Editorial

Noninvasive Screening of Neonatal Jaundice

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Neonatal jaundice (hyperbilirubinemia) is one of the most common conditions and needed medical attention. About 60% of term and 80% of preterm babies develop jaundice in the first week of life, and about 10% of breast fed babies are still jaundiced at age 1 month.[1]

Generally it is harmless but high concentrations of unconjugated bilirubin can cause bilirubin-induced neuronal deficits (BIND) i,e irreversible brain damage to the neonate and sequelae include choreoathetoid cerebral palsy, deafness etc. Studies in the USA and Europe suggest that BIND still occurs in about 0.5-1.0 per 100,000 infants born after 35 weeks of gestation.[2] Therefore, early recognition of jaundice is necessary to decide whether treatment is required or not. The gold standard to assess the level of jaundice in neonate is total serum bilirubin measurement (TSB).[3]

TSB levels are measured by invasive blood sampling which is painful and stressful for the neonate. It results in blood loss and can cause anaemia, when repeated measurement is required.[4] Also predisposes the infant to increased risk for infections.[5] Moreover in invasive method it is also time consuming and immediate result is not possible. All these problems have led to search for a non-invasive, reliable technique for estimation of TSB. Ultimately worldwide non-invasive Transcutaneous Bilirubin (TcB) measurement is accepted as a screening test and also an alternative methods to asses TSB.

American Academy of Paediatrics (AAP) recommends that every newborn be assessed for the risk of developing severe hyperbilirubinemia, by using predischarge TSB or Transcutaneous Bilirubin measurements and assessment of clinical risk factors before discharge. The Canadian Paediatric Society also recommended that TSB or TcB be measured in all infants (in term and late preterm newborn) during the first 72 hours of life with individualized follow-up based on risk assessment.[6]

It is very promising that after the initation of Universal Bilirubin Screening Program, the incidence of TSB levels of 25 mg/dL decreased from 1 in 1522 infants to 1 in 4037 infants.[7]

Many transcutaneous bilirubinometers for measuring TcB have been described in the literature. (Minolta Air-Shields jaundice meter, Ingram icterometer, Bilicheck and Chromatics Color Mate III etc.).

Ingram icterometer

First manufactured in 1954. Icterometer were developed as a means to monitor the daily progression of newborn jaundice.[8] Today, they are used in birth clinics, public health clinics, hospitals, community nursing programs and in private practice as a cost-effective, clinically accurate screening tool.

In this method a piece of transparent plastic known as Ingram icterometer is used. It is painted in five transverse strips of graded yellow lines. The instrument is pressed against the nose and the yellow colour of the blanched skin is matched with the graded yellow lines and bilirubin level is assigned.

In different study, the noninvasive electronic transcutaneous bilirubinometers have not been shown to be significantly more accurate than the Icterometer.[9]

Transcutaneous bilirubinometer

The first transcutaneous bilirubinometer was introduced in 1980.[10]

This is a hand held, portable and sophisticated but expensive tool. The optic head of the meter is gently pressed against the neonates skin (usually forehead or upper part of sternum). For correct measurement, the optic head should make full contact with the skin. This should be achieved by gentle pressure. When pressure is applied to the photoprobe, a xenon tube generates a strobe light, and this light passes through the subcutaneous tissue. The reflected light returns through the second fiber optic bundle to the spectrophotometric module. The intensity of the yellow color in this light, after correcting for the hemoglobin, is measured and instantly displayed in arbitrary units. Among all device Bilicheck, displays the results in clinically appropriate units: mg/dl or µmol/L.

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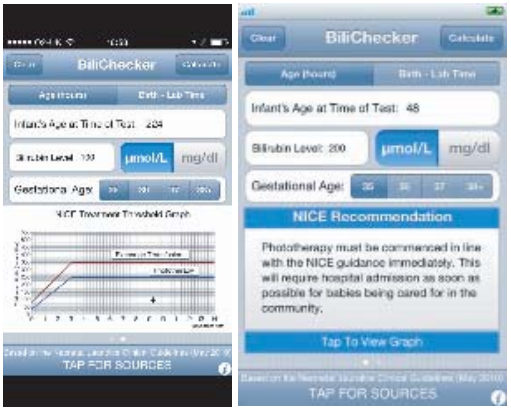
Measurements against bruises, birthmarks and subcutaneous hematoma should be avoided as accurate result will not achieved.

According to National Academy of Clinical Biochemistry laboratory medicine practice guidelines, only Bilicheck and JM-103 have been recommended for use in clinical setting as they provide results comparable to laboratory TSB.[11]

Bili Checker app

The Bili Checker application has been developed by the Royal College of Obstetricians and Gynaecologists (RCOG). The app enables the users to input the time and date of a baby's birth, together with the time and date of the bilirubin test, a blood test to measure levels of bile pigment in blood serum, to calculate the baby's age in hours. The app then uses this information in combination with the bilirubin levels to work out the safest management option based on the NICE guideline on neonatal jaundice.[12]

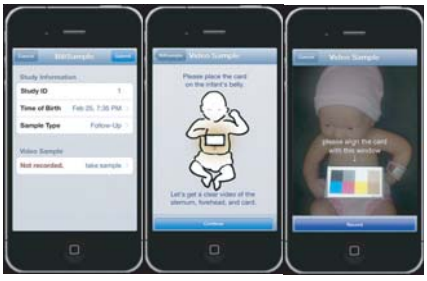


This can be done in less than a minute also helps the midwives, nurses, neonatologists, paediatricians, General Practitioners and RCOG members to choose the right plan for an individual baby, according to NICE guidelines. The app has available for iPhone, iPad and iPod Touch since 2013 (price 69 pounds)

BiliCam - a new smartphone app

Engineers and physicians of University of Washington (UW) developed a smartphone application to measure the level of jaundice in newborns, which can also deliver results to parents and pediatricians within minutes. It could also serve as a screening tool to determine neonatal jaundice.[13]

Bili Cam, uses a smartphone's camera and flash and a color calibration card (like a business card). A parent or health care professional (HCP) would download the app, place the card on her baby's belly, then take a picture with the card in view. The card calibrates and accounts for different lighting conditions and skin tones. Data from the photo are sent to the cloud and are analyzed by machine-learning algorithms, and a report on the newborn's bilirubin levels is sent almost instantly to the parent's or HCP's phone.



Today most of the available Transcutaneous bilirubino-meters are costly (several thousand dollars) and isn't feasible for home use. But Bili Cam to be easy to use and would be affordable for both clinicians and parents.

A study revealed that Bili Cam performed as well as or better than the current screening tool.[14] Eventhough it wouldn't replace a blood test.

Already UW researchers team have filed patents of this technology and they hope that within a couple of years Federal Drug Administration will approved the Bili Cam app that parents can use at home on their smartphones.

Now above mentioned all of the noninvasive screening deviceses are available worldwide, especially in the developed countries. But in Bangladesh transcutaneous bilirubinometers are available only in a very few private Hospitals at Dhaka city. Hope in near future for the shake of our neonates it will be available in many more hospitals of our country.

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