Home Health Nurse Clinical Assessment of Neonatal Jaundice

Comparison of 3 Methods

Diane J. Madlon-Kay, MD

Objective: To compare 3 methods of clinical assessment of jaundice in newborns by home health nurses.

Design: Prospective clinical trial.

Setting: Homes of newborns living within 10 miles of a 340-bed community hospital where they were delivered.

Participants: Home health nurses and newborn patients (≤2 weeks old).

Interventions: The nurses examined the newborns and documented whether they detected jaundice. In newborns thought to have jaundice, the nurses estimated bilirubin levels, documented the extent of caudal progression of the jaundice, and determined the Ingram (Cascade Health Care Products, Salem, Ore) icterometer readings from the newborns’ noses. Total serum bilirubin tests were obtained from all newborns studied.

Outcome Measures: Nurse assessment of the presence of jaundice and its caudal progression, nurse estimates of bilirubin levels, icterometer readings, and bilirubin levels.

Results: The nurses determined that 82 (50%) of the 164 newborns had jaundice. Their estimates of bilirubin levels were most highly correlated with serum bilirubin levels (Pearson correlation, 0.61). All 3 newborns with bilirubin levels greater than or equal to 291 µmol/L (≥17 mg/dL) were recognized by the nurses as having jaundice. These newborns had icterometer readings greater than or equal to 3.5 and had estimated bilirubin levels of greater than or equal to 274 µmol/L (≥16 mg/dL).

Conclusions: The method of evaluation that each nurse was accustomed to using was the most accurate in determining the severity of newborn jaundice. These results suggest that postpartum home health nurses can effectively evaluate newborns for the presence and severity of jaundice.


JAUNDICE OCCURS in approximately 60% of newborns in the United States and typically peaks during the first 3 to 5 days of life.

Because most newborns stay in the hospital for 2 days at the longest, the traditional clinic visit at age 2 weeks puts newborns at risk for delayed diagnosis of jaundice and possible kernicterus. In 1995, the American Academy of Pediatrics (AAP) recommended the following:

For newborns discharged in less than 48 hours after delivery, a definitive appointment has been made for the baby to be examined within 48 hours of discharge. The follow-up visit can take place in a home or clinic setting, as long as the personnel examining the infant are competent in newborn assessment and the results of the follow-up visit are reported to the infant’s physician, or his designees, on the day of the visit.

One of the purposes of this visit is to assess the infant’s degree of jaundice.

In response to public and clinical concern about shorter postpartum hospital stays, almost all states have passed maternity care legislation, and federal legislation became effective in January 1998. Most state laws include requirements for postdischarge follow-up services for mothers and newborns discharged early. There is substantial variation in the types of services specified and the extent to which insurers are responsible for covering early follow-up care. In Minnesota, for example, legislation requires coverage for at least 1 home visit by a registered nurse for a mother and newborn who voluntarily leave the hospital before the minimum mandated stay and specifies that the visit must occur within 4 days of the date of discharge. Neither federal nor state legislation nor the AAP guidelines address rou-
PARTICIPANTS AND METHODS

Home health nurses who visited newborns delivered at Regions Hospital in St Paul, Minn, participated in the study. I interviewed the nurses individually to determine their usual methods of assessing the presence and severity of jaundice in newborns. I then instructed the nurses as a group how to determine the caudal progression of jaundice by blanching the skin. The nurses were also instructed on the use of the Ingram icterometer, and each nurse was given one to use for the study.

Mothers in the postpartum department were invited to participate in the study. Mothers were excluded if they were not proficient in English or lived more than 10 miles from the hospital. Newborns were excluded if they were in the intensive care nursery or received phototherapy. Participating mothers were visited by the home health nurse before the newborn was 2 weeks old. The nurse first assessed the newborn for jaundice in the usual manner. If the nurse felt the newborn did not have jaundice, no further clinical assessment was performed.

If the nurse felt the newborn had jaundice, the total serum bilirubin level was estimated and it was documented whether bilirubin testing would be recommended to the newborn’s physician based on the usual assessment method. In newborns with jaundice, the nurse then determined the caudal progression of the jaundice and drew a horizontal line on an illustration of a newborn corresponding to where the jaundice ended. The distance from the top of the newborn’s head to the line drawn by the nurse was used to determine the caudal progression.

The nurse then used the Ingram icterometer to obtain a reading from the newborn’s nose. The Ingram icterometer is a simple handheld device made of clear plastic on which are painted 5 transverse stripes of precisely graded hues of yellow. The stripes and spaces in between are ⅜ in wide and are numbered from 1 (lightest in color) to 5 (darkest). When the icterometer is used, the painted side is pressed against the tip of the newborn infant’s nose until the skin becomes blanched. The yellow color of the blanched skin can then be matched with the yellow stripes and a jaundice score assigned. If the color falls halfway between 2 stripes, for example between 2 and 3, the number 2.5 is assigned.

Blood samples were obtained from all newborns and transported to Regions Hospital for determination of the total serum bilirubin level. If the level was greater than or equal to 239 µmol/L (≥14 mg/dL) the newborn’s physician was notified. The mothers received a $25 gift certificate for participating. The HealthPartners (Bloomington, Minn) institutional review board approved the study protocol.

Standard descriptive statistics were calculated for all variables. Pearson product moment correlations were calculated to examine the relationship among different quantitative measurements of jaundice. Accuracy of estimates was calculated by subtracting the nurse estimate of the bilirubin level from the actual total bilirubin level. Accuracy of different subgroups such as ethnicity was assessed using 1-way analysis of variance techniques. Categorical relationships were assessed using $\chi^2$ statistics as appropriate. All analyses were performed using SPSS for Windows version 10.0.3 (SPSS Inc, Chicago, Ill).

tine postdischarge follow-up after hospital stays longer than 48 hours.

Clinic visits within a few days of delivery are difficult for mothers and families regardless of social and economic resources. Clinic no-show rates as high as 26% have been noted. Moreover, maternal satisfaction is markedly higher with postpartum home visits than with pediatric clinic visits. However, the assessment of jaundice is much more complex in the home setting than in the hospital or clinic. The home health nurse must first decide whether the newborn has jaundice. If the nurse believes that the newborn has jaundice, she must then decide whether to recommend bilirubin testing. Then she must contact the newborn’s physician for permission to do the testing, obtain the blood sample, and transport it to the laboratory. The test results are reported to the physician who makes a recommendation. A key step in the process is the nurse’s ability to clinically assess whether the jaundice is serious enough to warrant bilirubin testing.

The AAP guidelines on newborn hyperbilirubinemia management are rather vague about the clinical evaluation of jaundice. Clinicians are advised to measure bilirubin levels when the jaundice is “clinically significant” by medical judgment. No further definition of clinically significant jaundice is given, and the AAP states that “adequate data are not available from the scientific literature to provide more precise recommendations.” The AAP does suggest blanching the skin with digital pressure to reveal the underlying color of the skin. The guidelines also state that clinical assessment must be done in a well-lighted room, and that as the bilirubin level rises, the extent of caudal progression may be helpful in quantifying the degree of jaundice. Several studies have documented that jaundice is first seen in the face and progresses caudally to the trunk and extremities. These studies also found good correlation between serum bilirubin levels and the advancement of dermal icterus. In contrast, a recent study concluded that the clinical examination for jaundice had poor reliability and only moderate correlation with bilirubin levels. However, the authors did conclude that finding no jaundice caudal to the nipple line reliably predicted a bilirubin concentration less than 205 µmol/L (12.0 mg/dL).

The AAP jaundice guidelines also state that the use of an icterometer or transcutaneous jaundice meter may be helpful in the clinical assessment of jaundice. These devices have not been used in most US hospitals, perhaps because of the ease of obtaining bilirubin tests, but are important for home health nurses’ evaluations of jaundice. A variety of instruments have been tested in differing patient populations and are useful in developing countries where few centers are equipped with facilities for micromethods of bilirubin testing, and frequent blood sampling is not feasible. Particularly promising because of its low cost ($17) and simplicity
is the Ingram (Cascade Health Care Products, Salem, Ore) icterometer. Successful icterometer use has been reported by 2 institutions that obtained serum bilirubin levels only on newborns with icterometer readings of 3 or higher. Because the use of home health nurses in the care of newborns after discharge is increasing, the ability of home health nurses to clinically assess jaundice is important to study. The purpose of this study was to examine the accuracy of 3 methods of jaundice assessment by home health nurses of newborns in the home: their usual methods of assessment, determining the caudal progression of jaundice, and using the Ingram icterometer.

RESULTS

One hundred sixty-four newborns and 12 home health nurses participated in the study. The 6 nurses interviewed had provided home health care for newborns for a length of time that ranged from 1 to 7 years, and in that time had cared for 4 to 50 newborns each month. The nurses described a variety of methods that they used to determine the severity of jaundice, including blanching the skin to determine its caudal progression, looking for jaundice at the nose, gum, or sclera, and judging “how yellow” the skin appeared. All of the nurses reported obtaining bilirubin levels selectively on newborns with jaundice in their usual practice. They considered several factors when deciding whether to obtain a blood sample for a bilirubin determination, including the severity of jaundice; the newborn’s level of alertness; stooling; urination and feeding patterns; concern about weight gain; parents perception of change in severity of jaundice; and the newborn’s age.

The mean (SD) age of the newborns at examination was 6.4 (2.5) days. The race or ethnic group as determined by the nurses was 60% white, 18% black, 6% Asian, 7% Hispanic, and 9% other ethnicity.

When assessed in the nurses’ usual manner, 82 (50%) of the newborns were judged to have jaundice (Figure). The nurses’ estimates of the bilirubin levels of the newborns with jaundice ranged from 34 to 325 µmol/L (2.19 mg/dL), with a mean (SD) of 176.0 (54.7) µmol/L (10.3 [3.2] mg/dL). The nurses judged that the jaundice in these newborns extended between the forehead and the knees, with the mean at the xiphoid area. The icterometer readings of the newborns with jaundice ranged from 1 to 5, with a mean (SD) of 2.6 (0.8).

The actual total serum bilirubin levels of all the newborns ranged from 12 to 345 µmol/L (0.7-20.2 mg/dL), with a mean (SD) of 125.0 (80.4) µmol/L (7.3 [4.7] mg/dL). Pearson correlations with actual bilirubin levels were calculated among the 3 methods of jaundice assessment used. The nurses’ estimates of the bilirubin levels had a correlation of 0.61 (P<.01); the assessment of caudal progression had a correlation of 0.47 (P<.01); and the icterometer had a correlation of 0.48 (P<.01). The accuracy of the nurses’ estimates of bilirubin levels was unaffected by the race or ethnic group of the newborns or by the different examiners.

The mean (SD) bilirubin level of newborns thought to have jaundice by the nurses was 180.0 (68.4) µmol/L (10.5 [4.0] mg/dL), while the mean (SD) bilirubin levels of newborns not thought to have jaundice was 71.8 (46.0) µmol/L (4.2 [2.7] mg/dL) (P<.001). The nurses would have recommended bilirubin testing in only 31 of the 82 newborns with jaundice if they were not in a study. The mean (SD) bilirubin levels of the newborns with jaundice they would have recommended testing for was 207.0 (66.7) µmol/L (12.1 [3.9] mg/dL). The mean (SD) bilirubin levels of newborns with jaundice they would not have tested was 164 (65) µmol/L (9.6 [3.8] mg/dL) (P<.005).

Only 3 newborns had bilirubin levels greater than or equal to 291 µmol/L (17 mg/dL), the level at which the AAP guidelines suggest considering phototherapy for newborns older than 72 hours. The nurses judged that the progression of jaundice in these newborns extended to the xiphoid in 2 and to the thigh in the third. The icterometer readings were 3.5, 4.0, and 4.5. The nurses’ estimates of the bilirubin levels were greater than or equal to 291 µmol/L (17 mg/dL) in 2 of these newborns and 274 µmol/L (16 mg/dL) in the third.

COMMENT

This study confirms that although jaundice is a common condition in newborns, bilirubin levels requiring phototherapy are infrequently obtained. Therefore, home health nurses providing care for newborns shortly after hospital discharge must be skilled in assessing the presence of jaundice and determining whether bilirubin testing is warranted. A recent study found equivalent clinical outcomes in newborns receiving either home health nurse visits or pediatric clinic visits on the third or fourth postpartum day. Although reassuring, the study did not provide specific information about morbidity related to newborn jaundice.

In this study, bilirubin levels were more strongly correlated with the nurses’ estimates of bilirubin levels based on their usual method of assessing jaundice than with their determination of the caudal progression of jaundice or with icterometer readings. When interviewed about their usual methods of evaluating jaundice, the nurses reported using caudal progression, checking for jaundice at certain sites, and judging how yellow the skin was. Using their usual methods of evaluation, the home health nurses correctly identified newborns with the most se-
vere jaundice and those without jaundice. The nurses were also appropriately selective in determining which newborns with jaundice they would recommend to receive bilirubin testing.

Although the nurses’ usual methods of evaluation included determining the caudal progression of jaundice, caudal progression alone was poorly correlated with actual bilirubin levels. The reason for this is unclear. In my previous study of newborns still in the nursery, the adjusted Pearson correlation of nurse assessment of caudal progression with actual bilirubin levels was 0.48, which is similar to the results of this study. In the previous study, however, correlation of the parental assessment of caudal progression with actual bilirubin levels was much higher (0.71).

In a previous study, I investigated how well parents, nurses, physicians, and an Ingram icterometer detected the presence and severity of jaundice in newborns while they were still in the nursery. There was moderate agreement between examiners about the presence of jaundice in the newborns (pairwise ρ, 0.48) However, all newborns with bilirubin levels greater than 205 µmol/L (12 mg/dL) were correctly identified as having jaundice by all examiners. The parents’ assessment of caudal progression and the icterometer readings were most highly correlated with bilirubin levels (adjusted Pearson correlations, 0.71 and 0.57, respectively). However, the bilirubin levels in this study were relatively low, reflecting the brief hospital stay of most of the newborns.

Another study found that the presence of visible jaundice extending caudal to the nipple line had a sensitivity of 97% and a specificity of 19% for identifying newborns with bilirubin levels greater than or equal to 205 µmol/L (12 mg/dL). The authors concluded that finding no jaundice caudal to the nipple line reliably predicted that a newborn would have a bilirubin concentration less than 205 µmol/L (<12 mg/dL), which might be useful in determining which newborns do not need serum bilirubin level determinations. In this study, the caudal progression was not as useful in identifying newborns with bilirubin levels greater than or equal to 205 µmol/L (≥12 mg/dL). The presence of jaundice caudal to the nipple line had a sensitivity of only 76% and a specificity of 60% for the identification of these newborns.

The correlation between Ingram icterometer readings and actual bilirubin levels was not as high in this study as in prior ones. The adjusted Pearson correlation in my previous study of newborns in the nursery was 0.57. A possible explanation for this difference is that in the previous study the icterometer was used on all newborns, while in the current study only newborns thought by the nurse to have jaundice had icterometer readings obtained.

The icterometer readings were not as helpful as previously reported in identifying newborns with bilirubin levels greater than or equal to 205 µmol/L (12 mg/dL). In my previous study, all 11 newborns with bilirubin levels greater than 205 µmol/L (>12 mg/dL) had icterometer readings greater than or equal to 2.5. In this study, an icterometer reading greater than or equal to 2.5 had a sensitivity of 75% and specificity of 72% for the identification of newborns with bilirubin levels greater than or equal to 205 µmol/L (≥12 mg/dL). However, an icterometer reading of greater than or equal to 3.5 was sensitive (100%) and quite specific (85%) in identifying newborns with bilirubin levels greater than or equal to 291 µmol/L (17 mg/dL).

A limitation of this study is the inability to further define the methods used by the home health nurses to estimate bilirubin levels. Other home health nurses may use different assessment methods that may in turn lead to a poorer correlation with actual bilirubin levels. In my previous study of newborns in the nursery, the nursery nurses’ estimates of bilirubin did not correlate as well with actual bilirubin levels (adjusted Pearson correlation, 0.52).

An additional limitation of the study is the relatively small number of newborns having bilirubin levels high enough to require potential intervention. Therefore, the sensitivities and specificities should be interpreted with caution. However, it is reassuring that the home health nurses appropriately identified the 3 newborns with bilirubin levels greater than or equal to 291 µmol/L (17 mg/dL). Therefore, despite these limitations, this study indicates that home health nurses have the clinical skills to appropriately evaluate newborns for jaundice.

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Corresponding author and reprints: Diane J. Madlon-Kay, MD, Ramsey Family Community Medicine Residency Program, 640 Jackson St, St Paul, MN 55101 (e-mail: madlono01@tc.umn.edu).

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