Original Article

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Prevalence of Readmission for Hyperbilirubinemia in Healthy Newborns

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Abstract

Objective: The aim of this study was estimation of prevalence of jaundice readmission and observes neonatal jaundice risk factors in singleton infant with birth weight more than 2500 gr.

Material & Methods: This study was done among women who delivered a normal singleton infant with birth weight of ≥2500 gr in Najmieh Hospital, Tehran, from 2004-2005. Maternal age, race, blood group and Rh, drug consumption during pregnancy, oxytocin consumption during labour, rupture of membranes together with neonatal sex, weight, maturity, gravity and length of nursery stay were recorded. The infants were followed during neonatal period to see if they were readmitted, and the reason of admission. The prevalence of readmission for neonatal jaundice was assessed and the risk factors for neonatal jaundice were compared between the icteric and non-icteric babies.

Findings: The prevalence of readmission because of jaundice was 12.6%. The maternal data recorded from all mother-baby pairs were not significantly different except for maternal race, Rh group and drug consumption during pregnancy. Arab mothers compared with other race groups had more icteric babies (P=0.001). Rh-negative mothers had more icteric infants (17.9%) compared with Rh-positive mothers (12%) (P=0.01). Premature infants were hospitalized significantly more than mature babies (20.3% versus 12.1%, P=0.04). The length of primary nursery stay differed significantly between two groups [mean (SD) 27 (9.8) hours for icterics versus 30 (2.5) hours for non-icterics, P<0.001]. The mean age of readmission was fifth postnatal day.

Conclusion: We conclude that infants, especially infants of Arab or negative Rh group mothers and premature babies, discharged early from the nursery should be advised to visit a pediatrician within the next 48-72 hours of birth to avoid complications of severe jaundice.

Key Words: Nursery stay; Readmission; Jaundice; Neonatal; Hyperbilirubinemia

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Introduction

The most common cause of readmission within neonatal period is jaundice or hyperbilirubinemia[1-4]. Kernicterus is a well known complication of neonatal jaundice. There is also significant increase in minor neurological dysfunctions throughout the first year of life because of jaundice[5].

Greater awareness is needed among all health workers about the description, causes, risk factors, effective treatment, and sequelae of neonatal jaundice[6]. Early discharge from well-baby nurseries (defined as less than 48 hours after birth by the American Academy of Paediatrics)[7] is now the rule in the United States and many other countries[1,2]. The recognition, follow-up, and early treatment of neonatal jaundice has become more difficult since earlier discharge of newborns from hospitals. A population based study from Canada found an association between a decreased length of neonatal stay from 4.5 to 3.7 days and the risk of readmission during first 2 weeks of life[2] whereas another study showed that newborns whose stay was less than 72 hours, were at a significantly greater risk for readmission than those who had longer stays[3]. Of course there are also other studies that didn't show any significant difference between shorter and longer nursery stays of rehospitalized infants for jaundice[8]. Therefore one important concern about shortening the length of hospital stay after birth is increase in severity of jaundice. There are also some known risk factors related to neonatal jaundice. Geiger and colleagues showed that Asian mothers had more rehospitalisation for jaundice. There are other documents that show there is an increased risk of jaundice readmission in maternal O positive blood group, preterm infants, and first born babies.

The aim of this study was to determine prevalence of neonatal readmission for jaundice and its risk factors.

Material & Methods

This cross sectional study was conducted among women who gave birth to their children at Najmieh Hospital, Tehran, from 20 September 2004 to 19 September 2005. A questionnaire was filled for each mother-infant pair at the time of delivery and completed at the time of nursery discharge. Mothers were asked to bring their babies to hospital in case of jaundice. The infants also were followed by phone (on the 3rd, 7th, 10th and 14th of life) to ask about jaundice or readmission. They were asked to bring their infant if they were jaundiced. The medical records of infants who were readmitted were reviewed and, in case of readmission, abstracted.

Serum total Bilirubin was tested in any infant who had visible icterus before or after discharge. Data recorded from the mothers included their age, race, blood group, drug consumption during pregnancy, oxytocin consumption during labour, and history of rupture of amniotic membrane. Data recorded from the babies included their sex, birth weight, maturity, gravity, and length of nursery stay. Subjects were selected from the population of mother-infant pairs in which the infants were singletons and weighing ≥2500 gr. A total number of 3112 women gave birth during the period of this study. Newborns weighing less than 2500 gr (236 cases), twin babies (37 cases), and those hospitalized for jaundice appearing prior to nursery discharge or any other reasons (137 cases) were excluded, remaining 2702 infants. Gestational ages of less than 37 weeks were considered as premature. Bilirubin level of more or equal 95% on bilirubin nomogram on the first 48 hours and more or equal 15 mg/dL thereafter was considered as indication for hospitalization. Those infants who had been readmitted within the neonatal period (first 14 days) because of jaundice were compared with all other infants who were not readmitted within this period of time.

The data of mother-infant pairs were analyzed in SPSS (version 11.5), using Chi-square or Fisher exact tests and logistic regression for categorical and t-test for continuous data. All statistical tests were two-tailed and *P*-values less than 0.05 were considered statistically significant.

Findings

There were 340 (12.6%) rehospitalizations for hyperbilirubinemia and remaining 2362 infants were non hospitalizsed cases. Maternal mean (SD) age was 27.71 (5.4) years and didn't differ between the two groups of icteric and non-icteric babies [28.1 (5.6) in icteric and 27.6 (5.4) in non-icteric, *P*=0.45]. Most of the mothers were Fars, followed by Turks, Kurds, Lors and Arabs. Maternal races were different in the two groups of icteric and non-icteric infants, *P*<0.001 (Table 1). Comparing groups showed that only in Arabs icteric infants were significantly higher than in other ethnic groups, *P*=0.001 (OR: 10.59, CI: 2.97-37.72).

Maternal recorded variables are shown in table 1. There were no differences between maternal blood groups of icterics and non-icterics (*P*=0.3), but Rh-negative mothers had more icteric babies than Rh-positive mothers (*P*=0.01).

Most of mothers didn't have any history of drug consumption during pregnancy, but mothers with positive history of drug consumption had more icteric babies than mothers with negative history, *P*=0.001 (Main drugs prescribed during pregnancy were Levothyroxin, Insulin and anti-convulsive drugs). Ruptured membrane was seen in 307 (11.4%) and didn't have any significant effect on neonatal icterus (*P*=0.7). Oxytocin was used during labour in 931 (34.5%) of mothers, but with no significant effect on their neonatal icterus, *P*=0.4.

Mean (SD) neonatal birth weight was 3301.1 (395) grams totally [3284.6 (393.0) in icterics and 3303.5 (385.9) in non-icterics], which did not differ between the two groups (*P*=0.41). Neonatal gestational age was 39 (1) weeks in total; 39.0 (1.[illegible] weeks in icterics and 39.2 (1.0) in non-icterics (*P*=0.001). Seventy nine (2.9[illegible]) newborns were delivered prematurely; [illegible]% of icteric babies were premature compared with 2.6% of non-icterics ([illegible]016). Premature babies were more rehospitalized because of jaundice, [illegible].3% versus 12.1% (*P*=0.004). There were 14[illegible]3 (52.3%) male and 1289 (47.7%) female [illegible]bies. There were no significant difference of sexes between the two groups of icteric and

Table 1- Maternal information in two groups of icteric and non-icteric neonates

Maternal information		Icteric N (%)	Non-icteric N (%)	Total N (%)	Df †	P-value*
Race	Fars	2[illegible] (12.4)	1560 (87.6)	1780 (100)	4	<0.001
	Turk	[illegible]06 (12.3)	75 (87.7)	861 (100)		
	Kurd	8 (20)	32 (80)	40 (100)		
	Lor	0	11 (100)	11 (100)		
	Arab	6 (60)	4 (40)	10 (100)		
Blood Group	A	101 (12.1)	736 (87.9)	837 (100)	3	0.29
	B	76 (12.6)	528 (87.4)	604 (100)		
	AB	21 (9.3)	206 (90.7)	227 (100)		
	O	141 (13.7)	886 (86.3)	1027 (100)		
Rh	Positive	293 (12)	2145 (88)	2438 (100)	1	0.01
	Negative	46 (17.9)	211 (82.1)	257 (100)		
Drug Consumption	Negative	305 (12)	2237 (88)	2542 (100)	1	0.001
	Positive	35 (21)	125 (78)	160 (100)		

* Chi-squre test
† Df: Degree of freedom

Table 2- Neonatal qualitive information of two groups of icteric and non-icteric infants

Neonatal Information		Icteric N (%)	Non-Icteric N (%)	Total N (%)	Df †	P-value*
Sex	Male	178 (12.6)	1235 (87.4)	1413 (100)	1	**1**
	Female	162 (12.6)	1127 (87.4)	1289 (100)		
Maturity	Term	308 (12.1)	2236 (87.9)	2544 (100)	1	**0.004**
	Preterm	32 (20.3)	126 (79.7)	158 (100)		
Child order	First	200 (12.9)	1347 (87.1)	1547 (100)	1	**0.55**
	Subsequent	140 (12.1)	1015 (87.9)	1155 (100)		

* Chi-squre test
† Df: Degree of freedom

non-icteric infants (*P*=1). Among 2702 babies, there were 1547 (57.3%) first offspring, no significant increase of readmission because of jaundice was found among these infants compared with subsequent babies (*P*=0.5). Neonatal information is abstracted in Table 2 ans 3. Effects of different variables on neonatal hyperbilirubinemia are shown in Table 4. Comparing groups showed that only in Arab ethnicity icteric infants were significantly more than in others (*P*=0.001).

Mean (SD) length of nursery stay was 30.2 (23.9) hours. Mean neonatal stay in non-icteric was 30.6 (2.5) hours, but in icteric babies was 27.7 (9.8) hours that is significantly longer in non-icteric infants (*P*<0.001). Sixty four infants had check of bilirubin level before discharge from the nursery. These infants had mean billirubin level of 13 (3.1) mg/dL (range 5-21 mg/dL). The mean (SD) peak bilirubin level of all hospitalized babies was 17.9 (3.7) mg/dL. Considering ≥2 mg/dL as significant hyperbilirubinemia, 348 infants (22.5% of hospitalized infants) had significant hyperbilirubinemia. Eighteen infants had Bilirubin level above 35 mg/L, and 4 had bilirubin level above 30mg/L (5.2% and 1.1% of hospitalized infants respectively). No one showed any evidence of bilirubin encephalopathy. The mean (SD) peak level of significant hyperbilirubinemia was 23.3 (4). The highest bilirubin level was 45 mg/dL in a neonate whose mother was diabetic and himself was G6PD deficient. The mean age of admission was fifth postnatal day, with 3 days of standard deviation. Ninety percent of admissions occurred in the first 11 days of life. Fifteen (4.4%) neonates had exchange transfusion; all remaining neonates needed phototherapy.

The mean (SD) duration of hospital stay was 3 (1.8) days. The majority of infants in the study were breastfed. Those who were jaundiced also were mostly breastfed, but

Table 3- Neonatal quantitve information of icteric and non-icteric infants

Variable	Icter	Mean (SD*)	P -value
Neonatal birth weight	Icteric	3284.6 (392.9)	0.41
	Non-icteric	3303.5 (395.9)	
Neonatal gestational age	Icteric	39.0 (1.2)	0.001
	Non-icteric	39.2)1.0)	
Neonatal hospital stay	Icteric	27.7 (9.9)	<0.001
	Non-icteric	30.6 (25.3)	

* SD: Standard deviation

Table 4- Odd's ratio and confidence intervals of maternal and neonatal variables

Variable		Number	OR*	95% CI †	
				Lower	Upper
SEX	Male	1413	0.92	0.62	1.35
	Female	1289			
Maternal Drug Consumption	Negative	2542	-	-	-
	Positive	160	1.33	0.67	2.62
Ethnic Groups	Turkish	861	-	-	-
	Arab	10	0.14	0.00	3778648
	Kurdish	40	0.89	0.00	4.8E+20
	Fars	1780	0.00	0.00	2136309
	Lor	11	0.01	[illegible]	3994728
Neonatal Maturity	Premature	158	0.47	0.24	0.92
	Mature	2544			
Maternal Oxytocin Consumption	Positive	931	1.20	0.54	2.64
	Negative	55			
Maternal Rh	Positive	2433	1.30	0.67	2.52
	Negative	25			
Child Order	First	1547	0.74	0.50	1.09
	Subsequent	151			
Maternal Blood Group	A	[illegible]7	-	-	-
	B	604	1.06	0.67	1.66
	AB	227	1.17	0.69	1.98
		1027	1.14	0.53	2.45

* Odds ratio
† Confidence interval

feeding had no significant effect on their jaundice (*P*=0.9).

In a logistic regression analysis adjusted for all mentioned variables in table 4 we found that only prematurity of newborn had a significant effect on neonatal readmission for jaundice (OR: 0.47,with CI of 0.24-0.97).

Discussion

The incidence of hyperbilirubinemia among our study group was 12.6%, the incidence of significant hyperbilirubinemia being 3.1%. Other studies report incidences of significant hyperbilirubinemia 1.7% to 12%[9,10], although an incidence of readmission as low as 4.2 per 1000 newborns has been documented in some studies[8]. These differences may be attributable to ethnic and geographic variations in different populations. In our study maternal mean age did not differ between the two groups of icteric and non-icteric babies.

Maternal ethnic groups were significantly different among icteric and non-icteric infants. The association of Asian race/ethnicity with jaundice has been well established before [3,9,11,12]. In our study only in Arab ethnicity, icteric infants were significantly more than in others.

There was no difference between maternal blood groups of icterics and non-icterics, but Rh- negative mothers had significantly more icteric babies than Rh-positive mothers. Although there are some studies that show increased risk of jaundice in maternal 0 blood group, but there is no difference between maternal ABO or Rh group in some other studies[13].

Mothers with positive history of drug consumption had more icteric babies than mothers with negative history. Neither ruptured membrane nor maternal oxytocin consumption had significant effect on neonatal icterus. Prolonged rupture of membrane had significant effect on neonatal jaundice in Gieger et al study group[13].

Birth weight did not differ significantly in the two groups of icterics and non-icterics. Birth weight was significantly different in Danielsen et al study group[12]. There were no significant differences of sexes between the two groups of icteric and non-icteric infants, although male sex has been found to be more prone to jaundice in some other studies[8,12].

In this study, only prematurity of newborn had a significant effect on neonatal readmission for jaundice. Similar results are shown in other studies[12].

In our study we found that the jaundiced neonates had significantly shorter nursery stay than those without jaundice. Geiger et al found that length of birth hospitalization did not differ between icteric and non-icteric infants of their study[13]. The study included only normal vaginally delivered infants. A case-control study by Soskolne et al, reported a 2.2 fold increase in the risk of rehospitalization for jaundice in infants hospitalized for less than 72 hr. This study included all infants. Liu et al found a small but statistically significant increase in rehospitalization among infants discharged <30 hr after birth[14]. Lee et al also mentioned an association between decreasing hospital stay and increasing rehospitalization[2].

In our study we didn't find any significant differences between maternal age, ABO group, rupture of membrane, oxytocin consumption, or neonatal birth weight, child order and sex in re-evaluation of these risk factors for significant hyperbilirubinemia.

Conclusion

Results of this study show that longer primary hospital stay may decrease incidence of readmission for hyperbilirubinemia. Also one should be careful about some infants with Arab maternal ethnicity, Rh-negative mothers and drug consumption during pregnancy.

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