Who should have bilirubin concentration measured? when and how?

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- Visual inspection of jaundice is often unreliable and hence laboratory estimation of total serum bilirubin (TSB) or as a surrogate transcutaneous bilirubin (TcB) is used for management of a case of neonatal jaundice.
- The American Academy of Pediatrics recommends universal screening with TSB or TcB levels, or targeted screening based on risk factors.
- Universal TSB/TcB screening can accurately identify infants whose TSB level is likely to exceed the 95th percentile for age.

AAP recommends the following for all clinicians taking care of newborns

1. Promote and support successful breastfeeding
2. Establish nursery protocols for the identification and evaluation of hyperbilirubinemia
3. Measure the total serum bilirubin (TSB) or transcutaneous bilirubin (TcB) level on the infants found jaundiced in the first 24 hours of life
4. Recognize that visual estimation of the degree of jaundice can lead to errors, particularly in darkly pigmented infants
5. Interpret all bilirubin levels according to the infant's age in hours as per AAP chart (Bhutani et al)
6. Recognize that infants born at less than 38 weeks' gestation, and breastfed, are at higher risk of developing hyperbilirubinemia and so they need closer surveillance and monitoring
7. Perform a thorough and systematic assessment on all infants before discharge for the risk of severe hyperbilirubinemia
8. Provide parents with written and verbal information about newborn jaundice
9. Ensure appropriate follow-up as per the time of discharge and the risk assessment
10. Treat newborns, when indicated, with phototherapy or exchange transfusion

Clinical assessment

- Pediatricians should ensure that all neonates are routinely monitored for the development of jaundice, and nurseries should have established protocols for assessment of jaundice.
- Jaundice should be assessed whenever the infant's vital signs are measured generally at an interval of every 8 to 12 hours.

- In newborn infants, jaundice can be detected by blanching the skin with digital pressure, revealing the underlying color of the skin and subcutaneous tissue.
- The assessment of jaundice must be performed in a room which is well lit and preferably, in daylight at a window.
- Jaundice is usually seen first in the face and progresses caudally to the trunk and extremities, but visual estimation of bilirubin levels (Krammer's chart) from the degree of jaundice often is erroneous. (Fig 1)
- In most patients with TSB levels of less than 15 mg/dL , non-invasive TcB- measurement often provides a valid estimate of the TSB level.

Lab evaluation

- A TcB and/or TSB measurement should be performed on every newborn who is jaundiced in the first 24 hours after birth.
- The need of and timing of a repeat TcB or TSB measurement will depend on the zone in which the TSB falls, the age of the newborn, and the evolution of the hyperbilirubinemia.
- A TcB and/or TSB measurement should be performed if the jaundice appears excessive for the neonate's age.
- In a situation of rapidly increasing jaundice (haemolytic situation), TcB estimates may lag behind, especially during first day of life. Hence significant jaundice appearing on first day of life, it is always prudent to cross check it with TSB
- TSB or TcB should also be measured If there is any doubt about the degree of jaundice.
- Visual estimation of bilirubin levels from the degree of jaundice is often erroneous in darkly pigmented neonates.
- The interpretation of bilirubin levels should be done in hours of life.

Indications for TSB or TcB measurements:

Indications	Assessments
Jaundice in first 24 h of life	Measure TcB and/or TSB
Jaundice appears excessive for infant's age	Measure TcB and/or TSB
Newborn receiving phototherapy or TSB rising rapidly (0.5mg/dl/hour or crossing percentiles) or approaching exchange levels, unexplained by history and physical examination, not responding to intensive phototherapy	• Blood type and Coomb test (if not already done in cord blood as in Rh negative pregnancies) • Complete blood count and smear • Measure direct or conjugated bilirubin • Reticulocyte count, G6PD, albumin (ETCOc, if available) • Repeat TSB in 4–24 h depending on infant's age and TSB level
Elevated direct (or conjugated) bilirubin level	Do urinalysis and urine culture. Evaluate for sepsis if indicated by history and physical examination. Liver function tests
Jaundice present at or beyond age 3 wk, or sick infant	Total and direct (or conjugated) bilirubin level. If direct bilirubin elevated, evaluate for causes of cholestasis. Do Thyroid and galactosemia screen

Risk assessment before discharge

- Before discharge, every newborn must be assessed for the risk of developing severe hyperbilirubinemia, and all nurseries should establish protocols for assessing this risk.
- Such assessment is particularly important in infants who are discharged before the age of 72 hours.
- The AAP recommends 2 clinical options used individually or in combination for the systematic assessment of risk: predischarge measurement of the bilirubin level using TSB or TcB and/or assessment of clinical risk factors. Whether either or both options are used, appropriate follow-up after discharge is essential.

- Risk factors for development of severe hyperbilirubinemia in infant of 35 or more weeks of jaundice

Major risk factors

Predischarge TSB or TcB level in the high-risk zone

Jaundice observed in the first 24 h

Blood group incompatibility with positive direct antiglobulin test, other known hemolytic disease (eg, G6PD deficiency), elevated ETCO

Gestational age 35–36 wk

Previous sibling received phototherapy

Cephalohematoma or significant bruising

Exclusive breastfeeding, particularly if nursing is not going well and weight loss is excessive

East Asian race

Minor risk factors

Predischarge TSB or TcB level in the high intermediate-risk zone

Gestational age 37–38 wk

Jaundice observed before discharge

Previous sibling with jaundice

Macrosomic infant of a diabetic mother

Maternal age > 35 y

Male gender

Decreased risk (these factors are associated with decreased risk of significant jaundice, listed in order of decreasing importance)

TSB or TcB level in the low-risk zone

Gestational age ≥ 41 wk

Exclusive bottle feeding

Black race

Discharge from hospital after 72 h

Hospital Policies and Procedures

- All hospitals should provide written and verbal information for parents of the neonates at the time of discharge, and it should include an explanation of jaundice, the need to monitor infants for jaundice, and advice on how monitoring should be done and when to review.

Follow up

- All infants should be examined by a pediatrician in the first few days after discharge to assess infant well-being and look for the presence of jaundice.
- The timing of this assessment will be determined by the initial length of stay in the nursery, presence or absence of risk factors for hyperbilirubinemia and risk of other neonatal problems.
- For some newborns discharged before 48 hours, 2 follow-up visits may be required, the first visit between 24 and 72 hours and the second between 72 and 120 hours.
- Clinical judgment should be used in determining follow up. Earlier or more frequent follow-up should be provided for those who have risk factors for hyperbilirubinemia, whereas those discharged with few or no risk factors can be seen after longer intervals.
- If appropriate follow-up cannot be ensured in the presence of elevated risk for developing severe hyperbilirubinemia, it may be necessary to delay discharge either until appropriate follow-up can be ensured or the period of greatest risk is over (72-96 hours).

Follow up assessment

- The follow-up assessment should include the infant's weight and percent change from birth weight, adequacy of intake, the pattern of voiding and stooling, and the presence or absence of jaundice.
- Clinical judgment should be used to determine the need for a bilirubin measurement. If there is any doubt about the degree of jaundice, the TSB or TcB level should be measured as visual estimation of bilirubin levels can lead to errors, particularly in darkly pigmented neonates.

References:

1. Maisels MJ et al. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics, 2004. 114(1): p 297-316.
2. Muchowski KE. Evaluation and Treatment of Neonatal Hyperbilirubinemia. *Am Fam Physician.* 2014 Jun 1;89(11):873-878.

3. Bhutani VK, Johnson L, Sivieri EM. Predictive ability of a predischarge hour-specific serum bilirubin for subsequent significant hyperbilirubinemia in healthy term and near-term newborns. Pediatrics. 1999;103: 6–14

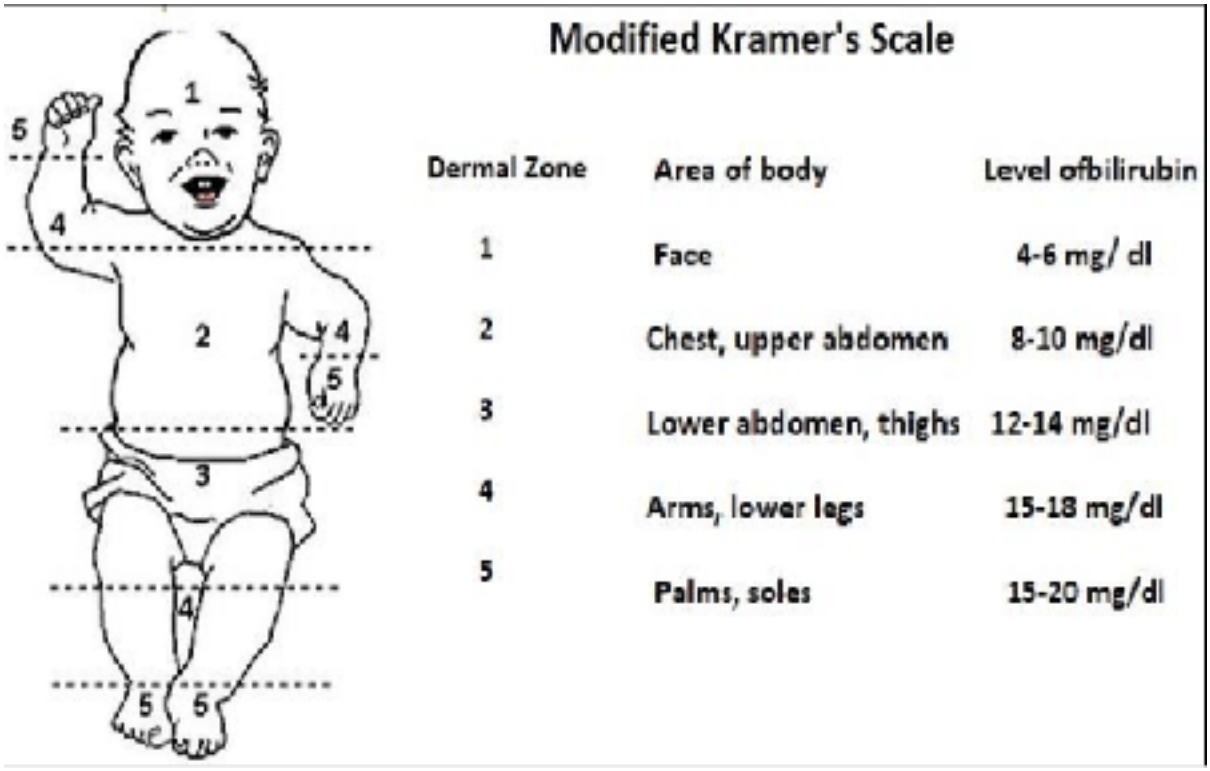

Fig. 1. Modified Krammer's Scale