



Prevalence of Urinary Tract Infection in Newborns with Prolonged Jaundice in Bam City, Iran (2015)

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Abstract

Background: Jaundice is one of the most common diseases of the infancy period. It could be caused by different factors, including infections such as the urinary tract. The present study aims to evaluate the prevalence and causes of urinary tract infection in newborns.

Materials and Methods: The present work is a cross-sectional study conducted on 100 newborns with jaundice hospitalized at the neonatal ward of the Pasteur Hospital of Bam or referred to its outpatient clinic. Participants were selected through convenient sampling. Besides the routine tests for jaundice, a urine sample was also taken from the newborns for culturing and evaluating urinary tract infection. After collecting the data, they were analyzed using the chi-square and t-tests.

Results: According to the results, 41 (41%) of the newborns were girls, and 59 of them (59%) were boys. The prevalence of urinary tract infection among newborns with jaundice was 27%. The most common cause of infection was Escherichia Coli, and the rate of infection was lower among newborns breastfed compared to those fed by infant formula ($p < 0/05$).

Conclusions: The most common risk factors for neonatal jaundice were prematurity, blood type incompatibilities, delivery problems, and decreased breastfeeding. Given that one of the most important causes of long-term jaundice is a urinary tract infection, it may appear before other symptoms.

Keywords: Jaundice, Urinary Tract Infection, Newborns.

Introduction

Neonate jaundice or icterus characterized by an increase in direct bilirubin from 5 to 10 mg/dl [1, 2] is one of the most common diseases of the infancy period [3, 4]. It is also the most common cause of infants' hospitalization at neonatal wards, occurring in 60% of term neonates and 80% of premature neonates. Mostly, its reason is physiologic, and its treatment does not require any specific measures; however, it could be the sign of a serious condition, and if not treated properly, it could lead

to serious and dangerous complications, such as kernicterus, causing, in turn, a lifetime paralysis [5, 6]. One of the reasons for the increase in serum level of bilirubin is the liver's temporary disability to clear bilirubin from the blood. During the embryonic period, bilirubin would be cleared from the blood of the placenta; however, during infancy, bilirubin would be excreted through the liver's cells, as well as biliary and digestive tubes [7, 8].

Prolonged jaundice is considered as jaundice longer than two weeks in mature newborns (37

weeks and more) and three weeks in premature newborns (less than 37 weeks) [9, 10]. In 95% of infants with severe jaundice, no clinical reason would be found for the disease [11]. Some studies have indicated that hyperbilirubinemia with undetermined reasons could occur due to bacterial infections [12]. Determining predisposing factors or risk factors of jaundice could be helpful in decreasing the intensity, controlling jaundice and the primary problem. One of these factors is urinary tract infection (UTI) [13].

UTI, as the second major cause of infection, is caused by a group of pathogenic microorganisms in the urinary tract. It is the existence of more than 10⁵ colonies in each milliliter in the urine. The mechanism of jaundice following UTI could be due to the disorder in the microscopic cycle of the liver, the direct effect of the bacterial productions, or the mediators caused by the secretion of endotoxins. Also, the occurrence of mild hemolysis by *Escherichia Coli* and other gram-negative organisms, thus increasing blood unconjugated bilirubin, has been reported [4, 14, 15].

8% of the girls and 2% of the boys suffer from urinary tract infection at least once before 7 years old, and *Escherichia Coli* is the most common pathogen that generates urinary tract infection, being responsible for almost 85% of infections in children [16]. The mean prevalence of urinary tract infection among infants with an age of below 8 weeks old with fever is 5% to 11% [2, 17]. Urinary tract infection among infants could be accompanied by the refusal of drinking milk, fever, nausea, and malaise; however, it could sometimes be asymptomatic [18].

Clinical expressions of urinary tract infection in infants extremely vary from severe illness to symptoms such as fever, vomiting, diarrhea, poor feeding, tachypnea, lethargy, irritability, and jaundice [19]. Since prolonged jaundice could be the only symptom of UTI in infancy [4, 20] and also considering the importance of urinary tract infection, on the one hand, and the prevalence of jaundice in infants, on the other hand [21], conducting a diagnostic evaluation for UTI in prolonged jaundice seems necessary. Therefore, the present study is conducted to evaluate the prevalence of UTI in infants of Bam city with prolonged jaundice to provide an appropriate preventive and therapeutic solution for this disease.

Materials and Methods

The present research is a cross sectional study conducted on 100 newborns with jaundice hospitalized at the neonates' ward or referred to

the clinic of the Pasteur Hospital of Bam city in 2015; the newborns were selected by convenience sampling. The inclusion criteria were being a newborn with an age of below 30 days with jaundice and without fever or sepsis referred to the hospital or were hospitalized. Causes of jaundice were determined based on clinical and laboratory information, including hematocrit, direct and indirect bilirubin, Coombs test, reticulocyte count, blood group and Rh of mother and neonate, urinalysis, urine culture, and other tests depending on the doctor's supervision.

The exclusion criteria included having a fever or any other clinical expressions (besides jaundice), such as diarrhea, vomiting, not breastfeed the baby, lethargy, and irritability. In addition to the routine test for jaundice, including a serum sample for the bilirubin level testing, a urine sample was also obtained from all the newborns for urine culture and analysis. To take a urine sample, a sterile bag is attached to the urinary tract while wearing sterile gloves, such that the urine be collected in it. The present study was approved by the Research Committee of Bam University of Medical Sciences, MUBAM.REC.1395.17.

Considering the ethical issues, all the samples were taken with parents' written consent. The information resulted from the history, clinical examination, and laboratory tests were recorded in pre-designed questionnaires (e.g., gender, age, gestational age, jaundice onset age, inpatient or outpatient hospital status, duration of hospitalization, nutritional status, bilirubin level, presence or absence of urinary tract infection, and other variables such as birth weight and history of jaundice in the family), which was researcher-made and approved by several urologists and infectious disease specialists. This self-made questionnaire had 27 questions. Its reliability and validity were confirmed by several urologists, infectious diseases specialists, and professors specializing in this field. After coding, the data were analyzed using SPSS20 and descriptive (mean, standard deviation, frequency, and percent) and inferential (t- and chi-square test) statistics. A p-value of less than 0.05 was considered significant for all the statistical tests.

Results

According to the results, 41 (41%) of the participants were girls. Six of the girls (14.6%) and 21 of the boys (35.6%) had UTI; further, 35 of the girls (85.4%) and 38 of the boys (64.4%) only had jaundice with no UTI. The prevalence of UTI was different between boys and girls; according to the chi-square test, the prevalence of urinary tract

infection was significantly higher among boys than girls ($p < 0/05$) (Table 1).

Table 1. Frequency of urinary tract infection in newborns with prolonged jaundice in Bam city, 2015, based on gender

Gender		Urinary tract infection	
		Yes	No
Girl	Number	6	35
	Percent	14.6	85.4
Boy	Number	21	38
	Percent	35.6	64.4

Of 100 newborns, 93 (93%) were term and 7 (7%) were preterm. Nineteen of the term newborns (20.44%) and 4 of the preterm newborns (57.14%) had urinary tract infection, and 74 of the term preterm newborns (79.56%) and 3 of the preterm newborns (42.86%) only had jaundice with no UTI.

According to the chi-square test, there was a significant relationship between urinary tract infection and gestational age ($p < 0/050$). The prevalence of urinary tract infection was significantly higher among preterm newborns than term newborns (Table 2).

Table 2. Frequency of urinary tract infection in newborns with prolonged jaundice in Bam city, 2015, based on gestational age

Gestational age		Urinary tract infection	
		Yes	No
Term (above 37 weeks)	Number	19	74
	Percent	20.44	79.56
Preterm (below 37 weeks)	Number	4	3
	Percent	57.14	42.68

As presented in Table 3, participants were divided into three groups based on their nourishment type. Of the studied newborn, 80 (80%) were being breastfed, 5 (5%) were fed by formula, and 15 (15%) were fed by formula and breast milk. Of those breastfed, 18 (22.5%) had UTI, and 62 (77.5%) did not. Four (80%) of the newborns fed by formula had urinary tract infection, and 1 (20%) did not. Fifteen newborns were fed formula and

breast milk at the same time, of whom 5 (33.3%) had urinary tract infection, and 10 (66.7%) did not.

According to the chi-square test, there was a significant relationship between the nourishment type and urinary tract infection ($p < 0/050$), indicating that the prevalence of urinary tract infection was significantly lower among newborns breastfed compared to the others.

Table 3. Frequency of urinary tract infection in newborns with prolonged jaundice in Bam city, 2015, based on the type of nourishment

Type of nourishment		Urinary tract infection	
		Yes	No
Breastfed	Number	18	62
	Percent	22.5	77.5
Formula	Number	4	1
	Percent	80	20
Breast milk formula	Number	5	10
	Percent	33.3	66.7

Based on the type of microorganism causing urinary tract infection, participants were divided into 4 groups. Of 100 studied newborns, 76 (76%) had a negative urine culture, while the remaining 19 (19%) had an infection caused by E. Coli; the cause of infection in 4 (4%) was Klebsiella and in 1

(1%) was reported to be other microorganisms. According to the chi-square test, there was a significant difference between groups ($p < 0/001$); the most prevalent cause of UTI was E. Coli, and the second common cause was Klebsiella (Table 4).

Table 4. The type of microorganisms in the urinary tract infection of the newborns with prolonged jaundice in Bam city, 2015

Negative urine culture		Positive urine culture		
		E. Coli	Klebsiella	Other microorganisms
Number	76	19	4	1
Percent	76	19	4	1

Discussion

Jaundice is one of the most common clinical findings among newborns during the first days after birth. On the other hand, determining the predisposing factors and aggravating or establishing factors of jaundice could be effective in decreasing the intensity, controlling jaundice and the primary problem. One of these factors is urinary tract infection [1, 2].

According to the results of the present study, 41 of the infants were girls, and 59 were boys. The prevalence of UTI was different between boys and girls; it was higher among boys than girls with a *p*-value of 0.023, and their difference was statistically significant. These results were in line with the results of Boskabadi and Garcia [22]. In justifying these results, it can be said that neonatal jaundice is more common in males; thus, being male may be a risk factor. On the other hand, preputial space is a potential reservoir of bacterial pathogens in boys. Bacteria may also be introduced into the urinary tract via instrumentation such as catheterization [23].

In the study of Eghbalian et al., the prevalence of urinary tract infection among preterm infants and term infants with low birth weight was significantly higher than term infants with normal birth weight [14]. Of 100 studied infants in the present study, 92 were term, and 8 were preterm. Twenty-two of the term infants and 5 of the preterm infants had urinary tract infection, and 3 of the preterm infants only had jaundice with no infection. There was a significant relationship between the prevalence of urinary tract infection and gestational age at birth (*p* = 0.032), showing that the prevalence of UTI was higher among preterm infants than term infants. These results were in line with the results of Eghbalian et al. and Mahmodi [24]. In justifying these results, it can be said that due to some factors, such as increased bilirubin in hepatocytes, decreased hepatic bilirubin uptake from plasma, and disruption in the conjugation of bilirubin, hyperbilirubinemia is more common in premature compared to term newborns.

Huang and Chen, in two separate studies, revealed that infants successfully breastfed would have physiologic weight loss, and the risk of hyperbilirubinemia in them is similar to the infants fed by formula [25]. Of the studied newborns, 80 were fed by breast milk, 5 with formula, and 15 with formula and breast milk. Eighteen newborns fed by breast milk had urinary tract infection. Four out of five newborns fed by formula also had urinary tract infection. Of 15 newborns fed by formula and breast milk at the same time, 5 had urinary tract infection. According to the existing

statistics, most newborns with jaundice are among the breastfed group. Also, there was a significant relationship between newborns' jaundice and their nourishment type (*p* = 0.016); thus, the prevalence of urinary tract infection among newborns breastfed was lower than those fed by the formula. The present results are in contrast with the results of Huang and Chen. To state the cause of this conflict, it can be stated that breastfeeding may protect against ear, throat, and sinus infections well beyond infancy. According to several studies, since no specific etiologies could be confirmed in the majority of infants diagnosed with hyperbilirubinemia, breastfeeding is normally reported as the main cause of neonatal jaundice [26].

In the study of Garcia, the most common causes of urinary tract infection were *Escherichia Coli* (60%), *Enterococci* (10%), *Enterobacter* (10%), as well as *Klebsiella*, *Staphylococcus Aureus*, Group B *Streptococcus*, and *Viridance* (5% each). In another research by Bilgen, the causes of infection were *Enterobacter* (38%), *Enterococci* (25%), *Klebsiella* (25%), and *Escherichia Coli* (12%) [1, 2]. In the present study, 73% of the participants had negative urine culture; however, in the remaining 27%, the cause of infection was *Escherichia Coli* (20%), *Klebsiella* (6%), and other microorganisms (1%), respectively. These results are in line with the results of Garcia but have some differences with those of Bilgen. This could be caused by the regional diversity and spread of bacteria. Different protocols may be another reason for this conflict.

The main limitation of the present study is that it involves a single city. Eventually, considering the low prevalence of urinary tract infection among newborns with jaundice with no other symptoms, it is recommended that in cases of prolonged jaundice, delayed jaundice, non-defined reason, as well as those with reduced bilirubin with difficulty and other symptoms, such as weight loss, not taking their milk, fever, and lethargy, urine culture would be performed. Further studies are suggested to learn more about risk factors for neonatal jaundice and determine the predictive value of each, especially for urinary tract infection.

Conclusion

Based on the above discussed, the prevalence of urinary tract infection is high among newborns with jaundice. Therefore, it is necessary to order a urine culture test for all newborns with jaundice. Urine analysis test is not sensitive for diagnosing urinary tract infection in newborns, and if the order of urine culture would only be based on the results of the U/A test, it could lead to a wrong diagnosis. The

prevalence of urinary tract infection among newborns with prolonged jaundice is higher than those of healthy. On the other hand, the prevalence of UTI among preterm newborn boys fed with formula is higher than term newborn girls breastfed. It might thus be inappropriate to request urine culture in all infants with prolonged jaundice, although recent NICE guidelines recommend this practice.

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Conflict of interest: None declared.

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