Osteopathic Family Physician (2013) 5, 17–23

ELSEVIER

acofp Osteopathic Family Physician

REVIEW ARTICLE

An osteopathic approach to reduction of readmissions for neonatal jaundice

Rachel Click, DO,[a] Julie Dahl-Smith, DO,[a] Lindsay Fowler, DO,[a] Jacqueline DuBose, MD,[a] Margi Deneau-Saxton, RN, CCCE, CIMI, CLC, CPD,[b] Jennifer Herbert, MD[c]

From [a]Georgia Health Sciences University, Medical College of Georgia, Department of Family Medicine, GA; [b]Georgia Health System, OB Labor and Delivery, GA; and [c]University Primary Care, Evans, GA.

KEYWORDS:
Breastfeeding;
Jaundice;
Prevention;
Hyperbilirubinemia;
Neonatal massage

Jaundice is a potentially life-threatening condition that continues to affect at-risk newborns, accounting for continued hospital readmissions. As family physicians, we should be cognizant of neonates who may be at risk for jaundice, including those with pathologic jaundice as well as newborns of breastfeeding mothers, and ensure sufficient intervention is taken to help prevent further elevations in bilirubin levels. Interventions are likely to include evaluation for sepsis, education regarding feeding frequencies for both breast- and bottle-fed neonates, reviewing maternal and hematologic risk factors for neonatal jaundice, and considering inborn errors of metabolism. An additional measure family physicians may consider is that of neonatal massage for those with elevated bilirubin levels. Neonatal massage, though not widely used, has been proven to promote excess bilirubin excretion, thus decreasing length of hospital stay; all the while, providing an intervention that allows parents to take an active role.

Introduction

Jaundice is a product of excess bilirubin (a product of broken down red blood cells), which manifests as a yellowing of the skin and eyes. It can be physiologic (normal) or pathologic (abnormal). Pathologic hyperbilirubinemia (excess bilirubin) is important to avoid because the sequela can be devastating, of which the most life threatening complication would be encephalopathy and kernicterus (damage of the nuclear region of the brain in infants causing decreased feeding and altered tone). Kernicterus has a high mortality rate and long-term morbidity rate with bilirubin > 20 mg/dL. "It has been estimated that the risk of kernicterus in infants with total serum bilirubin (TSB) greater than 30 mg/dL is about 1 in 7 infants".[1] Less serious complications of hyperbilirubinemia include infant weight loss, diarrhea, and for the mother, a sense of failure.

There are many different risk factors that can predispose an infant to hyperbilirubinemia. These include Asian descent, preterm infants (less than 36 weeks of gestation), phototherapy in a previous sibling, an infant with cephalohematoma, a positive Coomb's test, ABO incompatibility, or infants who had an assisted delivery by either forceps or vacuum. Infants born in higher altitudes are also at an increased risk.[2,3] A key to prevent jaundice is to allow enough time in the hospital. If jaundice occurs, increasing feeds as well as neonatal massage can help ameliorate the jaundice. A large US study (infants $n = 856$) concluded that

Corresponding author: Rachel Click, DO, Georgia Health Sciences University, Medical College of Georgia, Department of Family Medicine, 1120 15th Street Augusta, GA 30912.
E-mail address: rclick@georgiahealth.edu.

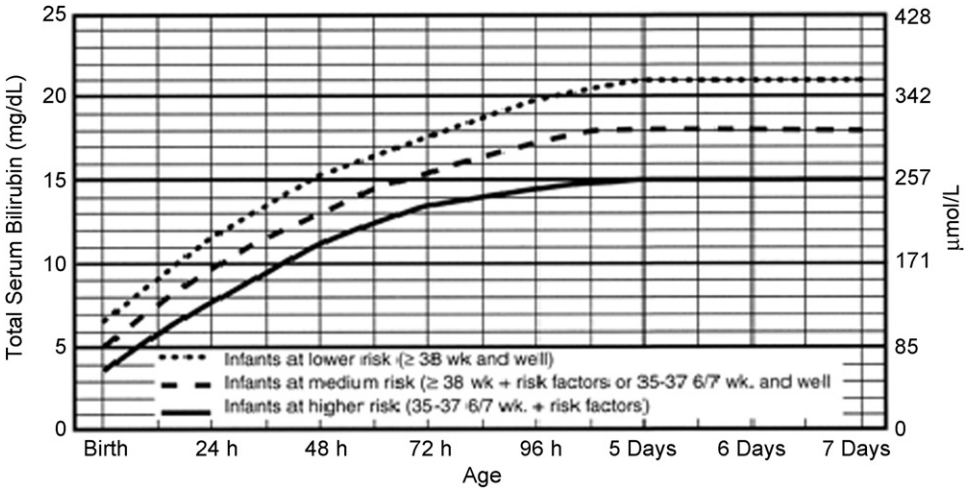
1877-573X/$ - see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.osfp.2012.09.005

newborns discharged at less than 30 hours were at an increased risk of re-hospitalization within the first month of life. They found that only 15% of infants were eligible for early discharge when careful guidelines were followed.[4] Even though the Provisional Committee for Quality Improvement and Subcommitte on Hyperbilirubinemia of the American Academy of Pediatrics has produced parameters on hyperbilirubinemia, there are still readmissions among certain high-risk groups which include infants of first time mothers, diabetic mothers, Asian mothers, mothers with pregnancy-induced hypertension, and mothers over 30. This has been associated with inexperienced parenting or breastfeeding difficulty or both.[3] "Insufficient lactation counseling is known to interfere with successful breastfeeding".[5] Lactation counseling is dependent on the institution the mother delivers at. In the hospital every infant needs to be assessed for the risk of developing hyperbilirubinemia, especially if they are less than 72 hours old. This can be done clinically whenever vital signs are taken. Visually, jaundice can be seen with blanching the skin and revealing the underlying color. Ideally this should be done under a window in the daylight. Jaundice can also be assessed with a TSB whenever there is a question about the degree of jaundice from a clinical perspective. A low threshold should be used when ordering a TSB test. These tests should also be ordered if there is jaundice within the first 24 hours of life or if jaundice appears excessive for the infant's age. A nomagram is then used to help you assess the risk. The nomagram along with your clinical judgment will determine if an infant needs phototherapy. You first assign an infant the status of low, medium, or high risk based on risk factors and clinical presentation. You then use the appropriate line on the nomogram. If the infant is above the chosen line, phototherapy would be initiated (Figure 1).

There are many causes of hyperbilirubinemia, some of which are ABO incompatibility, Rh antibody to the infant, sepsis, metabolic diseases, intrauterine infections, obstructive disorders (Dubin-Johnson syndrome), red blood cell abnormalities (hereditary spherocytosis), physiologic jaundice, which is considered a normal variant, and breastfeeding jaundice (inadequate intake of breast milk).[6]

Management is tied to the etiology of hyperbilirubinemia, most of which is beyond the scope of this article. Infants who are receiving inadequate feedings, or infants who have decreased urine or stool output, need increased feedings both in volume and calories to reduce intra-hepatic circulation of the bilirubin.[6] Therefore, if the mother is feeding every 3 hours, it needs to be increased to every 2 hours and for a longer time frame (eg: 25 minutes instead of 15 minutes); this is true for both breast- and bottle-fed infants. A lesser known, but effective technique, known as neonatal massage, can also decrease jaundice in neonates. These are techniques that can be taught to parents that will not only aid in recovery of jaundice, but will also serve as a means to bonding with their child. Jun Chen, who works for the department of medical informatics at Niigata University in Japan, has shown that neonatal massage promotes early defecation which accelerates bilirubin excretion, reducing neonatal hyperbilirubinemia.[7] Other benefits of infant massage include increased sleep duration, elimination of colic, reduced flatulence, improved physical development including weight, length, head circumference and bone mineral density, and improved development of nonverbal and verbal communication.[7] These techniques can be performed by either parent.

The mechanism by which these techniques work is by enhancing lymphatic and venous drainage, and alleviating congestion secondary to visceral ptosis.[8] They are very similar to mesenteric release techniques of the ascending



- Use total bilirubin. Do not subtract direct reacting or conjugated bilirubin.
- Risk factors = isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis, or albumin < 3.0g/dL (if measured)
- For well infants 35-37 6/7 wk can adjust TSB levels for intervention around the medium risk line. It is an option to intervene at lower TSB levels for infants closer to 35 wks and at higher TSB levels for those closer to 37 6/7 wk.
- It is an option to provide conventional phototherapy in hospital or at home at TSB levels 2-3 mg/dL (35-50mmol/L) below those shown but home phototherapy should not be used in any infant with risk factors.

Figure 1

and descending colon. This procedure improves bowel function by mechanically stimulating peristalsis, thus increasing gastrointestinal motility and alleviating or preventing constipation. It is more effective when performed several times a day.[9] If an Osteopath were to use a combination of lymphatic techniques and neonatal massage, the outcome would still be increased bilirubin excretion.

The World Institute for Nurturing Communication, WINC without borders (www.winc.ws) has crafted a set of massage techniques, appropriately named 'Welcome Baby Massage Techniques' (Figure 2),[10] to support stimulation and relaxation of newborns. These are taught to mothers after birth. There are several methods that can be used in any sequence; not all methods have to be utilized. These methods are described below.

WINC without borders infant massage routine (www.winc.ws)

Instruct the parent to undress the infant except for his or her diaper.

Method 1: "O" My Lips, which is used to improve suck reflex, by using an index finger to move slowly around the baby's mouth in clockwise circles, using slight pressure. The Babkin reflex can also be used to improve the suck reflex. This technique is performed as follows: press in the palm of the baby's hand; this causes the mouth to open in an 'O' shape (Figure 3).

Method 2: "Spirals". This focuses on abdominal reflex stimulation. Use an index finger and start at the left of the cord stump. Move in a clockwise fashion around the umbilicus. Gradually widen the spiral. Always return to the left of the cord stump (Figures 4-7).

Method 3: "Spider Walk". "Walk" the fingers across the abdomen from left to right above the umbilicus; this stimulates peristalsis to occur (Figures 8 and 9).

~~ CIMI® Teaching Guide ~~

World Institute for Nurturing Communication, WINC without borders™

(Origin 1970's, incorporated 1986 in USA) – Copyright® 2005-2012 – All Rights Reserved • www.winc.ws

Welcome Baby Newborn Massage Techniques

Welcome Baby Newborn Massage was created to support the physiologic transition of the newborn. No specific format or sequence is provided as the strokes are done to meet the specific needs of the infant. Choose a stroke or group of strokes thoughtfully; repeat each individual stroke 3 – 4 times. The massage should be done both gently and slowly.
Note: All intentional stroking of the infant should be preceded by face to face interaction, "asking permission", and calming touch. All stroke directions (left/right) are described for the parent facing the baby. Strokes on the baby's belly are **usually in a clockwise direction.**

Supportive Stimulation

"O" My Lips – Using one finger, move slowly around the baby's mouth in circles, in clockwise fashion, using a slight pressure. Variations: a) With index finger, gently sweep down over the lips from the tip of the nose/just under the nose to the chin. Return and repeat. b) Gently press thumb into the palm of baby's hand.	Helps stimulate the nerves that support digestion Stimulates musculature around mouth; awakens suck reflex *Use to support breastfeeding and to achieve a latch Variations cause reflexive opening of the mouth.
1. Spirals - Using index finger, start to the left of the cord stump. Moving clockwise, make gradually widening spirals, going outward & toward the edge of the abdomen. May repeat, but always return to the position to the left of the cord site.	Triggers reflex action that increases peristaltic waves in the intestines Relieves gas and passage of meconium *Avoid direct contact with the cord site/umbilical stump
2. Spider Walk – Using all 4 fingers, walk lightly or do tapping motions across the abdomen moving only from baby's left to right. Focus on the area just above the umbilicus. Lift and return technique.	Stimulates intestinal peristalsis, especially in transverse colon Supports passage of meconium Impacts the abdominal path of vagus nerve
3. Tummy Kneading – Place heel of hand on **one** side of baby, staying below rib cage, resting fingers on opposite side of the belly. Gently push heel of hand against belly and then, pull with fingers creating a rhythmic rocking motion. (1, 2, 3, - 4, 5, 6)	Stimulates lower abdomen for gas relief Promotes movement of meconium
4. Tummy Hearts – Place thumb/index finger on each side of umbilicus. Stroke outward, then lift & return as if strumming. Then, move finger tips upwards on each side of umbilicus to just below the rib cage & then downward to the bladder, forming a heart.	Strokes out across the transverse colon Vagus nerve stimulation of the abdominal muscles and the colon. Stimulates movement of gas and meconium

Figure 2

~~ CIMI® Teaching Guide ~~

World Institute for Nurturing Communication, WINC without borders™

(Origin 1970's, incorporated 1986 in USA) – • www.winc.ws

5. Yummy Tummy – Place cupped hand on the abdomen just below the umbilical stump; stroke hand over hand downward towards the groin. Use a gentle paddling motion, ensuring that one hand is always on baby. May also be done with fingers.	Vagus nerve stimulation relaxes abdominal muscles and colon. Promotes expulsion of meconium stool *Avoid any direct pressure on the umbilical stump
6. Eezie Kneezies - Flex the legs, bringing knees up on lower abdomen. Hold briefly. Do a gentle pulsing action (1 and 2 and 3 and). Gently jiggle the legs to release all tension.	Provides pulsating massage to lower bowel Promotes expulsion of meconium stool

Supportive Relaxation

7. The Gentle Stretch - With baby lying face up, place hands under the buttocks, with fingers in the sacral area. Gently push upward motion with your fingers while keeping your hands cupped under the baby's bottom, **lifting** the hips up about 2 inches with each stroke. LIft, release, and repeat creating a slow gentle rhythm.	Gentle stretching soothes tight muscles Simulated floating action calms and soothes. Baby stretches as a result of the gentle lifting.
8. O My Sole – Move one thumb over the other stroking from heel to toes on bottom of foot or use thumbs to apply a gentle pressure technique. Gentle squeezing and rolling of the toes may be included.	Stimulates release of endorphins promoting relaxation & pain relief Impacts reflexology points for stomach releasing digestive enzymes *Be careful to avoid any heel stick sites
9. Scalp Circles & More – Holding head in one hand, make small circles over entire scalp using finger tips of the other hand. Stroke across forehead, cheeks and down the nose. Include ear rubs.	Promotes relaxation Ear rubbing stimulates the auricular branch of the vagus nerve *Be careful to avoid applying pressure to soft spots or any bruised areas.
10. Gentle Sweeping – Place a cupped hand on the upper back, and slowly move down the back to the buttocks, stroking hand over hand. Use a gentle paddling motion, ensuring one hand is always on baby.	Promotes relaxation *Can be easily done with baby held skin-to-skin while in semi-reclining position

Figure 2 continued

Method 4: "Tummy Kneading". Place the heel of the hand on one side of the baby's abdomen, staying below the rib cage. With hand cupped and fingers resting on the opposite side of belly, gently push heel of hand against abdomen then pull back with fingers, creating a rhythmic rocking motion (Figures 10 and 11).

Method 5: "Tummy Hearts". Place thumb or index finger on each side of umbilicus. Stroke outward, then lift and return, as if strumming. Then, move finger tips upwards on each side of umbilicus to just below the rib cage, then downward to the bladder, forming a heart (Figures 12-14).

Method 6: "Yummy Tummy". Place cupped hand just above umbilicus and stroke hand-over-hand on the abdomen downward toward the groin in a gentle paddle motion, ensuring that one hand is always on the baby. This may also be done with just fingers (Figure 15).

Method 7: "Ezie Kneezies". Flex the knees, bringing them to the lower abdomen. Hold and do a gentle pulsing action for 3 counts, then release with a slight jiggle (Figure 16).

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

There are also techniques that could help promoting relaxation, such as stroking the bottom of the baby's feet with your thumb. This stimulates reflexology points for the stomach releasing digestive enzymes (Figures 17 and 18). Another technique is to place the baby in a semireclined

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

position, and with a cupped hand on the baby's upper back, slowly move down the back to the buttocks. Stroking hand-over-hand in a gentle paddling motion, ensure that one hand is always on the baby. This technique promotes digestion (Figures 19 and 20).[10,11]

Not only will these techniques be beneficial to the baby, but the parents as well, allowing them to bond with their child. A large longitudinal study at the University of Minnesota shows a critical developmental issue in the first year of life is the formation of an affective bond, an

Figure 19

Figure 20

attachment, between the infant and its mother. The quality of that attachment has been related to various aspects of the child's functioning at later ages. These include exploration at the age of 1 year, problem solving and toddler sociability at age 2 and curiosity, flexible management of behavior and ego control in the preschool years.[12]

At the University of Miami's Touch Research Institute, it was shown that premature babies given daily massage gained 47% more weight and were discharged 6 days earlier from the hospital (at a savings of $10,000 each in medical costs) than premature babies without massage.[13] These techniques are best first performed before discharge, at the hospital. Parents are taught by a trained health care professional. They are then continued at home. These techniques can be performed as often as the parents deem necessary. Other options could include lymphatic or soft tissue osteopathic manipulative treatment or neonatal massage classes at the hospital by an osteopathic family physician or trained professional prior to and after the birthing process.

Before discharge, it is important to instruct the parents to be attentive to any skin color changes. It is also important that the parents feel comfortable with feedings. If the mother is breastfeeding a lactation specialist can speak with the parents about any worries they are having. She can also observe feedings to make sure it is appropriate for adequate intake. Another way to assess adequate intake is to weigh the infant each day from birth and calculate the percent change from birth weight. There needs to be no more than 10% weight loss in the first 3 days of life.[2] Parents also need to be comfortable with the neonatal massage techniques. These too can be observed by a health care provider trained in infant massage.

After a discharge has taken place at an appropriate time, a follow up with a family physician needs to take place within 48 hours. The American Academy of Pediatrics

recommends that all infants be examined within 48 hours of discharge from the hospital.[2]

There are several reasons for this, including ensuring that the infant is not becoming jaundiced and requiring intervention. It is also to ensure that appropriate breastfeeding is taking place. The family physician needs to take this time to reeducate the parents on the importance of neonatal massage. At the office, follow-up should consist of the infant's weight, percent change from birth weight (no more than 10% weight loss in first 3 days), pattern of voiding or stooling, adequacy of intact breast milk, and the clinical presence or absence of jaundice. If there is jaundice or if there is any doubt, obtain a TSB. Again, reiterate correct breastfeeding and infant massage techniques as well as infant feeding schedules at the follow-up appointment. This is also the time to address any other parental concerns.

In conclusion, it has been proven by Chen et al. and Miami's Touch Research Institution that neonatal massage is an effective tool to decrease physiologic hyperbilirubinemia and hospital stay of infants, thus saving monies for the hospital.[7] Therefore, since osteopathic physicians are more versed in "touch" or hands-on treatments, it is our responsibility to promote this worthwhile approach. These techniques need to be implemented perinatally, if not at prenatal visits.

Acknowledgments

A special thanks to Megan Gibson, MA for coordination of this project and to Collette Razey for allowing us to use her child as a model.

References

1. Prevention of acute bilirubin encephalopathy and kernicterus in newborns: position statement #3049. Adv Neonatal Care. 2011;11:S3-S9
2. Hyperbilirubinemia AAoPo. Clinical Practice Guidelines: Management of hyperbilirubinemia in the newborn infant 35 or more weeks gestation. *Pediatrics*. 2004;114:297–306
3. Paul IM, Lehman EB, Hollenbeak CS, et al. Preventable newborn readmissions since passage of the Newborns' and Mothers' Health Protection Act. *Pediatrics*. 2006;118:2349–2358
4. Zimmerman DR, Klinger G, Merlob P. Early discharge after delivery. A study of safety and risk factors. *Sci World J*. 2003;3:1363–1369
5. Stark AR, Lannon CM. Systems changes to prevent severe hyperbilirubinemia and promote breastfeeding: pilot approaches. *J Perinatol*. 2009;29(suppl 1):S53–57
6. Cloherty JP, Stark AR. *Manual of Neonatal Care*, 4th ed. Philadelphia: Lippincott-Raven Publishers; 1998
7. Chen J, Sadakata M, Ishida M, et al. Baby massage ameliorates neonatal jaundice in full-term newborn infants. *Tohoku J Exp Med*. 2011;223:97–102
8. Nicholas A, Nicholas DO, Evan DO. *Atlas of Osteopathic Techniques*, 1 ed. Philadelphia: Lippencott-Williams and Wilkins; 2008
9. Nelson K, Glonek, Thomas PhD DO. *Somatic Dysfuntion in Osteopathic Family Medicine*, 1st ed. Illinois: Lippincott-Williams and Wilkins; 2007
10. Deneau-Saxton M., Child massage adaptations welcome baby massage strokes birth-3 months keeping the connection "as they grow" adaptations for the various ages. In: CIMI Teaching Guide; 2005-2009.
11. International Academy of Infant Massage, in
12. Egeland B, Farber EA. Infant-mother attachment: factors related to its development and changes over time. *Child Dev*. 1984;55:753–771
13. Giving infants a helping hand. Newsweek. 1997