Neonatal Jaundice

By

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Neonatal Jaundice (Hyperbilirubinemia)

- Definition: Hyperbilirubinemia refers to an excessive level of accumulated bilirubin in the blood and is characterized by jaundice, a yellowish discoloration of the skin, sclerae, mucous membranes and nails.

- Unconjugated bilirubin = Indirect bilirubin.
- Conjugated bilirubin = Direct bilirubin.

Healthy baby

Baby with severe jaundice

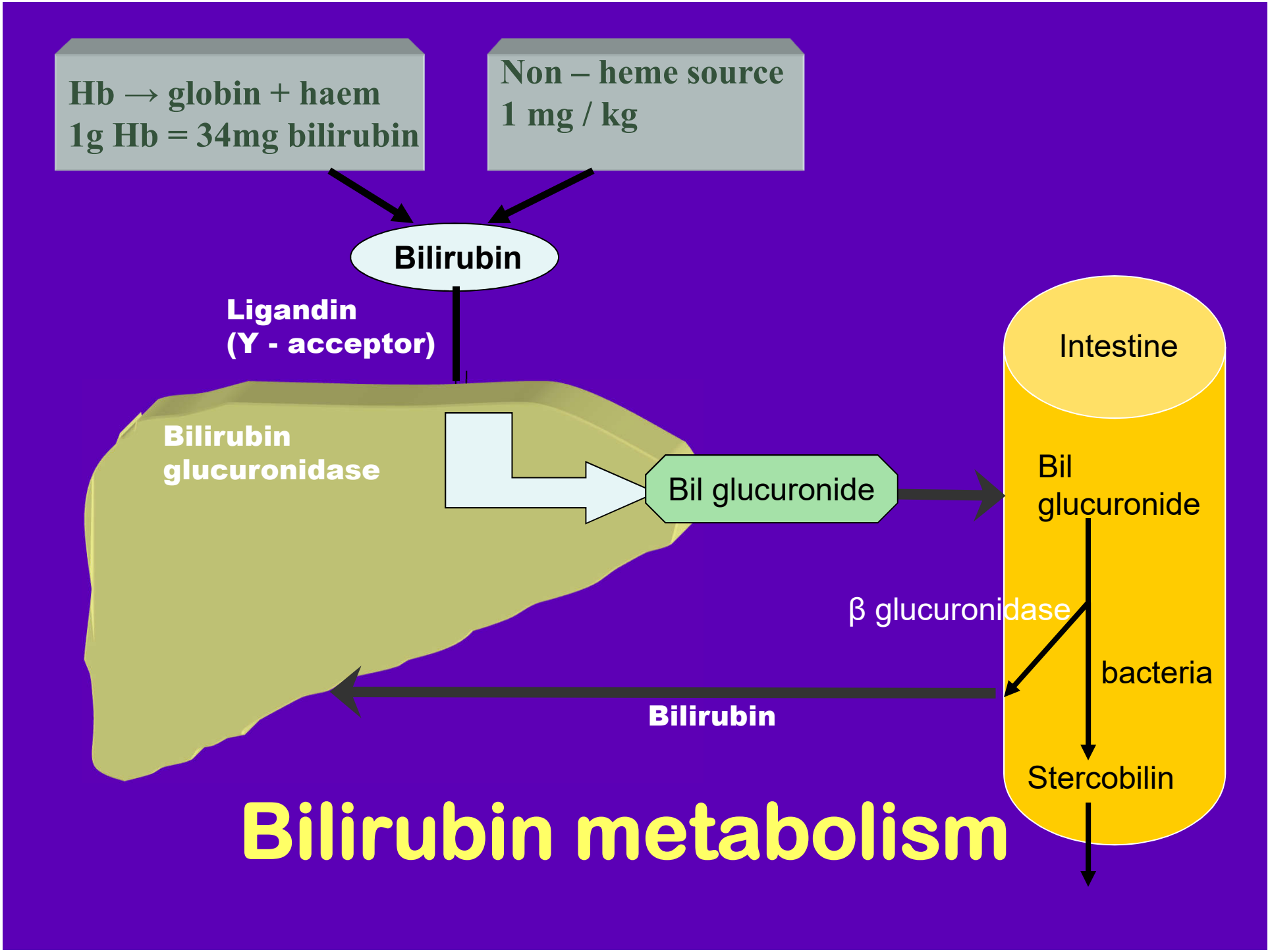
A.D.A.M.

Neonatal Jaundice

- Visible form of bilirubinemia
  - Newborn skin >5 mg / dl
- Occurs in 60% of term and 80% of preterm neonates
- However, significant jaundice occurs in 6% of term babies

Bilirubin metabolism

- Formation of bilirubin (unconjugated) from RBC destruction
- Bounding of bilirubin to albumin
- Uptake of bilirubin by liver cells
- Conjugation of bilirubin by glucouronyl-transferase enzyme
- Excretion of conjugated bilirubin into intestine:
  - Excreted in the stool (large amount) stercobilin
  - Excreted in urine (small amount) urobilirubin
  - Return back to liver through enterohepatic circulation (small amount)


Hb → globin + haem
1g Hb = 34mg bilirubin
Non – heme source
1 mg / kg
Bilirubin
Ligandin
(Y - acceptor)
Bilirubin
glucuronidase
Bil glucuronide
Intestine
Bil
glucuronide
β glucuronidase
bacteria
Bilirubin
Stercobilin
Bilirubin metabolism

Rough Clinical assessment of jaundice

Area of body	Bilirubin levels mg/dl (*17=umol)
1-Face	1- 4-8
2- Upper trunk	2- 5-12
3- Lower trunk & thighs	3- 8-16
4- Arms and lower legs	4- 11-18
5-Palms & soles	5- > 20

Physiological jaundice

Characteristics

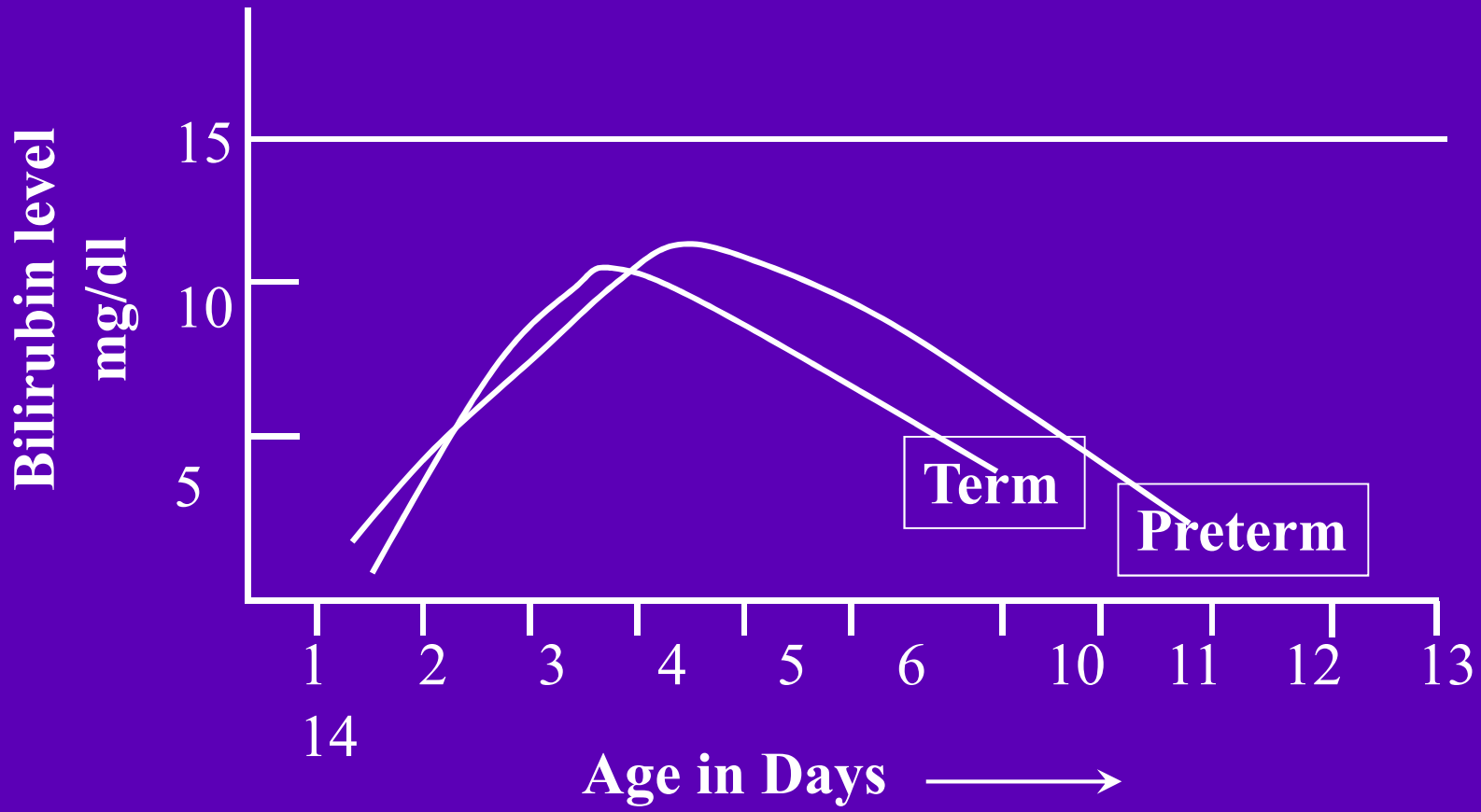
- Appears after 24 hours
- Maximum intensity by 3th-5th day in term & 7th day in preterm
- Serum level less than 15 mg / dl
- Clinically not detectable after 14 days
- Disappears without any treatment

Note: Baby should, however, be watched for worsening jaundice.

Why does physiological jaundice develop?

- **Increased bilirubin load.**
- **Defective uptake from plasma.**
- **Defective conjugation.**
- **Decreased excretion.**
- **Increased Hemoglobin level**
- increased enterohepatic circulation

Course of physiological jaundice



Pathological jaundice

- May appears within 24 hours of age
- Increase of bilirubin > 5 mg / dl / day
- Serum bilirubin > 12 mg / dl
- Jaundice can persisting after 14 days

Causes of Unconjugated Hyperbilirubinemia

- Polycythemia (Small for date baby, Twin-to-twin transfusion, Delayed cord clamping, Infant of diabetic mother)
- Hemolysis
  - Rh incompatibility
  - ABO incompatibility, subgroup ABO incompatility
  - Abnormal RBCs—G6PD, spherocytosis, thalassemia
- Birth Trauma—Bruising, Cephalohematoma
- Infections: Sepsis, TORCH
- Metabolic Abnormalities—Crigler Najjar, Gilbert Syndrome, Galactosemia
- Breast milk jaundice
- Medications—Sulfonamides
  - Displaces bilirubin from albumin; same binding site

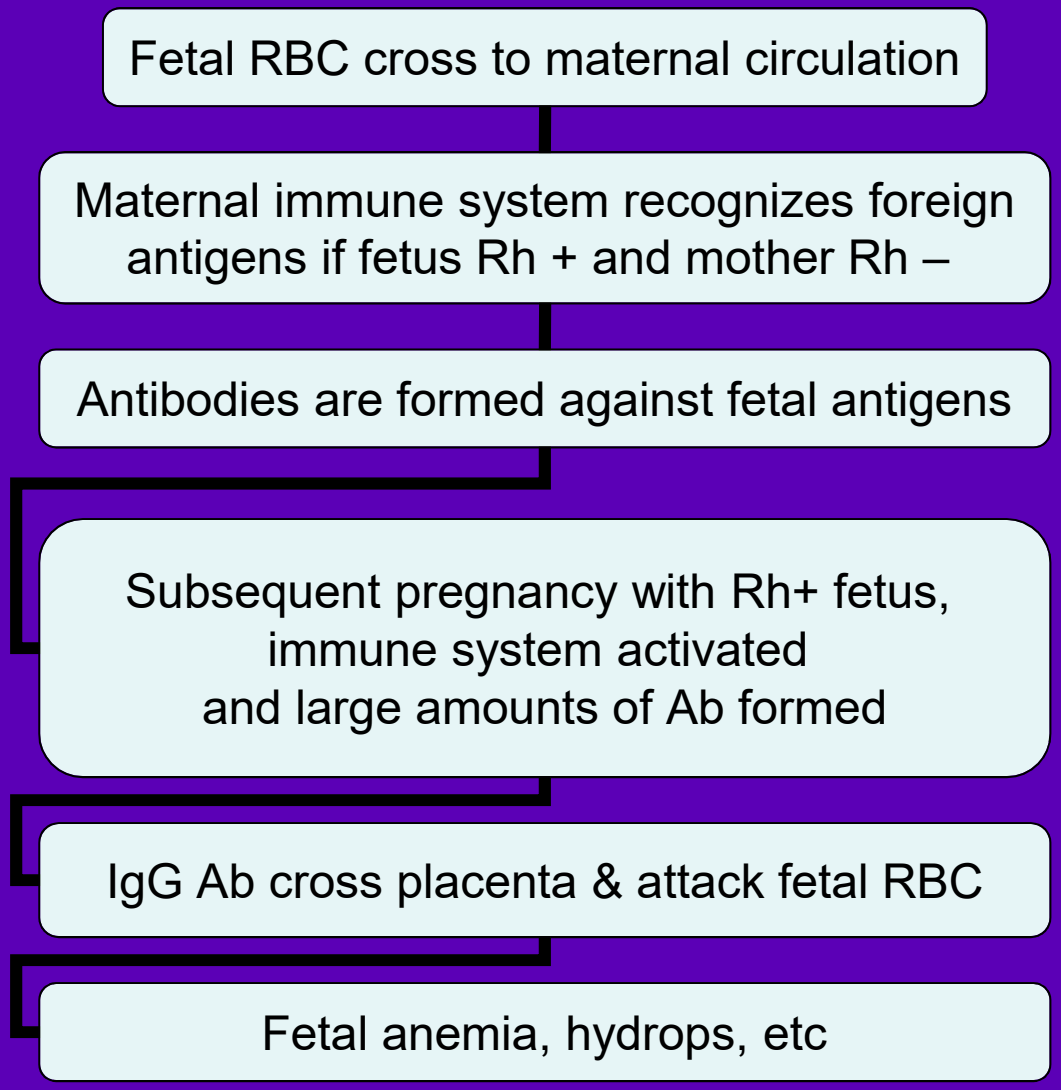
Breast-milk jaundice

- This is relatively common cause of jaundice in breast fed babies.
- It can be prolonged (up to 3 months).
- Apart from jaundice the baby is otherwise healthy.
- If in doubt, investigate to exclude a pathological jaundice.
- Never cause kernicterus
- Treatment: Reassurance & follow up
- **Do not stop breast feeding or added formula feeding**

Rh incompatibility

- In the past this was a common and dangerous cause of unconjugated jaundice.
- Mother Rh-ve and baby Rh+ve
- Now it became less common due to screening of mothers during first pregnancy and giving anti-D globulin to Rh –ve mothers.

Pathogenesis

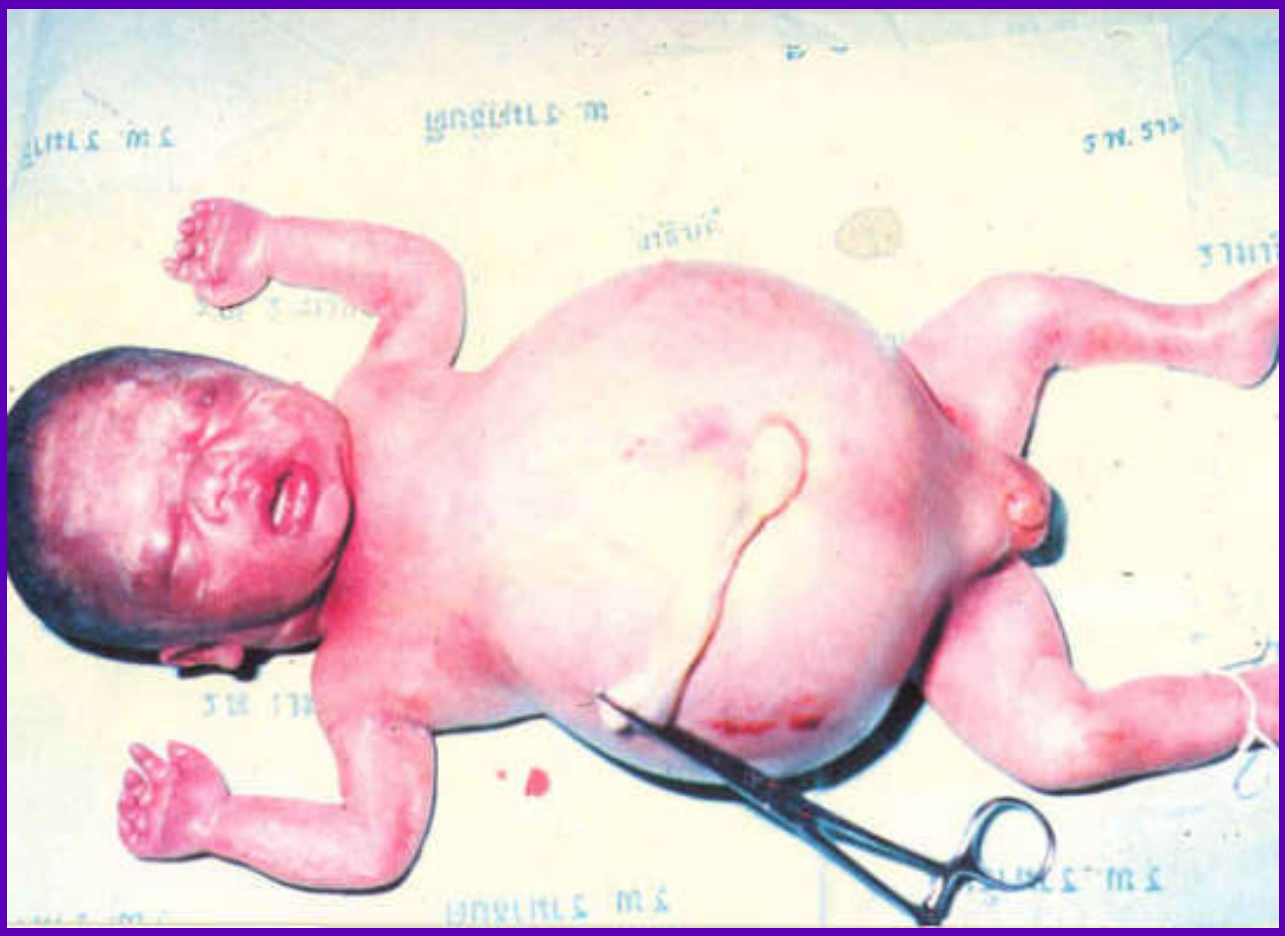


Clinical presentation of Rh incompatibility

- Only 5-10% of pregnant women with Rh-negative blood who are exposed to Rh-positive fetal blood cells develop Rh incompatibility
- Severe neonatal jaundice with positive direct coomb test.
- Anemia
- Hydrops fetalis

Hydrops fetalis clinical picture

- Anemia
- Ascites
- Heart failure
- Pericardial effusion
- Pleural effusion



Management of Rh incomparability

- Fetus Rh Negative: - Observation
- Fetus Rh Positive: -
  - Intrauterine transfusion of ‘Rh Neg’ blood as indicated if sign hydrops developed
  - Timely delivery any time after 32 weeks
  - Management of the infant up to 8 weeks
- In cases of severely sensitized women, consider medical termination of pregnancy
- Anti-D for the mother after delivery
- Management the baby general supportive treatment and specific treatment by anti-heart failure, phototherapy, exchange transfusion by o-ve blood

ABO incompatibility

- This is relatively common cause of unconjugated jaundice.
- The mother is usually blood group O and the baby is either blood group A or B.
- The first baby can be affected.
- It is less severe than Rh incompatibility as antibodies are mainly of IgM type and this not cross the placenta and small amount IgG which cross the placenta.
- The main presentation is pathological jaundice with positive direct coomb test.
- No prophylaxis, treatment with phototherapy
- Only 2-5% of cases need exchange transfusion by o+ve blood

Kernicterus

- This is a very serious complication of raised unconjugated bilirubin.
- unconjugated bilirubin can cross blood brain barrier and precipitated in certain areas of brain (extrapyramdal tract & basal ganglia) causes damage to these area
- Therefore all treatment lines are aimed at prevention of kernicterus.

Clinical Manifestations kernicterus

- Acute Bilirubin Encephalopathy
  - 1st phase: hypotonia, poor suck-present in the first few days
  - 2nd phase: Hypertonia (opisthotonos position)
  - 3rd phase: Gradual disappearance of the hypertonia-Up to years after the first week
- Chronic Bilirubin Encephalopathy: characterized by
  - Extrapyramidal Abnormalities (choreoathetoid cerbral plasy)
  - Hearing Loss,
  - Eye Gaze palsy
  - Dental Dysplasia

kernicterus

Laboratory Measures

- There is currently no lab value that correlates well with the development of kernicterus; there seem to be many risk factors (prematurity, sepsis, RH-ve, ABO, Etc,,,,) that lead to its development,
- Guidelines for initiating therapy for hyperbilirubinemia currently include the variables of Bilirubin level and age of baby.
- There are no good guidelines for **preterm** infants as preterm infant had immature blood brain barrier
- An unconjugated bilirubin level of more than 25mg/dl in term babies may be correlated with kernicterus.

Nursing considerations of Hyperbilirubinemia

- **Assessment:**

  observing for evidence of jaundice at regular intervals. Jaundice is common in the first week of life and may be missed in dark skinned babies

Blanching the tip of the nose

Approach to jaundiced baby

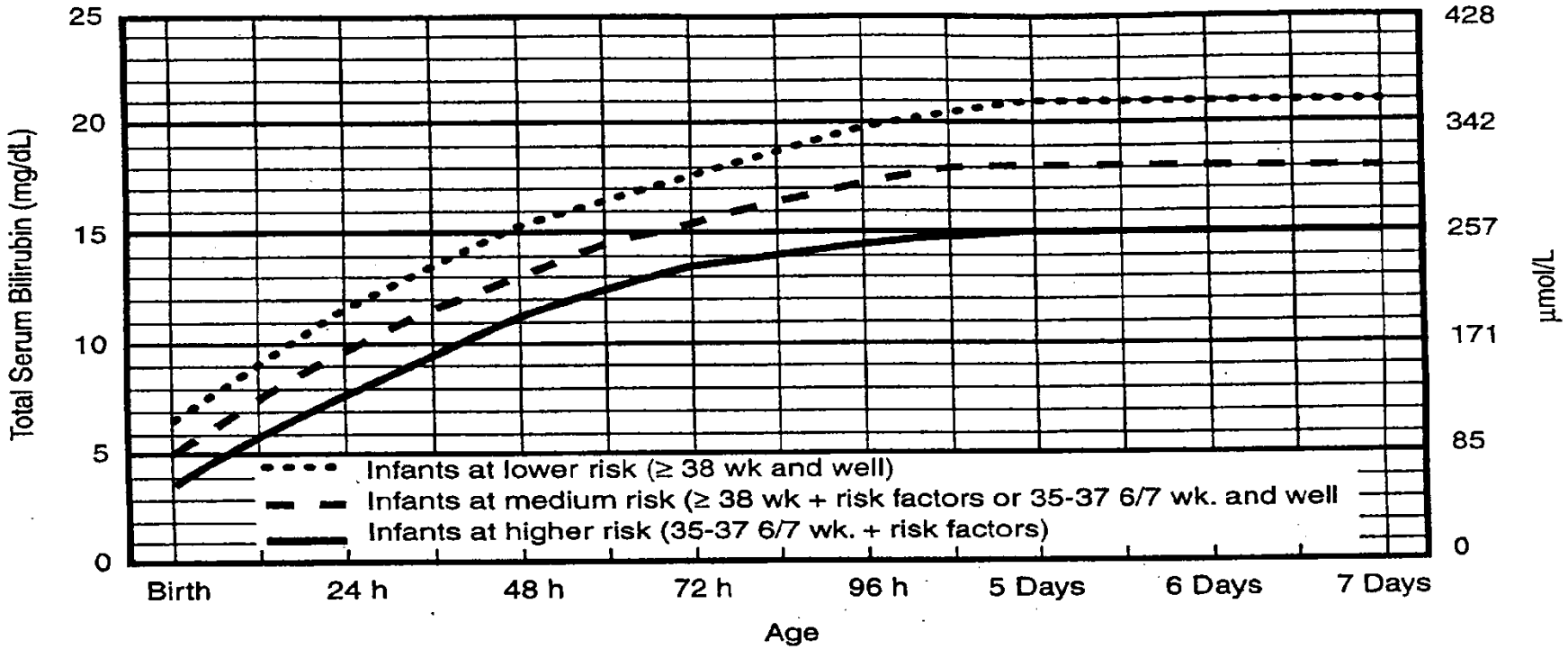
- Ascertain birth weight, gestation and postnatal age
- Ask when jaundice was first noticed
- Assess clinical condition (well or ill)
- Decide whether jaundice is physiological or pathological
- Look for evidence of kernicterus* in deeply jaundiced neonates (*Lethargy and poor feeding, poor or absent Moro's, or convulsions)*

The goals of planning

- Infant will receive appropriate therapy if needed to reduce serum bilirubin levels.
- Infant will experience no complications from therapy.
- **Family will receive emotional support.**
- Family will be prepared for home phototherapy (if prescribed).

Therapeutic Management

- **Purposes**: reduce level of serum bilirubin and prevent bilirubin toxicity by used bilirubin charts.
- Prevention of hyperbilirubinemia: early feeds, adequate hydration
- Reduction of bilirubin levels: phototherapy, Intravenous immunoglobulin, exchange transfusion,
- Drugs **Use of Phenobarbital may promote liver enzymes and protein synthesis, but it cause respiratory, CNS depression..**
- **No role for sylmiarin, Agar, Vitamins, urodeoxycholic acid**



- 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.

Fig 3. Guidelines for phototherapy in hospitalized infants of 35 or more weeks' gestation.

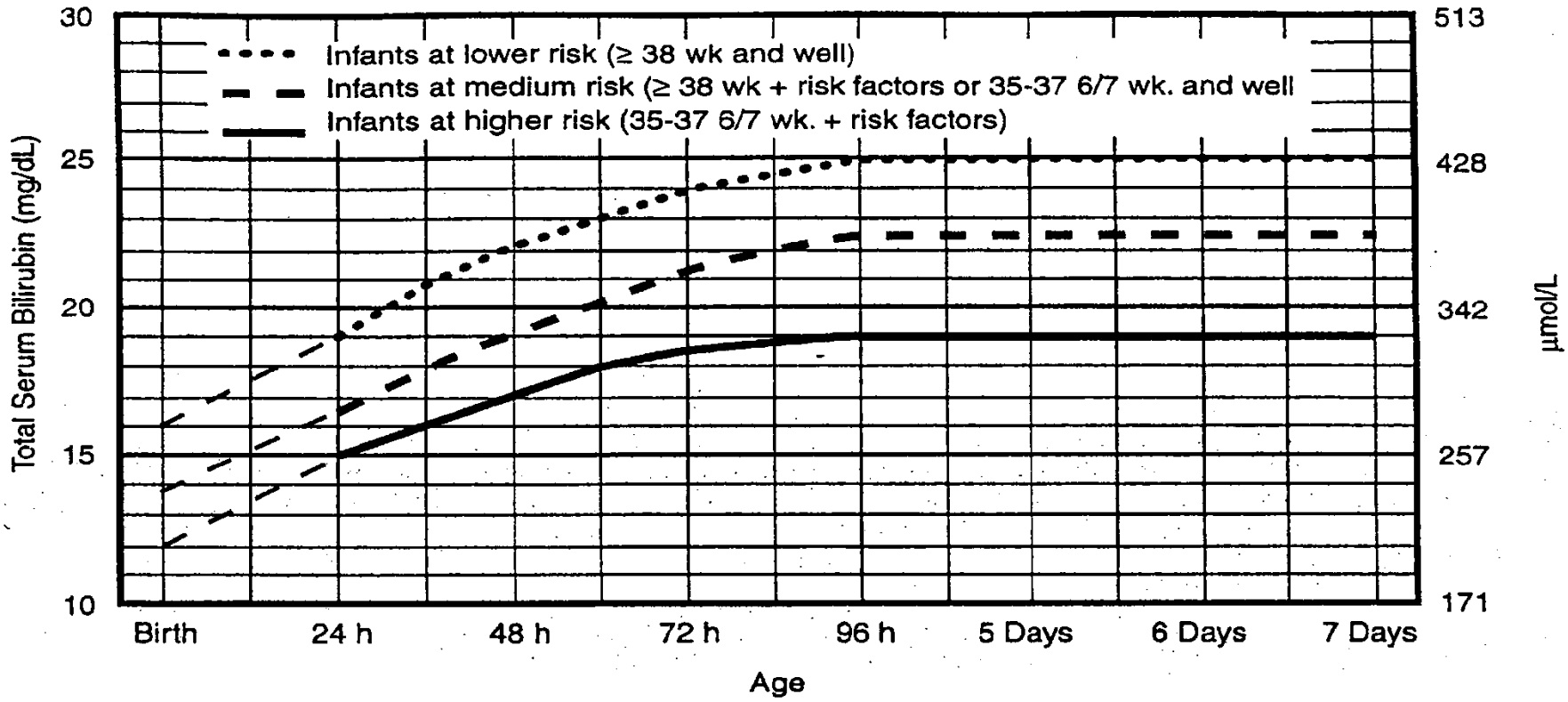
Note: These guidelines are based on limited evidence and the levels shown are approximations. The guidelines refer to the use of intensive phototherapy which should be used when the TSB exceeds the line indicated for each category. Infants are designated as "higher risk" because of the potential negative effects of the conditions listed on albumin binding of bilirubin,[45–47] the blood-brain barrier,[48] and the susceptibility of the brain cells to damage by bilirubin.[48]

"Intensive phototherapy" implies irradiance in the blue-green spectrum (wavelengths of approximately 430–490 nm) of at least 30 $\mu W/cm^2$ per nm (measured at the infant's skin directly below the center of the phototherapy unit) and delivered to as much of the infant's surface area as possible. Note that irradiance measured below the center of the light source is much greater than that measured at the periphery. Measurements should be made with a radiometer specified by the manufacturer of the phototherapy system.

See Appendix 2 for additional information on measuring the dose of phototherapy, a description of intensive phototherapy, and of light sources used. If total serum bilirubin levels approach or exceed the exchange transfusion line (Fig 4), the sides of the bassinet, incubator, or warmer should be lined with aluminum foil or white material.[50] This will increase the surface area of the infant exposed and increase the efficacy of phototherapy.[51]

If the total serum bilirubin does not decrease or continues to rise in an infant who is receiving intensive phototherapy, this strongly suggests the presence of hemolysis.

Infants who receive phototherapy and have an elevated direct-reacting or conjugated bilirubin level (cholestatic jaundice) may develop the bronze-baby syndrome. See Appendix 2 for the use of phototherapy in these infants.



- The dashed lines for the first 24 hours indicate uncertainty due to a wide range of clinical circumstances and a range of responses to phototherapy.
- Immediate exchange transfusion is recommended if infant shows signs of acute bilirubin encephalopathy (hypertonia, arching, retrocollis, opisthotonos, fever, high pitched cry) or if TSB is ≥5 mg/dL (85 µmol/L) above these lines.
- Risk factors - isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis.
- Measure serum albumin and calculate B/A ratio (See legend)
- Use total bilirubin. Do not subtract direct reacting or conjugated bilirubin
- If infant is well and 35-37 6/7 wk (median risk) can individualize TSB levels for exchange based on actual gestational age.

Fig 4. Guidelines for exchange transfusion in infants 35 or more weeks' gestation.

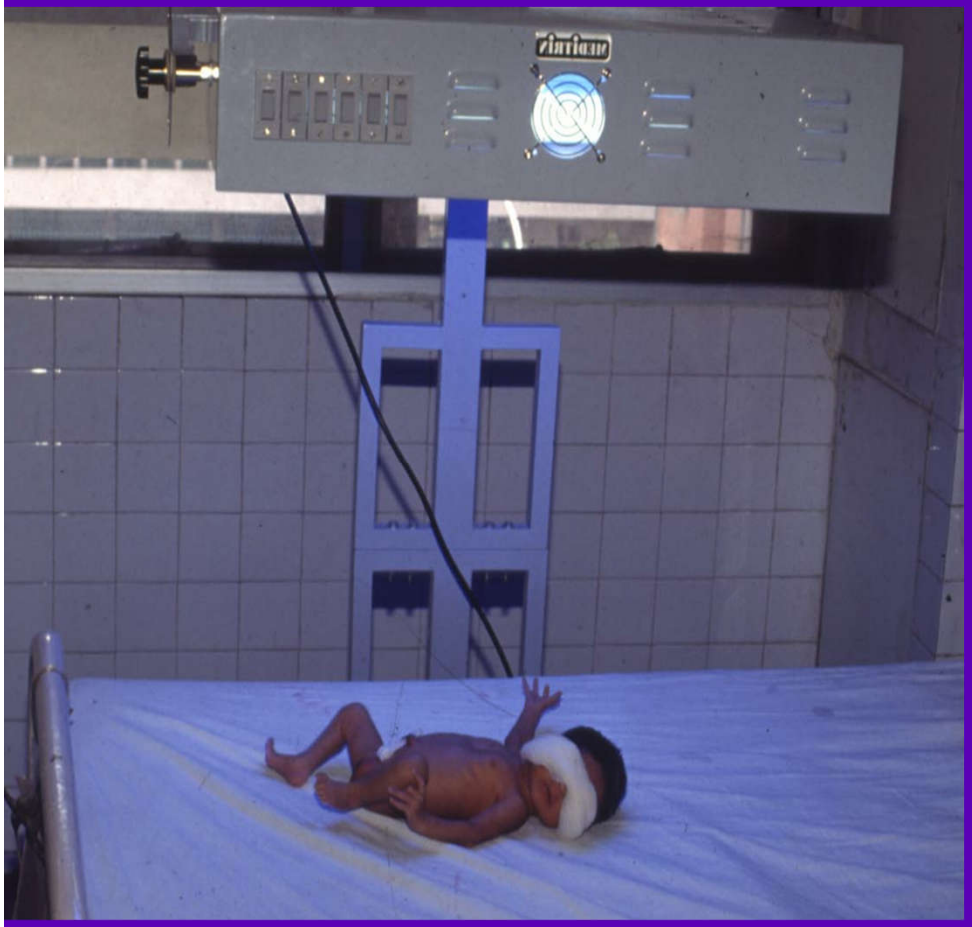
Note that these suggested levels represent a consensus of most of the committee but are based on limited evidence, and the levels show are approximations. See ref. 3 for risks and complications of exchange transfusion. During birth hospitalization, exchange transfusion recommended if the TSB rises to these levels despite intensive phototherapy. For readmitted infants, if the TSB level is above the exchang level, repeat TSB measurement every 2 to 3 hours and consider exchange if the TSB remains above the levels indicated after intensiv phototherapy for 6 hours.

The following B/A ratios can be used together with but in not in lieu of the TSB level as an additional factor in determining the nee for exchange transfusion[52]:

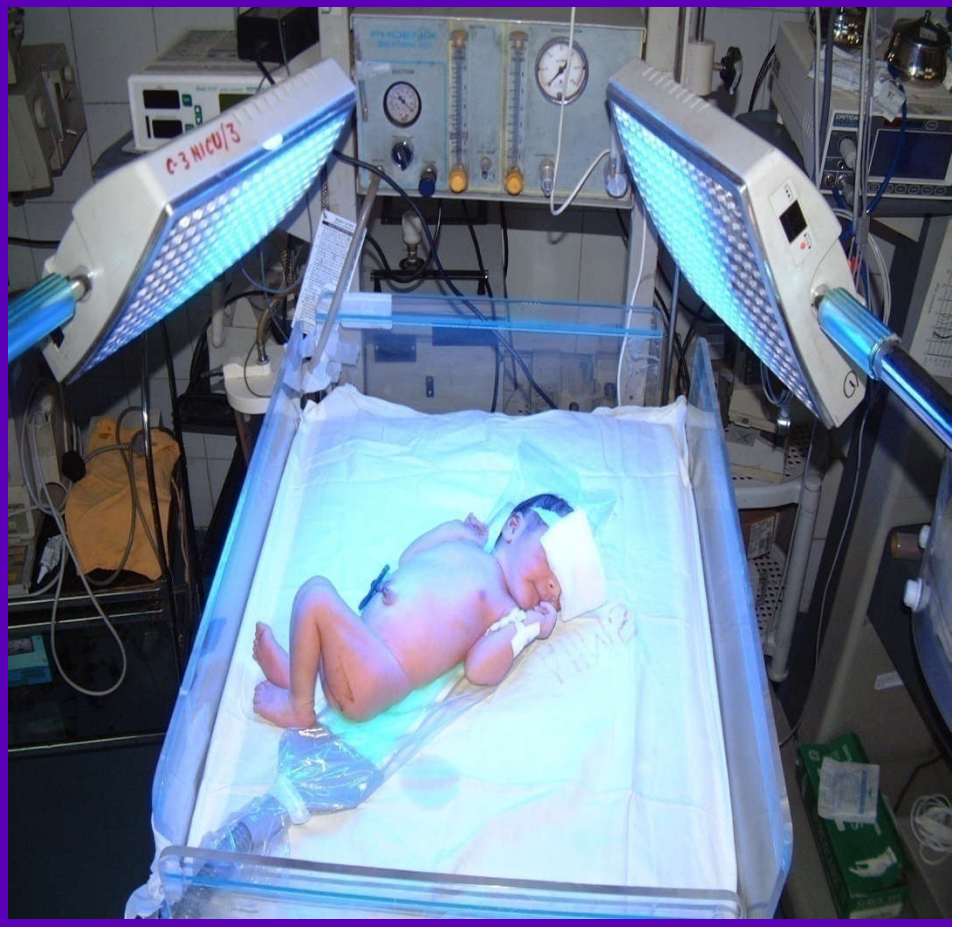
Phototherapy

- This act by photo-oxidation and isomerization of bilirubin
- Usually carried out according to bilirubin chart for preterm and term infant against patients age
- Diarrhea, dehydration, skin rash are the main complications of Phototherapy
- During Phototherapy eyes and genitalia must be covered to avoid their damage.

Babies under phototherapy



Baby under conventional phototherapy



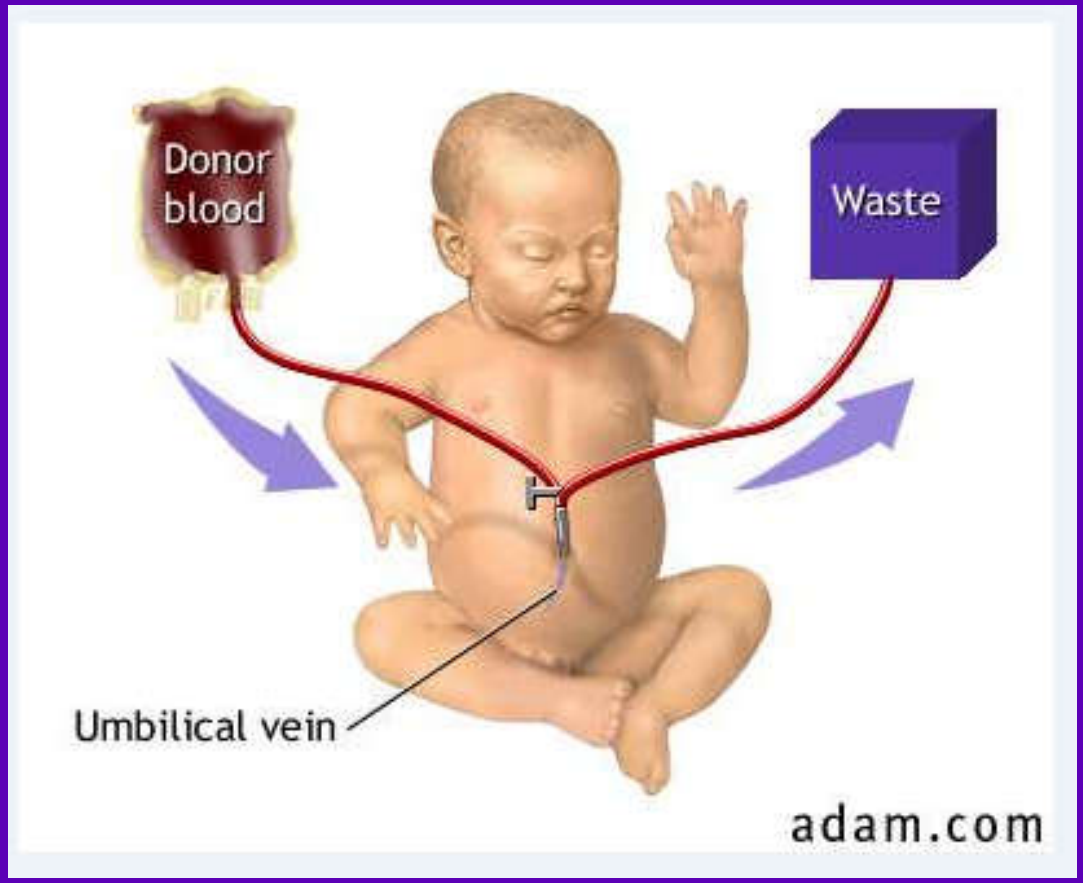
Baby under double unit intense phototherapy

Exchange transfusion

- This is the removal of blood from the baby and replacing it by blood from normal adult.
- The idea is to achieve rapid removal of excessive bilirubin to prevent kernicterus.
- It is indicted in cases with high unconjugated bilirubin ACCORDING BILIRUBIN CHART FOR EXCHANGE TRANSFUSION (full-term without risk factor indirect bilirubin level of 25 mg/dl or more).
- Give IV immunoglobulin during preparation for exchange decrease the need for exchange

Exchange transfusion

- **Sometimes it is carried out at a lower level in presence of risk factors as ……..**
- **It can also be carried out in cases with an established kernicterus (to prevent further brain damage).**
- **Amount of blood needed for exchange transfusion = wt in kg X 2 X 80**
- the main complications of exchange transfusion are Hypothermia, hypoglycaemia, electrolyte imbalance, cardiac arrest and apnea


Donor blood
Waste
Umbilical vein
adam.com

Prognosis

Early recognition and treatment of *hyperbilirubinemia* prevents severe brain damage.

MSQ

To help limit the development of hyperbilirubinemia in the neonate, the plan of care should include:

A. Monitoring for the passage of meconium each shift

B. Start phototherapy for 30 minutes every 6 hours

C. Substituting breastfeeding for formula during the 2nd day after birth due to breast milk induced jaundice

D. Supplementing breastfeeding with glucose water during the first 24 hours

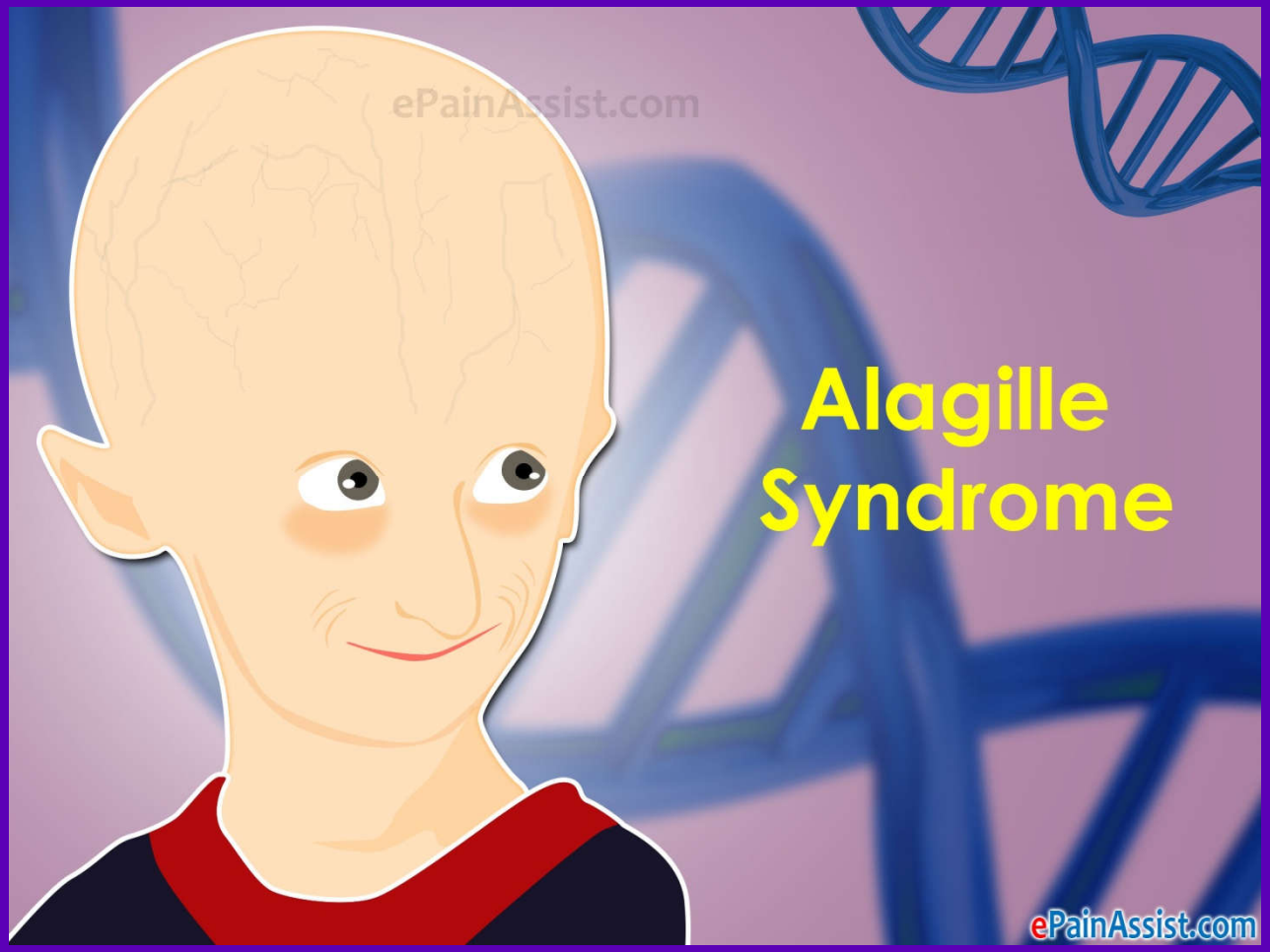
Conjugated hyperbilirubinaemia (neonatal cholestasis)

DEFINITION

- Neonatal cholestasis is defined as conjugated hyperbilirubinemia developing within the first 90 days of extrauterine life.
- Conjugated bilirubin generally exceeds 20% of the total bilirubin.

COMMON ETIOLOGIES

- Idiopathic neonatal hepatitis
- Extrahepatic biliary atresia
- Choledochal cyst
- Sepsis/Acidosis
- Inspissated Bile Syndrome (long standing unconjugated hyperbiliuremia as in RH and AB0 incompatibility lead bile bulge and cholestasis
- TPN-associated
- Drug-induced cholestasis
- Metabolic liver diseases as galactosaemia
- Alpha-1-antitrypsin deficiency
- Intrahepatic cholestasis syndromes (Alagille syndrome= pulmonary stenosis + biliary atresia + triangle face)


ePainAssist.com
Alagille Syndrome
ePainAssist.com

CLINICAL PRESENTATION

- Jaundice
- Scleral icterus
- Hepatomegaly
- Acholic stools (pale stool)
- Dark urine
- Other signs and symptoms depend on specific disease process
- Itching

GOALS OF TIMELY EVALUATION

- Diagnose and treat known medical and/or life-threatening conditions.
- Identify disorders amenable to surgical therapy within an appropriate time-frame.
- Avoid surgical intervention in intrahepatic diseases.

EVALUATION

- History and physical examination (includes exam of stool color)
- CBC and reticulocyte count
- Electrolytes, BUN, creatinine, calcium, phosphate
- SGOT, SGPT, alkaline phosphatase
- Total and direct bilirubin
- Total protein, albumin, cholesterol, PT/PTT
- Blood culture for sepsis
- Metabolic screen in suspected cases
- Hepatobiliary scintigraphy by radionucleotide scan (HIDA) as noninvasive technique to diagnosis biliary atresia
- Liver biopsy in cases of suspected biliray atresia or metabolic disorders

TREATMENT

- Medical management
  - Nutritional support
  - Treatment of pruritus by cholestyramine, Ursodeoxycholic acid
  - Management of portal hypertension and its consequences

TREATMENT

- Nutritional support
  - Adequate calories and protein
  - Supplement calories with medium chain triglycerides
  - Maintain levels of essential long-chain fatty acids
  - Treatment and/or prophylaxis for fat-soluble vitamin deficiencies (vitamins A, D, E, and K)

TREATMENT

- Surgical
  - Kasai procedure for biliary atresia
  - Limited bile duct resection and re-anastomosis
  - Choledochal cyst excision
  - Liver transplantation

KASAI PROCEDURE

- Performed for biliary atresia that is not surgically correctable with excision of a distal atretic segment.
- Roux-en-Y portoenterostomy
- Bile flow re-established in 80-90% if performed prior to 8 weeks-old.
- Bile flow re-established in less than 20% if performed after 12 weeks-old

Thank you