ORIGINAL CONTRIBUTION

The Clinical Significance of ABO Blood Group Incompatibility

Diane J. Madlon-Kay, MD

Objective: To compare incidence, severity, and treatment of jaundice in ABO-compatible and -incompatible infants.

Design: Retrospective chart review.

Setting: A 340-bed acute-care public and teaching hospital.

Patients or Other Participants: All infants with blood groups A or B delivered in 1990 by Rh-positive mothers with blood group O. On direct antiglobulin testing 65 infants had positive and 78 had negative results. The control group comprised 78 infants with blood group O born to mothers of blood group O.

Intervention: None.

Results: Infants who were ABO-incompatible and showed positive results to the direct antiglobulin test had the highest incidence of jaundice and underwent more tests and phototherapy. Infants who showed negative results to the direct antiglobulin test had jaundice incidence rates between those seen for control infants and infants who tested positive. Mean peak bilirubin levels did not differ significantly among the groups.

Conclusion: Incompatibility of ABO blood group is associated with an increased incidence of jaundice and higher phototherapy rates. Clinicians should continue to be concerned about possible ABO incompatibility in infants with jaundice born to mothers with blood group O.

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From the Department of Family Medicine, St Paul (Minn)–Ramsey Medical Center.

INCOMPATIBILITY OF ABO blood group occurs in approximately 20% of all pregnancies.[1] The spectrum of disease that results is extremely broad, with a relatively small percentage of infants requiring intervention for control of hyperbilirubinemia or anemia.[2] It is thought, however, that most ABO-incompatible infants have some degree of hemolytic disease.[3] Routine cord blood testing of infants born to mothers with blood group O and direct antiglobulin testing (DAT) on infants with blood groups A or B have been recommended by several authorities to facilitate early recognition and treatment of ABO incompatibility.[2,4,5]

A recent study questioned whether ABO incompatibility is truly of clinical significance. Quinn et al[6] reported that neither the incidence nor the severity of jaundice in ABO-incompatible infants differed significantly from that of ABO-compatible infants. In a response to this report, it was suggested that "ABO-incompatible jaundice is a figment of the pediatricians' vivid imagination."[7] The report by Quinn et al,[6] however, did not include any information about phototherapy received by the infants, which would have affected the severity of their jaundice. The purpose of my study was to further compare jaundice recognition and treatment, including phototherapy, in ABO-compatible and -incompatible infants.

RESULTS

One hundred forty-three infants with blood groups A or B were identified, of whom 65 were DAT-positive. **Table 1** demon-

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MATERIALS AND METHODS

All Rh-positive women with blood group O who delivered in 1990 at St Paul (Minn)–Ramsey Medical Center were identified by review of the hospital's standardized labor and delivery forms. The cord blood group and DAT results of the infants of these women were obtained from computerized laboratory data. These tests were conducted automatically on infants cared for by the pediatric service. Most infants cared for by the family medicine service and a health maintenance organization were also tested automatically.

Charts of all infants with blood groups A or B were reviewed. A control group was identified that included infants with blood group O born to mothers with blood group O. Each of these infants was born earlier on the same day as a group A or B DAT-negative infant; if no group O infant was born that day, the first eligible one born later was included.

Infants were excluded from the study if they were cared for in the intensive care nursery. The normal newborn nursery prominently displays nomograms by Cockington[8] as a guide to the treatment of hyperbilirubinemia. The nomogram is a graph of age vs bilirubin level with a marked line indicating the level at which phototherapy is recommended. The line slopes steeply at early ages and then reaches a plateau. Examples of bilirubin levels above which phototherapy is recommended for infants greater than 2500 g at birth are as follows: 86 μmol/L (5 mg/dL) at age 12 hours, 137 μmol/L (8 mg/dL) at 24 hours, 214 μmol/L (12.5 mg/dL) at 48 hours, 257 μmol/L (15 mg/dL) at 72 hours, and 274 μmol/L (16 mg/dL) at age 96 hours. The χ^2 test and analysis of variance were used for statistical analysis.

strates the demographic data on these infants and the control infants. No significant differences were found between the groups in any of these characteristics.

Recognition and treatment of jaundice in the infants are shown in **Table 2**. Many significant differences were found, with ABO-incompatible DAT-positive infants having the highest incidence of jaundice and undergoing more tests and phototherapy. Phototherapy was started at a significantly younger age in the DAT-positive infants. Mean peak bilirubin levels did not differ significantly among the groups.

Bilirubin levels were determined in 14 infants who had no documentation of jaundice by either the physician or nurse; of these, 10 were DAT-positive. When mean peak bilirubin levels of only those infants clinically identified as having jaundice were compared, no significant difference was found among the groups.

Physicians followed the phototherapy nomogram guidelines in 116 of 118 infants who underwent bilirubin determination. One DAT-positive infant received phototherapy and one DAT-negative infant did not receive phototherapy, contrary to the guidelines.

COMMENT

Incompatibility of ABO blood group was clearly of clinical significance in this infant population. On all but one variable of jaundice recognition and treatment, DAT-positive incompatible infants were more severely affected. Infants who had negative results on the DAT were generally affected at rates between those seen for control and DAT-positive infants, confirming earlier reports of a spectrum of incompatibility.[3]

Mean peak bilirubin level was the single measurement that was not higher in DAT-positive infants. This level is obviously affected by phototherapy, which the DAT-positive infants received seven times more often at younger ages and for twice the duration of that received by the control infants. A study in which infants received no phototherapy would be necessary to definitively prove whether bilirubin levels are higher in ABO-incompatible infants. However, such a study would be difficult to support for ethical reasons.

Incompatibility of ABO blood group was clearly of clinical significance in this infant population.

Table 1. Demographic Characteristics of Infants*

Characteristic	Group A or B		Group O (n=78)
	DAT-Positive (n=65)	DAT-Negative (n=78)	
Male, No. (%)	33 (51)	44 (56)	46 (59)
Breast-fed, No. (%)	23 (35)	25 (32)	36 (46)
Mean (±SD) gestational age, wk	39±1.3	39±1.6	39±1.5
Mean (±SD) birth weight, g	3281±435	3312±464	3354±473
Race, No. (%)			
White	30 (47)	51 (65)	32 (41)
Black	18 (28)	12 (15)	22 (28)
Asian	9 (14)	8 (10)	10 (13)
Other	7 (11)	7 (9)	14 (18)
Service, No. (%)			
Pediatrics	47 (72)	60 (77)	59 (76)
Family medicine	15 (23)	16 (21)	14 (18)
Health maintenance organization	3 (5)	2 (3)	5 (6)
Tested automatically, No. (%)	59 (91)	73 (94)	75 (96)

*DAT indicates direct antiglobulin test.

Table 2. Recognition and Treatment of Jaundice in Infants*

Characteristic	Group A or B		Group O (n=78)
	DAT-Positive (n=65)	DAT-Negative (n=78)	
Jaundice documented by nurse, No. (%)†	48 (74)	37 (47)	40 (51)
Jaundice documented by physician, No. (%)‡	31 (48)	17 (22)	12 (15)
Bilirubin tested, No. (%)‡	61 (94)	31 (40)	26 (33)
No. of bilirubin tests per infant, mean±SD	2.8±2.4	2.2±1.9	1.7±1.3
Hemoglobin tested, No. (%)‡	21 (32)	4 (5)	3 (4)
Mean (±SD) peak bilirubin, μmol/L (mg/dL)	156±76 (9.1)	180±72 (10.5)	157±62 (9.2)
Phototherapy received, No. (%)†	17 (26)	8 (10)	3 (4)
Mean (±SD) age phototherapy was started, h†	35±24	63±43	92±41
Mean (±SD) duration of phototherapy, h	50±24	39±8	21±3
Readmission for phototherapy, No. (%)	3 (5)	3 (4)	2 (3)
Mean (±SD) hospital stay, d†	3.8±1.7	3.4±1.1	3.2±1.1
Mean (±SD) time until recommended follow-up visit, d†	6.6±5.6	9.1±4.6	9.6±4.6

*DAT indicates direct antiglobulin test.
†P<.05.
‡P<.0001.

The study by Quinn et al[6] also concluded that the incidence of jaundice in ABO-incompatible infants was no higher than that in control infants. In fact, 14 (39%) of 36 DAT-positive infants had jaundice while 16% of 110 control infants had jaundice ($P<.01$). When DAT-positive infants were combined with DAT-negative but elution-positive incompatible infants, the incidence of jaundice (26% of 110) was higher than that in control infants but did not reach statistical significance. Also, no mention was made in the study of any phototherapy received by either control or incompatible infants, making interpretation of these results difficult.

Jaundice recognition is, unfortunately, subjective and may have been influenced by knowledge of the infants' DAT status. Knowledge of DAT status obviously influenced the ordering of bilirubin level testing in the 10 DAT-positive infants who were not clinically identified as having jaundice. Fortunately, knowledge of DAT status did not influence physician use of phototherapy, with one exception. The significantly higher phototherapy rate in ABO-incompatible infants was appropriate according to the recommended guidelines.

DAT-positive incompatible infants were more severely affected

In conclusion, this study confirms traditional teaching that ABO incompatibility is associated with an increased incidence of jaundice and higher phototherapy rates. Clinicians should continue to be vigilant in their recognition of ABO incompatibility.

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Reprint requests to Department of Family Medicine, St Paul–Ramsey Medical Center, 640 Jackson St, St Paul, MN 55101-3540 (Dr Madlon-Kay).

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