Newborn screening is being carried out in developed nations for the last 40 years. It aims at early detection of disorders so that timely intervention can help prevent children from serious disease consequences. Newborn screening is based on the premise that many metabolic and endocrine disorders may not be symptomatic in the early neonatal period but which if not detected early can lead to permanent serious handicaps for the child. Various criteria have been defined to decide which diseases should be included in the newborn screening service. Some of these are (a) disorder associated with significant morbidity and mortality if untreated; (b) effective treatment available; (c) and (d) availability of an ethical, safe, simple and robust screening test.

Examples of the various diseases being screened are - congenital hypothyroidism, congenital adrenal hyperplasia, phenylketonuria, cystic fibrosis, galactosemia, G6PD deficiency, biotinidase deficiency, hemoglobinopathies e.g. Sickle Cell Disease (SCD), and nongenetic targets such as hearing and intrauterine infections, especially toxoplasmosis.

Newborn screening is done by collecting blood samples from cord blood or a heel prick. Collecting on a specially designed filter paper allows easy transport of samples to a central laboratory in the same or nearby city. For Congenital Hypothyroidism both cord blood or postnatal sample are acceptable. However, cord blood cannot be used for certain inborn errors where the metabolite to be measured accumulates in the blood only after the baby has taken a few feeds, ie., a postnatal sample is needed.

Thus, if a program is aiming to test for multiple diseases, samples should ideally be collected after 72 hrs and before the 7th day of life. However this remains a challenge all over the world, due to early discharge of mothers having a normal delivery. Samples taken before 24 hours of age are highly likely to give false positive values for TSH, as every baby has a surge in TSH to values greater than 100 mU/L in the first 24 hours of life.

Newborn screening is still not part of a national program in our country and is being carried out only in some pockets.

Our project:
A newborn screening project funded by the Department of Biotechnology, Govt of India is currently under way in SGPGIMS. The diseases being screened are- Congenital hypothyroidism, Galactosemia & Biotinidase deficiency. The hospital included in this project are SGPGIMS, Chatrapati Shahuji Maharaj Medical University (KGMU), Ram Manohar Lohia, Avanti Bai women’s hospital, Jhalkari Bai hospital, Barabanki women’s hospital, BCM hospital Sitapur.. All laboratory investigations are carried out in SGPGIMS Lucknow.

Heel prick samples are collected on special Whatman 903 filter papers after 24 hrs of life and transported to SGPGIMS. Here samples are processed and analysed. Serum levels of TSH, galactose and biotinidase enzyme are measured using a DELFIA fluoroimmunoassay. Babies who are detected positive on screening (as per individual disease cut offs) are recalled for confirmatory testing.
Congenital hypothyroidism

Screening programs for congenital hypothyroidism were designed way back in the 1970’s in Quebec and have now become an established norm in all developed countries. It is one of the most common preventable causes of severe mental retardation. In world literature the incidence has been found to be 1:3000 to 1:4000, the incidence varying between different ethnic groups. Pilot studies in India have found a much higher incidence of CH ranging from 1/1700 to 1/2800.

CH can be permanent or transient. Permanent CH can further be classified into Primary and central. The most common cause of CH is thyroid dysgenesis- aplasia, hypoplasia, ectopic gland. Other causes of CH are dyshormonogenesis and defects in TSH binding and action.

Screening for CH

Two strategies for CH screening have been formulated-1) primary T4 with TSH backup 2) primary TSH with T4 backup. Initially most countries adopted the primary T4 method however with increasing sensitivity of newer TSH assays many countries have now adopted the primary TSH method of screening. One problem with the primary TSH method is the practice of early discharge of mothers. The TSH surge within the first 24 to 72 hours may cause a large number of false positives. Thus these results have to be interpreted with caution. Age related cut offs should be used, depending upon age of sampling of the baby.

Screening strategy in our project.

In our current project heel prick samples are collected from the baby only after completion of 24 hours of life. If the mother is not being discharged early then samples are collected after 72 hours of life. Age related cut offs are used for recall of babies for confirmatory samples. Babies sampled at 24- 48 hours of life are recalled at any value of TSH >=34 mU/l, those sampled at >48 hrs are recalled if TSH >20. These babies are recalled for a repeat filter paper sample (at their hospital of birth) to be taken at 2 weeks of age to allow for false elevated values to settle into normal.. However any child with screening TSH >40 is immediately recalled for a confirmatory serum sample by veneupuncture for TSH and T4 by our routine chemiluminescence assay. Babies confirmed to have either TSH >20 mU/L and / or T4 < 100 nmol/L or FT4 < 12 pmol/L are evaluated by radionuclide and ultrasonography imaging of the thyroid, and then treated and followed up by the pediatric endocrinologist as well as the NBS program.

By this protocol, using these cut offs, it is possible some cases of subclinical or transient hypothyroidism may be missed. However, it is the aim of our program to not miss severe permanent CH and at the same time have a minimum recall rate and minimum false positives, so that parents are not given unnecessary anxiety, babies are not unnecessarily overtreated, and the system is capable of responding to those in most need.
SOP for social workers involved in Newborn Screening

Instructions for Medical Social Workers on counseling parents

A. Start preparing mothers for new born screening in the antenatal period
B. Ensure that posters about Newborn Screening (NBS) are put up in the antenatal clinic. Also ensure that the brief pamphlet regarding NBS is available.
C. Keep in contact with the obstetricians and ask for their cooperation in counseling the expectant mothers about the merits of NBS.
D. For booked and admitted patients make a visit prior to the baby’s birth, hand out the brief NBS pamphlet and explain about NBS.
E. Fill register with list of all previous days’ deliveries and visit all mothers as soon as possible after the baby’s birth.
F. Counsel mothers along with all available family members. Try and visit during visiting hours if possible.
G. Explain about NBS- what is the scheme about, how it benefits the baby and how simple a test it is. Also explain that it a routine procedure being followed in other countries for many years and is a standard process like for e.g. - vaccination.
H. Reassure them that only 3 drops of blood will be taken from the baby’s heel and with minimum pain. Assure them that in case first prick is inadequate and another prick is needed, it is for the baby’s benefit.
I. Make an example of the other mothers in the ward for whose baby’s newborn screen has already been performed.
J. Motivate them that their baby’s future is in their hands and a simple test can help save their baby from a lifelong disability.
K. In case the mother has doubts or wants to consult her family – come back later when the whole family is present or ask them to come to your room to talk in detail later.
L. If the mother is being discharged early i.e. before 24 hours give them the option of coming back later for sampling i.e. within 7 days of babies birth.

Instructions regarding sampling procedure

First and foremost remember- never take babies sample before parental consent. If parents refuse to get their baby sampled, take the help of the obstetrician or pediatrician to motivate and convince the family.

A. Filling out consent form-
   a. Write a detailed and accurate address including 2 to 3 phone no. In c/o rural area- write name of Pradhan/ASHA/ANM worker and address in the form of village, post, thana, tehsil and district. In c/o urban area- write house no, street, locality, PIN nos, landmarks. Ensure all the above details to allow for personal contact if required & accurate postal address.
   b. Write study no on last page of the pamphlet.
   c. Ensure that the most detailed address is present on the consent form.

B. Items needed for sampling- ensure that all the following items are ready before proceeding for sampling.
   a. Warm water.
   b. Beaker
   c. Hot water bag
   d. Towel/ dressing pad
   e. Thermometer
   f. Isopropyl alcohol
g. Gauze
h. Lancet
i. Specimen card
j. Hard ball point pen
k. Consent form

C. Procedure for sampling-
   a. For all normal deliveries ideally take sample after 48 hrs of life. Only if mother is being discharged before 48 hr, take sample early- but not before 24 hours of life.
   b. DO NOT sample cesarean births before 72 hours of life as all mothers undergoing cesarean section will be in the hospital for at least 3 days after delivery.
   c. Keep warm water / hot water bag ready. Switch on water heater prior to sampling. The temperature of the water should be 40 to 42 deg C. Always check temperature prior to sampling with the thermometer provided. Do not use water which is too hot as it may burn the baby’s heel. Dip the towel/ gauze in the water and squeeze out excess water.
   d. Keep sampling equipment ready.
   e. Expose baby’s heel, warm for at least 3 minutes for good quality drop. Keep heel lower than the level of the heart.
   f. Dry and then clean heel with 70% isopropyl alcohol soaked swab.
   g. Prick only on sides of heel, avoid centre.
   h. Make single prick (with lancet rather than with a needle) to a depth of about 2mm.
   i. Wipe away first drop of blood.
   j. Allow a good sized blood drop to form then lightly touch to filter paper and allow blood to soak through.
   k. Avoid repeated squeezing
   l. Avoid taking multiple blood drops over a previous drop to prevent overlayering.
   m. Allow blood spot to air dry in a horizontal position for at least 3-4 hours in the rack provided. In summer months pack dried samples in ziplock bag with dessicant and store in the refrigerator.
   n. Complete the information required, on filter paper.

D. Filling filter paper-
   a. Use hard ball point pen for writing.
   b. Complete all required columns.
   c. Write date of sampling separately on the card.
   d. Mention whether parents reside in urban/rural area.
   e. For repeat samples mention clearly on top of filter paper and assign baby the old study number.
   f. Fill in address and phone no. completely.
   g. Complete date and time of birth (am/pm) clearly.
   h. Write age of baby at sampling (in hours, not days).
   i. Take care to mention baby’s gestational age accurately. Term is 37 weeks; in case of preterm babies inquire from the mother how prematurely the baby was born i.e. how many days before EDD (expected date of delivery) as told by the doctor.
   j. Ensure legible signature of person taking sample.
   k. Insert consent form between the filter paper strip, such that blood spot of one baby and the next do not touch each other. If protective cover for filter paper is available then cover only after the sample has completely dried.
   l. Arrange filter papers according to study no., not haphazardly.
   m. Puck filter papers in an envelope. Reuse old envelopes.
   n. On top left hand corner of envelop write – name of hospital, study nos. being sent and date of transportation.

E. Special situations
a. **Sick babies** - TSH reports can be unreliable in sick babies, similarly galactose reports can be falsely normal if a baby is sick and has not been fed. Sample the baby 1 week after birth or when stable, but definitely before 15 days of age.

b. **Preterm less than 37 weeks** - sample after 1 week of birth (for those getting discharged early take sample as late as possible). Counsel parents regarding possible need of resampling at 1 month of life.

c. **Twins** – sample babies after 1 week of birth.

**Instructions on reporting results**

A. Tell parents that if any report is abnormal they will be contacted and called for a repeat sample.

B. For finding out reports parents can call up SGPGI NBS lab from 10-11 am, about 10-15 days after giving the sample. Explain to them what their study no. is – for facilitation of reporting.

C. Ask those parents who want written reports to come after 20-25 days. Give written reports according to the reporting format already given to you. Remember to sign the report.

D. In case all 3 tests could not be done for a baby due to inadequacy of sample, give the parents the option of coming back for resampling if it is feasible.

**Instructions for recall of patients**

A. Keep a record of all patients recalled in your register.

B. Assure parents that recalling them for a repeat sample does not necessarily mean that the baby has the disease.

C. Tell them that in case it is confirmed that the baby has the disease - the treatment is simple, easy and inexpensive and will be facilitated as much as possible by the Institute.

D. If parents are amenable ask them to come as soon as possible for a repeat sample.

E. If parents do not show a favorable response after multiple calls or are not easily contactable - discuss with concerned doctors in SGPGI, home visit may be required. The obstetrician / pediatrician in the hospital of birth may be able to convince them; their help should be sought.

F. If repeat filter paper sample is required tell parents to give sample in hospital of birth. Ensure early transport of sample.

G. In case of requirement of serum sample - if taking babies serum in hospital of birth is feasible then take the sample, centrifuge it and ensure transport the same day to SGPGI. If taking serum in hospital of birth is not possible then send patient to SGPGI and coordinate with concerned staff/doctors to facilitate the process.

H. Call every patient who has given a repeat sample personally, to inform them about the result.

**Recordkeeping**

A. Use 2 registers for your daily use. One being the printed register issued from SGPGI for recording details of all mothers contacted and the other including details only of those babies who were sampled.

B. Every day visit the labour room/OT and take a list of the prior days deliveries. Target visiting those patients that day for first visit - counseling and handing over brief pamphlet. Tell the parents to fill in the address and phone number columns given on the back of the thin pamphlet before coming for sampling.

C. In the detailed register - assign a total of 6 pages i.e. a set of 3 pages for each day and note down the details of the babies born on that day. This will make documentation methodical and information easily accessible.

D. In the 2nd register only record details of babies who are sampled and are issued study numbers.

E. Visit the wards and counsel the mothers - note down the details of all mothers whom you visited and handed over the brief pamphlet to. Also inform the mothers visited, when their babies sample is due.

F. Every day go through the previous pages of the detailed register to find out which babies are due for sampling and target those mothers while visiting the wards.
G. In case parents refuse to allow you to sample their babies mention it in the register. Also if you are unable to trace a patient- talk to the sister in charge and find out what happened to that baby i.e. early discharge, LAMA or NICU referral and mention the details in the register.

H. For those babies who are being sampled please issue study numbers only after checking in 2nd register to prevent overlapping of numbers.

Stockkeeping and weekly reports

1. Every week you are expected to hand in a report of week’s work- in terms of actual work done and stock reporting.
2. The format for weekly reporting will be given to you. Please fill all the required columns.
3. From the detailed registers amalgamate the information regarding the total no. of deliveries, no. of Cesarean births, no. of mothers staying beyond 24 hours, how many babies were sampled and reasons for babies who could not be sampled.
4. A stock report will also be required in which you should fill in the details of the stock already issued to you, how much is remaining and your requirement.

Hand over a copy of the report at the weekly meetings and keep one copy with yourself for recordkeeping purposes.

Annexures

Site and procedure of sampling
Newborn Screening filter paper card

A very good sample