Identifying ABO Incompatibility in Newborns: Selective vs Automatic Testing

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Background. Two approaches to identifying blood group (ABO) incompatibility in infants have been suggested. The routine approach is to automatically perform blood type and direct antiglobulin tests on every infant born to a mother with type O blood. The selective approach is to test only significantly jaundiced infants.
Methods. One hundred thirteen infants of mothers with type O blood were tested automatically and 188 other infants were tested selectively. Charts of the infants were reviewed for jaundice recognition and management.
Results. Jaundice recognition and management and mean peak bilirubin levels did not differ significantly between the two groups. However, three of the infants who were tested selectively had bilirubin levels above 342 μmol/L (20 mg/dL). Two infants were readmitted for phototherapy despite automatically having had their cord blood tested. All infants requiring phototherapy were clinically jaundiced before 48 hours of age.
Conclusions. Selective cord blood testing was found to be a reasonable, less expensive alternative to routine testing. However, in clinical settings in which newborns are often discharged before the third day of life, automatic cord blood testing may be preferable. All infants discharged before 48 hours of age need close clinical follow-up regardless of the testing protocol used.
Key words. Jaundice, neonatal; hyperbilirubinemia; phototherapy; blood group incompatibility. *J Fam Pract 1992; 35:278-280.*

ABO incompatibility is a common occurrence and often has no clinical significance. It may, however, cause severe hemolytic disease in the newborn. Approximately 40% of infants of mothers with type O blood are either group A or B.[1] The results of direct antiglobulin tests (DAT) of cord blood are positive in approximately one third of these infants. Only a small fraction of DAT-positive infants develop clinical disease, and the incidence of severe hemolytic disease is very low.[2] Although the DAT is almost always positive in clinically significant hemolytic disease resulting from ABO incompatibility, the DAT may be negative.[1,2]

Two alternative approaches to identifying ABO incompatibility have been suggested.[3] One approach is to look for ABO incompatibility only in those infants who become sufficiently jaundiced to warrant diagnostic studies to determine the cause of jaundice. For term babies, this includes any infant with clinical jaundice in the first day of life or a bilirubin level greater than 171 μmol/L (10 mg/dL) anytime thereafter.[3] The trend toward early discharge is a potential problem for this selective approach to testing.

An alternative approach is to screen every infant born to a mother with type O blood to determine blood type and DAT status. All infants who are DAT positive can then be followed closely for hyperbilirubinemia. This routine testing will identify a larger number of infants, most of whom will have no clinical disease, and could lead to unnecessary laboratory tests and phototherapy.

Two studies that looked specifically at the automatic testing approach concluded that there are no appropriate screening tests capable of selecting those ABO incompatible infants who will have hemolytic disease severe enough to require treatment.[4,5] It was concluded that screening for hemolytic disease due to ABO incompatibility was not cost-effective,[4] and the importance of clinical observation of the newborn was emphasized.[5] However, neither study compared the outcomes of infants tested automatically with those tested selectively.

The purpose of this study was to compare the effectiveness of automatic and selective testing in identifying ABO incompatibility in infants of mothers with group O blood types. The following specific questions were asked: (1) Does the selective approach lead to higher peak

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bilirubin levels in infants and more readmissions for phototherapy? (2) Does the automatic approach lead to more laboratory tests and phototherapy?

Methods

The study took place at the St Paul–Ramsey Medical Center in St Paul, Minnesota. Infants in the normal newborn nursery who were cared for by the family practice service were the study population. Infants in the intensive care nursery were excluded from the study. The study infants received care from family physician residents and faculty. A phototherapy nomogram by Cockington[6] is prominently displayed in the nursery and used as a guide for management of hyperbilirubinemia.

In 1989 the Ramsey pediatric service began automatically testing the cord blood of infants of mothers with type O, Rh-positive blood to determine type, Rh-factor, and DAT status. (The cord blood of all infants of Rh-negative mothers are routinely typed so that the mothers may be treated with anti-Rh immunoglobulin.) Although the family practice service did not initiate routine testing, many infants on the service were mistakenly tested.

Labor and delivery records for 1990 and 1991 were reviewed to identify infants of women with type O, Rh-positive blood. Charts of the infants who received care from the family practice service were reviewed retrospectively for demographic information, laboratory testing, and jaundice recognition and management. The management of infants with automatic and selective cord blood testing were compared. Statistical analysis was done with chi-square and Student's *t* tests.

Results

Three hundred one infants of mothers with type O, Rh-positive blood were identified. One hundred thirteen (38%) infants had their cord blood type, Rh-factor, and DAT status determined automatically without a physician order. Of the 188 infants whose cord blood was not tested automatically, 34 (18%) had their cord blood tested selectively by physician order.

Infants whose cord blood was tested automatically are compared demographically with those who were tested selectively (Table 1). The two groups of infants did not differ significantly by sex, race, gestational age, weight, feeding method, or follow-up appointment time. The length of hospital stay was slightly longer for infants tested automatically. Twenty-nine (26%) of the infants tested automatically had blood type A or B, and 14 (12%) were DAT positive. Eighteen of the infants tested selectively had blood type A or B, and 13 were DAT positive.

Table 1. Demographics of Infants Tested Automatically and Selectively for ABO Incompatibility

Characteristics	Tested Automatically (n=113) No. (%)	Tested Selectively (n=188) No. (%)
Male	55 (49)	97 (52)
Race		
White	50 (45)	84 (45)
Black	21 (19)	28 (15)
Asian	18 (16)	36 (19)
Other	24 (21)	40 (21)
Mean gestational age (w)	39.3	39.4
Birthweight (g)		
2000–2499	4 (4)	7 (4)
≥2500	109 (96)	181 (96)
Mean birthweight (g)	3363	3332
Mean length of hospital stay (d)*	3.3	2.9
Breast fed	38 (34)	60 (32)
Mean follow-up scheduled (d)	11.0	10.4
Cord blood group, DAT		
Unknown	0 (0)	154 (82)
Type O	84 (74)	16 (9)
Type A or B, DAT negative	15 (13)	5 (3)
Type A or B, DAT positive	14 (12)	13 (7)

*$P < .01$.

Jaundice management of the two groups of infants did not differ greatly (Table 2). Similar percentages of infants in both groups had jaundice noted by the nurse and physician. The number of infants having total bilirubin levels checked and the mean peak total bilirubin level were similar between the two groups.

Three infants had total bilirubin levels above 342 μmol/L (20 mg/dL). All were DAT positive and had been tested selectively. One of these infants was first noted to be clinically jaundiced at 17 hours of age, and phototherapy was started at 23 hours of age. Despite appropriate treatment, the infant's bilirubin reached a

Table 2. Jaundice Management of Infants Tested Automatically and Selectively

	Tested Automatically (n=113)	Tested Selectively (n=188)
Jaundice noted by nurse (%)	45	35
Jaundice noted by physician (%)	25	22
Total bilirubin determined (%)	32	28
Hemoglobin determined (%)	7	6
Mean peak total bilirubin level, μmol/L (mg/dL)	168 (9.8)	174 (10.2)
Phototherapy used (%)	3.5	4.3
Readmission for phototherapy (%)	1.8	0.5

peak of 366 μmol/L (21.4 mg/dL) at 68 hours of age. The other two infants were breast fed and noted to be clinically jaundiced at 25 and 30 hours of age. Bilirubin levels were checked on these infants at the time of the next routine blood drawing, a delay of 15 and 18 hours, respectively. At that time the levels were already greater than 342 μmol/L (20 mg/dL).

The percentage of infants receiving phototherapy was similar. Of the 12 infants receiving phototherapy, 11 were blood group A or B, and 10 were DAT positive. Five of the infants receiving phototherapy were noted to be clinically jaundiced within the first 24 hours of life. All were clinically jaundiced within the first 48 hours of life. Two of the three infants readmitted for phototherapy had undergone routine testing. None of the infants received an exchange transfusion.

Discussion

The selective and automatic approaches to identifying ABO incompatibility had similar outcomes in this population. The selective approach did not result in identifying infants with significantly higher peak total bilirubin levels than those of infants in the group automatically tested. Furthermore, readmissions for phototherapy occurred no more frequently in the selectively tested group. Although the three infants with total bilirubin levels above 342 μmol/L (20 mg/dL) were tested selectively, the extreme elevation in one infant occurred despite early recognition of jaundice and optimal management. The other two cases could have potentially been avoided by checking bilirubin levels promptly when jaundice was first noted rather than waiting for the next routine blood drawing. Automatic cord blood testing did not result in increased use of laboratory testing or phototherapy. Therefore, either approach appears to be reasonable.

A major disadvantage of automatically testing infants of blood type O, Rh-positive women is the cost. The charge for determining cord type and Rh factor and performing the DAT at Ramsey is $33. Charges elsewhere are much higher.[7] When the proportion of women with type O, Rh-positive blood (42%) and the annual number of births in the United States (3.7 million) are considered, substantial costs could be incurred by automatic testing of cord blood.

The findings in this study, however, may not apply to all clinical settings, particularly in facilities where earlier discharge of newborns is common. Despite national trends toward sending infants home sooner, most of the babies in this study were discharged on the third day of life. Only 6 (2%) infants were discharged on the day of birth and 72 (24%) on the second day of life. All of the infants requiring phototherapy were clinically jaundiced before 48 hours of age. In clinical settings where there are more frequent discharges before the third day of life, automatic cord blood testing may be preferable. Nevertheless, automatic testing cannot substitute for close clinical follow-up, particularly in babies discharged before 48 hours of life.[5]

An important limitation of this study was its small size. In particular, few infants were readmitted for phototherapy. A true difference in jaundice management or outcome may have been missed because of a type II error.

The Ramsey family practice service has continued its use of selective cord blood testing of infants of women with group O, Rh-positive blood. Physicians in similar clinical settings who automatically test these infants should consider adopting a selective approach.

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