lower compared to infants without (2.9 against 4.3 days, and 4.4 against 6.3 days respectively, $P=0.001$). Also, mean bilirubin level in neonates with azotemia at admission was higher than in neonates without (19.1 against 17.3 % mg, $P=0.013$). (table 1)

Table 1- Comparison of demographics of neonates in groups with and without pre-renal azotemia

		Mean	Standard deviation	P-value
Gestational age (weeks)	Without azotemia	38.31	1.72	1.10
	With azotemia	37.66	2.81	
Age at onset of jaundice (days)	Without azotemia	4.37	3.05	0.037
	With azotemia	2.95	0.97	
Age at admission (days)	Without azotemia	6.31	3.64	0.001
	With azotemia	4.38	1.49	
Hospitalization serum bilirubin (% mg)	Without azotemia	17.34	2.95	0.013
	With azotemia	19.12	4.01	
Duration of jaundice before hospitalization (days)	Without azotemia	1.90	1.95	0.034
	With azotemia	1.42	0.74	

Discussion

In the present study, 10.7% of healthy infants with jaundice had pre-renal azotemia. The main reason for pre-renal azotemia is dehydration, which is common in infants with inadequate intake of milk (13-14). Dehydration due to poor breastfeeding is a common problem in neonates that can lead to hypernatremia and brain damage. In a study in Taiwan, 2.3 out of 1000 infants were dehydrated (15). It seems the incidence of this problem is growing in some areas (16). In a retrospective study in Ankara, 4.1% of infants had dehydration. A main symptom in these infants was jaundice (17). In a study on 86 neonates presented with jaundice, 33% had weight loss and 12% had hypernatremia due to severe weight loss, which shows that a high percentage of neonates presenting with jaundice may have weight loss and hypernatremia (18). In the present study, mean value of bilirubin in infants with azotemia was higher than in infants without. A similar relationship was also found in other studies (17, 18). The relationship between

neonatal jaundice and dehydration is clear, but the question is whether these infants suffer dehydration and jaundice because of poor feeding (19), or is it due to high bilirubin that makes the infant take less milk?

In this study, no correlation was found between incidence of azotemia and gestational age and neonate's weight. Nonetheless, infants with azotemia were affected with jaundice earlier. This could be due to poor breastfeeding, which can also cause more acute and earlier jaundice, as well as azotemia.

Conclusion

Given the findings of this study, apparently healthy infants that were only hospitalized for hyperbilirubinemia, may also suffer dehydration and pre-renal azotemia, which if neglected, could lead to kidney failure or hypernatremia and neurological complications. Thus, evaluation of urea, creatinine, and blood electrolytes in neonates with hyperbilirubinemia, to detect dehydration and pre-renal azotemia is recommended.

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