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NEONATOLOGY

FOR NURSES

Neonatology for Nurses

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Introduction

To the ones who cannot speak for themselves

The first days of life are difficult and crucial for the future of the tiny human. His first steps in life are shaped by his vulnerability. The thin red line between life and death and the borderline between health and hindered development will never be as narrow as they are now. Expectations, responsibility, and hopes are great at this time; both commitment and emotional involvement of the family and the ones in charge of the baby are very high.

Neonatology has made amazing advances lately and develops swiftly. Nurses working in neonatal intensive care units, neonatology wards, pediatrics departments, or general practices and midwives are the ones most close to the infants, in the front line of the defense of their health and welfare.

Prenatal Infant Care

Prenatal care deals with the intrauterine wellbeing, growth, and development of embryo and fetus and with the prevention of his conditions. Growth is the increase of dimensions and weight and development is the differentiation and maturation of system structures and functions.

Intrauterine development stages

- Embryonic phase - the first 60 days of the pregnancy; organogenesis and morphogenesis take place during this stage;
- Fetal period - lasting from day 60 of pregnancy to birth.

Intrauterine life is highly dynamic and very vulnerable to disruptive events. The placenta is the embryo-fetus/ environment interface in charge of nutrition, respiration, excretion, hormone exchanges and anti-infective as well as antitoxic defenses of the baby. It can provide appropriate protection; yet, there are some physical, chemical and infective agents able to overrun this barrier.

Fetal health can be impaired by maternal issues that are preventable and treatable before they harm the unborn baby. Nurses are the first ones to get in touch with the mother-to-be and play a crucial role in her nurture and counselling; their involvement in spotting high - risk pregnancies and in their assessment, treatment, and follow-up is most valuable.

A. Preventable maternal issues that can affect the fetus

1. The odds of premature birth and intrauterine growth restriction may be increased in women

- With a low socioeconomic status
- Of extreme ages- too young (under 20) or too old (over 35)
- With family difficulties- single or divorced mothers, widows
- With a poor nutritional status or overweight
- With an unbalanced diet
- Who expose themselves to toxic substances- alcohol, tobacco, drugs
- With a history of miscarriages and premature labor
- With many pregnancies and a short time between births
- With chronic conditions- heart diseases, hypertension, diabetes mellitus
- With uterine issues: malformations, previous surgery, abortions, etc.
- With infectious illnesses: urinary tract infections, vaginitis, cervix infections, toxoplasmosis, syphilis, listeriosis, brucellosis, genital herpes, cytomegalic disease
- Using assisted reproductive technologies
- With elective cesarian section scheduled before 39 weeks of gestation.

2. Congenital infections (syphilis, toxoplasmosis, rubella, herpes, and cytomegalovirus) carry an increased risk of malformations, prematurity, neonatal pathology, fetal and neonatal death, sensory deficits, neuromotor impairments, and cognitive delay.

Some of them are curable - syphilis by Penicillin and toxoplasmosis by Pyrimethamine, Sulfadiazine and folinic acid.

Other congenital diseases can be prevented by vaccines (rubella, mumps) or by avoiding raw meat and direct contact with cat stools (toxoplasmosis).

HIV positive mothers may reduce the risk of virus transmission to the baby by prenatal treatment with Zidovudine and delivery by caesarean section.

Vaccination of the mother-to-be during the last trimester of pregnancy prevents severe infections the child may acquire at birth (the deadly neonatal tetanus associated with giving birth in poor sanitary conditions and without qualified assistance) or during the first months of life (whooping cough).

3. Nutritional deficiencies of the mother

- Her iron deficiency increases the risk of iron deficiency anemia in her offspring. Pregnant women should enjoy a balanced diet, including liver, meat, and eggs. Women with high -risk pregnancies may require iron supplements. Iron-deficiency anemia of the expectant mother ought to be cured.
- Her iodine deficiency impairs the development of the fetal brain and fetal thyroid; the most serious consequence is cretinism, with severe developmental delays and dwarfism. Pregnant women should only use iodized salt.
- Her zinc and folic acid deficiency may lead to critical malformations: spina bifida (the spine and spinal cord do not form properly, the spinal canal is open along several vertebrae therefore meningitis, paralysis and bladder and bowel dysfunction occur) and anencephaly (lethal absence of a major part of the brain, skull and scalp).

4. Rh Isoimmune disease is the immune response of an Rh-negative mother to the Rh-positive red blood cell of the fetus. An Rh-negative mother and an Rh-positive father may have an Rh-negative child in 50% of cases and an Rh-positive one in 50% of cases. Small amounts of fetal Rh-positive red blood cells entering the mother's circulation during birth or miscarriage sensitize her, i.e. make her produce antibodies against Rh-positive red blood cells. Synthesis of these antibodies is increased during a subsequent pregnancy with an Rh-positive fetus; antibodies pass through the placenta into the fetus and cause hemolysis. This event does not occur during the first pregnancy with an Rh-positive fetus: it appears during the second one and may lead to fetal demise, severe anemia starting in utero, severe neonatal jaundice with a risk of death, cerebral palsy, cognitive delay or permanent hearing loss. The fetus may suffer from cardiac failure caused by anemia and accompanied by hydrops fetalis (pleural, pericardial and peritoneal effusions).

Rh isoimmune disease of the fetus may be prevented by anti D immune globulin given to the mother within the first 72 hours after the termination of her first pregnancy with an Rh-positive fetus - be it birth or miscarriage.

Isoimmune disease may also occur in mothers having OI blood type and AII or BIII fetuses. 50% of babies with an OI blood type mother and an AII blood type father have AII blood type, 50% of them are OI. 50% of children with an OI mother and a BIII father have OI blood type, 50% of them are BIII; 50% of the babies of an OI mother and an ABIV father have AII blood type, 50% of them are BIII. Fetuses can be affected starting from the first pregnancy of their mother.

5. Long term stress and distress of the expectant mother has a significant, long-lasting damaging impact upon the baby: prematurity, intrauterine growth restriction, psychological imbalances (depression, restlessness, sleeping disorders, personality disorders).

B. Environmental factors that may harm the fetus

- Radiations and some drugs (anticonvulsants, antipsychotics, oral anticoagulants, Captopril, cytostatics, antidepressants) increase the risk of having a baby with malformations.
- Drug abuse during pregnancy is linked to intrauterine growth restriction and brain injury (restlessness, seizures, lethargy, irritability and sleeping disorders in the infant).
- Smoking is related to a higher risk of prematurity and intrauterine growth restriction.
- Alcohol consumption during pregnancy may lead to intrauterine growth restriction, developmental delays, behavioral disorders and malformations in the offspring.

Infant Adjustment to Extrauterine Life

Newborn babies have particular features of the adjustment of their main functions during their transition from intrauterine to extrauterine life; these traits are of great importance to their care.

Adjustment of breathing

Gas exchanges of the fetus depend upon the placenta; fetal lung alveoli are collapsed and filled with liquid; this liquid is removed from the lungs during the baby's way through the birth channel. Sometimes, i.e. birth by cesarean section, the clearance of the liquid is deferred, and respiratory distress may occur. First breaths of the infant open up the alveoli; these are lined with a complex mix of lipids and proteins which prevents their end-expiratory collapse- the surfactant. In preemies, the synthesis of surfactant has not reached maturity; therefore respiratory distress is an important issue. Surfactant is given to the baby for this condition.

Adjustment of circulation

During intrauterine life, pulmonary circulation and systemic circulation are independent of each other and have the same pressure. Communications between them- the ductus arteriosus and the foramen ovale - close after birth. In premature babies or infants with severe respiratory distress the ductus arteriosus may remain patent or may re-open, causing heart failure; this has to be treated by drugs as Indomethacin or Ibuprofen, by catheter procedure or surgical closure of the patent ductus.

Pressure in the systemic circulation rises after birth and pressure in the pulmonary circulation decreases; if this reduction does not occur, as in the persistent pulmonary hypertension of the newborn, cardiac failure and respiratory distress appear. Inhaled nitric oxide and oral sildenafil are used in the treatment of this condition as they promote vasodilation in the pulmonary circulation.

Adjustment of immune defenses

The fetus lives in a germ-free environment, and his colonization by the maternal and environmental flora occurs after birth. Acquiring a healthy microbiome(beneficial bacteria) bears a great impact upon the present and future lifelong well-being of the infant. Babies delivered by cesarian section take longer to build a salutary microbiome than infants born vaginally. Baby's resistance to infection depends upon the maternal antibodies which pass through the placenta during the last weeks of gestation and it is very low, therefore strict asepsia and antisepsia must be observed during all kind of care, particularly invasive maneuvres. Extra care has to be paid to issues as proper handwashing before and after each maneuvre, ward hygiene, observance of the circuits of the unit, and adequate sterilization. Staff with respiratory or skin infections, acute diarrhea, herpes or germ carriers must observe quarantine and complete the adequate cure before entering the ward. Breastfeeding is vital to the development of the immune system and healthy microbiome of the infant.

Thermoregulation in the newborn baby

Infants do not have a fully developed ability to maintain a constant body temperature; preemies and sick, asphyxiated babies are particularly prone to hypothermia, because they lose heat quickly and have limited resources to produce heat.

Maintaining thermal comfort of newborns throughout all care procedures is paramount as hypothermia is related to higher neonatal mortality and morbidity and hyperthermia has a deleterious impact upon the evolution of various neonatal conditions.

1. Neonatal hypothermia

Babies at risk

- Premature babies
- Infants with intrauterine growth restriction
- Newborns needing resuscitation at birth
- Sick babies with various conditions - respiratory distress, sepsis, severe jaundice, shock, malformations of the abdominal wall, seizures, etc.
- Babies needing up-transfer.

Prevention of neonatal hypothermia [1,3,4,5, 9, 12].

- Ensure an adequate room temperature (25-28^{o} C) in the delivery rooms, premature babies' wards, neonatal intensive unit, and rooming-in wards.
- Avoid draughts - close well the doors and the windows, place cribs, incubators and radiant heaters far from the doors and windows.
- Wash hands with warm water and warm them up before touching the newborn.
- Warm up the objects in contact with the baby- stethoscope, linen, clothes, X-ray cassettes.
- Place the infant under a radiant heater in operation after birth and dry him completely with sterile, warm linen; discard the wet linen and replace it with a dry, warm one.
- Encourage skin-to-skin contact of the baby with his mother- she's a ''live incubator''.
- Place sick newborns in heated double-walled incubators and carry out all care maneuvres opening their doors for as little time as possible and as seldom as possible. Servocontrolled incubators with parameters set according to the infant's birth weight, gestational and postnatal age are ideal; servo control may not be efficient in shocked babies- manual control of the incubator is a better choice for them. Safeguard newborns cared for in incubators or overhead warmers against the risk of burns.
- Get the infants clothed and carry on diagnostic and curative maneuvres undressing them as little and seldom as possible.
- Use heated humidified oxygen for resuscitation and ventilation.
- Use skin probes to monitor the baby's temperature in newborns at risk of hypothermia.

Signs of hypothermia:

- Rectal temperature below 36,4 ^{0} C
- Cold, red skin
- Sclerema
- Bradycardia- slow heart rate
- Poor tonus and reactivity, lethargy
- Poor feeding.

Management of hypothermia: gradual warming; the initial temperature of the incubator as monitored by servo control should be 1-1,5^{0} C higher than the baby's rectal temperature.

Monitoring of the hypothermic newborn [1,3,4,5, 9, 12]:

1. Clinical assessment:

- Temperature
- Heart rate
- Blood pressure
- Respiratory rate
- Presence and severity of respiratory distress.

2. Paraclinical parameters:

- Peripheral oxygen saturation, assessed by pulse oximetry
- Blood sugar
- Blood gas analyses (pH, partial pressure of oxygen-PaO2-, partial pressure of CO2-PaCO2).

Baby's temperature should not rise with more than 1-1,5^0 C per hour. Warming must be adjusted according to his tolerance, to prevent the risks of a too fast rewarming: tachycardia (fast heart rate), cardiac arrhythmias, hypotension (low blood pressure), hypoglycemia (low blood sugar), and worsening of the respiratory distress.

3. Neonatal hyperthermia

It occurs much less frequently than hypothermia.

It has to be distinguished from the fever due to infections.

Causes

- Inadequate incubator settings
- Dehydration
- Too thick clothing
- Too hot environment, direct exposure to the sun
- Sepsis.

Signs of hyperthermia

- Rectal temperature over 37,5^0 C
- Warm, red, skin
- Tachycardia- fast heart rate
- Tachypnea- fast breathing rate
- Irritability, followed by lethargy and hypotonia (low muscle tone)
- Poor feeding.

Management of hyperthermia [1].

- Take the infant out of the hot environment.
- Turn off the incubator and/ or the phototherapy lamp.
- Undress the baby.
- Hydrate him appropriately, either orally, with breast milk, or parenterally.
- Wrap the baby in linen soaked in lukewarm water.

Adjustment of digestion and nutrition

The fetus gets his nutrients via the placenta; the fetal digestive system plays a minor role, but suction reflex, swallowing reflex, peristalsis of the digestive tube are present during fetal life, as well as the activity of the digestive enzymes. Sucking and swallowing reflexes, as well as suck/swallow and suck/breathing coordination may not be completely mature in premature babies; therefore they may need gavage feedings. Own mother's breast milk is the gold standard for newborns, the only choice that is perfectly suited to the infant's ability to process food. Differences in breast milk composition between mothers of premature babies and mothers of term babies (protein and lactose amount, osmolarity) promote the adjustment of digestion in preemies.

Sudden interruption at baby's birth of the high glucose intake during pregnancy makes the large for gestational age babies and the infants of diabetic mothers prone to hypoglycemia- low blood sugar- which poses a risk of brain injury. The same goes for newborns with insufficient nutrient intake during fetal life- premature babies and babies with intrauterine growth restriction. They all require blood sugar monitoring and bringing blood sugar back to normal, if necessary, by feedings or by intravenous glucose, given by bolus or continuous infusion.

Metabolic and hematologic adjustment

The fetus has a low oxygen pressure; therefore a great number of red blood cells is required to meet the oxygen needs of the developing tissues and growth. After birth, blood oxygen pressure rises, and the number of red blood cells decreases. Bilirubin is produced by the breakdown of hemoglobin; it is bound to a protein by the liver (conjugated bilirubin). The ability of the liver to synthesize conjugated bilirubin, as well as the bilirubin circuit between the liver and the gut (that promotes bilirubin clearance) are not completely developed in newborns. Therefore most infants may have physiological jaundice - a yellowish discoloration of their skin that usually starts by the third day of life reaches its peak between days five-six and completely vanishes by the tenth day of life. Jaundice may start earlier, can be more intense and may last longer in children with immature bilirubin conjugation by the liver (premature babies) and/or impaired bilirubin conjugation (due to asphyxia) as well as in infants with an excessive breakdown of red blood cells (due to isoimmune disease). As unconjugated bilirubin may harm the immature brain (kernicterus with a risk of death and increased odds of neuromotor or sensory disabilities as permanent hearing loss and blindness) these types of jaundice need therapy.

Feeding the Newborn Baby

Breastfeeding

Breast milk is the gold standard of child nutrition [1].

Benefits of breastfeeding

A. Benefits for the baby:

- Nutritional balance - all needed nutrients are in ideal amounts and proportions; their digestion, absorption, and usage are optimal, with no overload for the digestive system, liver, and kidneys - all of them still immature. Consequently, the child's development is appropriate, and he is safe from serious nutritional diseases (malnutrition, anemia, rickets). Later in life, his risk of diabetes mellitus and obesity is decreased.
- A complex mix of anti-infective factors protects the baby

against the contagious diseases his mother suffered from and also against pneumonia and acute diarrhea.

- Protection against allergies - breast milk does not comprise antigens and offers substances that promote the development of the child's immune system.
- Breastfeeding fosters a balanced neuropsychological development of the infant and a close, warm, balanced mother-baby relationship.
- Sucking helps the mouth, palate, and teeth of the baby develop harmoniously.
- Breast milk is uniquely tailored to suit the specific needs of the infant, according to his age and the moment of feedings. For instance, the colostrum of the first days after birth is rich in proteins and antibodies while the mature milk is richer in lactose and fat. The foremilk at the beginning of the feedings is more watery and rich in proteins and lactose to quench the baby's thirst and the hindmilk at the end of the feedings is rich in fat to ensure his satiety.

B. Benefits for the mother:

- Breastfeeding is convenient, comfortable, practical, and demands little effort.
- It helps her avoid a pregnancy that occurs too soon by deferring the return of her period.
- It promotes postnatal uterine recovery and decreases the risk of postpartum hemorrhages and endometritis.
- It fosters a self-image of a good, competent mother and boosts her self-esteem.
- It offers protection against the risk of breast cancer and osteoporosis.
- It eases the return to the silhouette before pregnancy.

C. Advantages for the family

Breastfeeding saves time and money.

D. Benefits for the environment

- Breastfeeding avoids pollution with packages and washing powders.
- It also saves resources: water, fuel, energy, etc.

To fully take advantage of these benefits, breastfeeding should be total during the first six months of life: no water, juices, teas, and formula. Breastfeeding should last for two years.

Unfortunately, where there is a high incidence of short breastfeeding duration and fewer mothers are breastfeeding their babies there is also an undesirable high death rate and increased morbidity in children.

Issues impending over the success of breastfeeding:

- Inefficient sucking: sleepy and/or weak baby, shallow latch.
- Lack of information on the advantages of breastfeeding expectant and new mothers need.
- Stress, lack of self-confidence, anxiety, and distress the new mother endures.
- Pressure family, media, formula ads, acquaintances, and unfortunately sometimes healthcare professionals put on the new mother by making abuse of formula feeding recommendations or by deprecatory remarks about the quantity or quality of her breast milk.
- Lack of support mothers need from their families and health staff. Mothers of preemies, twins, babies with various conditions requiring long hospital stays, mothers with low socioeconomic status, and lacking tuition are particularly prone to fail to breastfeed.
- No support any working mother is entitled to receive from her employer: a too-short maternity leave, no flexible working hours.
- Breastfeeding - related inner pressure some mothers experience: their feeling they have to be perfect parents, able to provide totally to all the present and future needs of her child.
- Mismanagement of the incidents occurring at the beginning of breastfeeding,
- Flat, inverted, retractile nipples.
- Exposure of the mother to tobacco, alcohol, or drugs.
- Conditions of the baby: prematurity, malformations, birth asphyxia, neonatal encephalopathy, neonatal jaundices, infections.

How to ensure the success of breastfeeding

1. Inform and support mothers-to-be and new mothers- especially during their childbed; mothers of twins, premature or sick infants, and the ones with low socioeconomic status, are particularly at risk of failing to breastfeed.

2. Avoid bottle feeding and pacifiers until the breast milk flow is well established and use formula only if needed and for the shortest possible time.

3. Show the mothers-to-be how to get their breasts ready for breastfeeding during pregnancy by a gentle massage with protective ointments.

4. Show the mothers how to take good care of the breasts:

- By maintaining their hygiene with mild soaps - no scrubbing- and wearing adequate, comfortable underwear;
- Explain to them how to prevent nipple soreness by helping the baby get a deep latch onto the breast and gently rubbing some drops of expressed milk or protective ointment onto the nipples after every nursing session.

5. Guide mothers and explain to them how to prevent breast engorgement.

- Show them how to pump their breasts before a nursing session, after the baby has finished nursing, and there is still milk left in the breasts, or every time breasts tend to become too full. Keeping warm towels on the areoli for a while before breast pumping can ease milking.
- Help the infant sit comfortably in his mother's arms, get a deep latch, and suck well.
- Make sure both breasts are emptied after every nursing session- be it by the baby or by pumping.

6. Ensure a warm, peaceful, relaxed, cozy environment during the nursing sessions.

7. Help mothers feed their babies on demand, day and night; the infants will gradually establish their routine during the first months of life.

8. Promote a balanced lifestyle of the mother, free from alcohol, tobacco, drugs, and excessive burdens.

9. Encourage mothers to have a balanced diet, with enough fluids and nutritious food, without pointless dietary restrictions or excesses.

10. Support new mothers to cope with the inherent stress of motherhood and show them how to have a positive approach to it.

11. Help them start breastfeeding as soon as their health and the condition of their babies allow- ideally in the delivery room.

12. Assist mothers to recognize when their babies are ready to feed and help them get their children ready to suck: alert, fussy, crying babies getting their fists into their mouths are eager to suck. Sleepy newborns may need a gentle massage to arouse, latch onto the breast, and suck well. After having his diaper changed the infant needs to sit comfortably in his mother's arms, tummy to tummy with her. His face must face the breast, his head has to be aligned with his body, his mouth wide open, grasping the whole areola, not just the nipple. The infant's chin must touch the breast and his swallowing ought to be audible. Triggering the rooting reflex of the baby by gently touching the corner of his mouth helps him move his head into position to start sucking. Expressing some drops of milk into his mouth encourages him to suck well.

13. Promote mother-child dialogue during nursing: words, songs, smiles, looking in each other's eyes, caresses, gentle pats on baby's cheeks, chin, or ear if he becomes sleepy. Babies should be allowed to choose when to suck - provided their suck is energetic enough and lasts enough to get them well-fed.

14. Make sure both the mother and infant are comfortably seated, tummy to tummy, and the baby latches well onto the breast. His body should be well held, his head and body well aligned, his chin not flexed, his cheek next to the breast, his mouth widely open, grasping the whole breast areola (not just the nipple), and his lower lip twisted. Baby's nose has to be free. The child should not munch, and he should audibly swallow.

15. Help mothers room in with their infants in the well-baby ward and stay in touch with their hospitalized children. Mothers of children with severe conditions and/or long hospital stays (i.e. birth asphyxia, respiratory distress, prematurity, neonatal encephalopathy, infections, malformations requiring surgery during the first days or weeks of life, and so on) find it useful and helpful to have access to the intensive care unit. Expressing milk near the baby's incubator is both valuable and inspiring. Supporting, encouraging, and counseling these mothers is crucial as breast milk is much more precious to a frail, sick child than to a healthy one. They ought to be introduced to and helped with the techniques of milk expression and they need help to overcome the hardships and pitfalls of the beginning. Stress should be laid on the complete emptying of the breasts on a regular basis, even if the infant is not yet able to be orally fed and later on regardless of the amount of milk he tolerates.

1. Breastfeeding

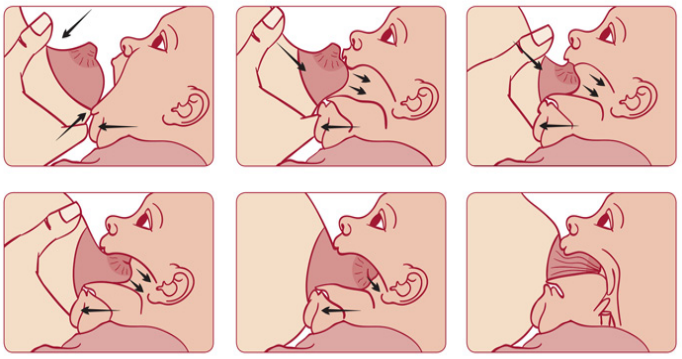
It's the simplest and most convenient way to feed a newborn.

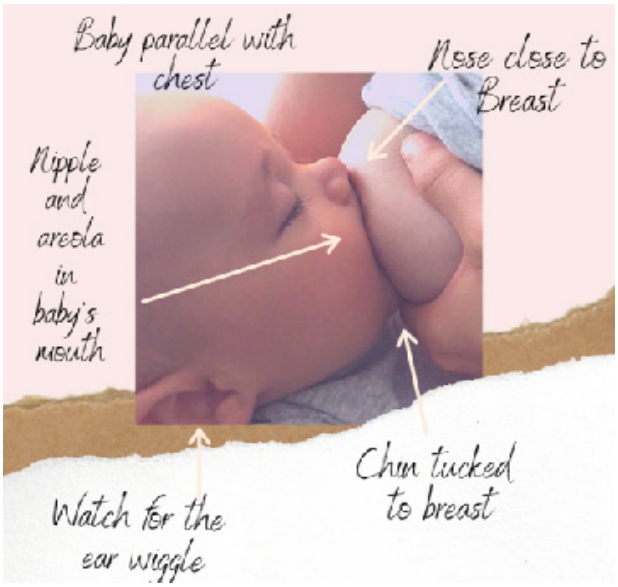
It calls for a good condition of the mother and the baby.

Attention must be paid to hands and breast hygiene.

Both mother and baby should sit comfortably, be it in bed or chair, tummy to tummy. The infant's face should face the breast, his head should be aligned with his body, without flexion of the chin or extension of the neck; baby's mouth should be wide open, taking hold of the whole areola, not just the nipple and his lower lip should de twisted. Sucking should be energetic, accompanied by swallowing, silent, and constant. Do not push the baby's head against the mother's breast.

After the nursing session, the baby should be kept raised on his mother's shoulder until he burps to avoid eructations and afterward laid in lateral decubitus.





2. Spoon-feeding

It is less demanding for the baby.

Care should be taken to assure proper hygiene and asepsia of the spoon and cup the mother uses to express her milk.

3. Gavage

It is indicated in:

- Premature babies with a low gestational age
- Very low birth weight babies
- Children with neurologic conditions affecting suck and coordination of suck- swallow- respiration
- Children who are not strong enough to tolerate spoon – feedings.

If the aforementioned ways to feed the newborn are on-demand, gavage feedings are given every two or three hours, depending on the baby's gestational and postnatal age. Some infants with a very low feeding tolerance may require continuous gavage.

Attention must be paid to the following issues

- Observe hygiene, asepsia, and antisepsia while expressing breast milk, placing the oral feeding tube, and administering the milk.
- Make sure the feeding tube is in the baby's stomach before giving the milk: attach a sterile syringe to the empty feeding tube and withdraw its plunger.
- Assess gastric residual volume and appearance (cloudless, cloudy, bilious, with bloody streaks or undigested milk).
- Let the milk flow freely, without pushing it - remove the syringe plunger.
- Advise and help the mother to empty her breasts, regardless of the milk intake of her baby.

Contraindications to oral feeding of the newborn:

- Severe birth asphyxia
- Unstable babies: cyanosis spells, apnea spells (cessation of breathing longer than 20 seconds and bradycardia), low blood pressure, bradycardia/tachycardia (slow/ fast heart rate), respiratory distress (high respiratory rate, nasal flaring, grunting, intercostal retractions)
- Babies with conditions of the digestive tract: necrotizing enterocolitis, malformations requiring surgery
- Infants with other malformations requiring surgical correction
- Gastric residuals greater than one-third of the prescribed intake, and turbid, bilious or hemorrhagic gastric residuals regardless of their volume ask for an interruption of oral feedings.

Assessment of baby's feedings

- Baby's weight curve: after the weight loss of the first 3 days of life (that shouldn't exceed 10% of the birth weight) the baby should grow with 30- 50 grams a day. Weighing the child before and after the nursing session is not always useful nor helpful and might be an unnecessary stress for the mother,
- Infant's amount of urine- well-fed infants pass urine at least 5 times a day; this urine does not contain urates that leave red marks on the pampers.
- Child's stools- he should pass at least 1-2 a day; they should be yellow and soft, not dark green and dry.
- Baby's sleep- he should enjoy at least 2-3 hours' tranquil sleep between feedings.
- Infant's behavior- he should be satisfied, happy, alert, not restless or lethargic.
- Newborn's skin turgor is assessed by pinching the skin, releasing the skin fold, and measuring how long the skin takes until it recoils; it should be normal (less than 2 seconds), not poor (prolonged).
- Presence, volume, and aspect of the gastric residuals in babies fed by gavage; its aspect (bilious, hemorrhagic, cloudy, clear, or with undigested milk) is noteworthy.

Incidents of breastfeeding

Most of them are minor and usually do not justify the inter-

ruption of feedings.

They occur more frequently at the beginning of breastfeeding and they are easily preventable by nurturing and counseling the expectant mothers and new mothers.

If managed clumsily, with no delicacy of feeling and no determination they may impact deleteriously upon breastfeeding; they may even put a stop to the mother's lactation.

A. Incidents involving the baby

1. Some children, particularly the ones who suck greedily and do not burp may regurgitate some milk after the nursing sessions. Keeping the infant raised on his mother's shoulder until he gets rid of the excess air in his stomach and gently rubbing his back helps.

2. Postprandial "diarrhea" is actually a gastro-colic reflex that makes babies pass a stool during or right after the nursing session,

3. Breast milk jaundice is extremely rare and never severe enough to call for the cessation of breastfeeding.

B. Incidents affecting the mother

1. Cracked, sore nipples are a frequent, painful problem. New mothers should follow these steps to prevent and treat it.

- Help the baby latch properly onto the breast.
- Maintain breast hygiene.
- Gently rub milk or a protective ointment onto the nipples after feeding the baby.
- Briefly expose the breasts to air after every nursing session.

2. Breast engorgement is a serious problem that may be accompanied by fever and may impede the baby's feeding: improper latching onto the breast, and very difficult sucking. It can be prevented and solved by breast pumping before every nursing session. New mothers ought to make sure the breasts are completely emptied after every nursing session. Keeping warm towels on the areoli for a while before breast pumping can ease milking.

3 Uterine contractions during breastfeeding are painful but they mean the uterus recovers quickly after birth.

4. Hypogalactia (milk secretion that does not meet the infant's needs) is an issue some mothers or/and their families may sometimes exaggerate or unduly claim, particularly at the beginning of breastfeeding. What actions are required?

- Increase the frequency of feedings.
- Make sure the baby latches well onto the breast.
- Proper hydration of the mother.

Formula supplements, if needed, should be given for the shortest possible time and never by bottle feeding.

Contraindications to breastfeeding

A. Maternal pathology

1. Temporary contraindications:

- Generalized infections
- Infectious diseases that may be transmitted to the baby: flu, measles, mumps, rubella, chickenpox, herpes with lesions of the breasts
- Some medication that may pass into the breast milk and harm the baby: antibiotics (Chloramphenicol, Tetracycline, Cotrimoxazole, Metronidazole, Clindamycin, Nitrofurantoin, and Nalidixic acid), low molecular weight heparin, iodinated contrasts, radioactive tracers.

Care should be taken to maintain lactation by constant breast pumping during the temporary interruption of breastfeeding.

2. Permanent contraindications:

- Chronic infections: tuberculosis, hepatitis B, hepatitis C, infection with HIV
- Chronic neurologic diseases
- Chronic hepatic, kidney, and heart illnesses
- Mental diseases
- Long term medication: iodine, cytostatics, antiarrhythmic drugs- Atenolol, Amiodarone-, anticonvulsant drugs, gold compounds, antidepressants, aspirin, diuretics, Metoclopramide, codeine, estrogens.

B. Child pathology

1. Temporary contraindications:

- Premature babies with a very low gestational age and a very low birth weight

- Unstable babies sufering from infections, neurologic conditions, respiratory distress, congenital heart defects, malformations of the digestive system, and so on

- Seizures
- Severe birth asphyxia
- Necrotizing enterocolitis
- Congenital heart defects, congenital disorders of the respiratory system, congenital diaphragmatic hernia, malformations of the digestive system, abdominal wall defects, and congenital reno-urinary malformations requiring neonatal surgery.

2. Permanent contraindications: some inherited metabolic diseases: phenylketonuria, galactosemia, tyrosinemia, and so on.

There are some myths related to breastfeeding worth busting because they have no basis and no beneficial effect upon mothers, hence upon their children.

- Smaller breasts do not produce enough milk- as a matter of fact, breast size depends upon the breast fatty tissue whereas milk secretion depends upon the mammary glands, which have roughly the same dimension in all breasts.
- If the breast shape does not allow the baby to latch on easily there is nothing to do- actually flat, retractile, inverted nipples may benefit from a gentle massage, a breast pump with an adequate breast cup, or some well-fitting silicone nipple shields.

- Nursing-related pain is normal- in fact, it means the baby latches onto the nipple instead of latching onto the breast areola so he cannot get enough milk, and nipple sores occur.
- If the baby nurses for a long time the breast milk is insufficient- the truth is nursing sessions are special moments of emotional and physical comfort the baby enjoys and he wishes they should last longer; breast milk is easily absorbed thus it does not stay too much in the infant's stomach.

Baby's appropriate feeding is warranted by his ascending growth curve, his behavior (he should be lively, not placid or restless), his skin turgor, his urine (it should have normal color, without urates that leave red marks on the pamper, and the infant should fill 5 pampers a day), and his stools (up to one stool after each meal- soft and yellow-not dark green and dry).

- The baby is better satiated when fed formula- the truth is, the formula is less readily absorbed than breast milk, therefore it stays longer in his stomach.
- Less frequent nursing helps breast milk flow establish easier and faster- in fact regular, frequent, complete breast emptying (be it by nursing or breast pumping if the baby does not suck appropriately) is the main stimulus of breast milk flow establishment during the first days of lactation.
- Mothers should avoid certain foods while breastfeeding because they could harm the baby- in reality, a balanced diet of the mother helps the infant to accept easier a wide range of foods during weaning. Alcohol is a big no-no, as it can very easily pass into the breast milk and thus quickly becomes toxic; foods the mother does not agree with should also be avoided.
- Breastfeeding harms breast shape and health- actually, it does not alter breast shape and it greatly lowers breast cancer risk.
- If breastfeeding is not a success right from the start it will never be, however one can have unexpectedly good results in some cases - especially child health issues- it takes patience, thoughtfulness, and determination.
- Breastfeeding may prevent unwanted pregnancy by itself- as a matter of fact, after the mother's period returns both parents should use other birth control means as well: condoms, other barrier devices, intrauterine devices, mini pills.
- Breastfeeding alone is enough to support the development of the baby's immunity- in reality, vaccines are vital to the growth of the baby's defensive system.

Mixed feeding

It is an option in cases of maternal hypogalactia, but just until her milk flow is established.

Infant formula is to be given by spoon, only after both breasts have been emptied.

Bottle feeding

Infant formulas are the only valid choices, as cow's milk and goat's milk are not suitable at all for babies under one year and carry high risks of anemia, rickets, and malnutrition.

What babies can be bottle-fed?

- Abandoned infants
- Babies of mothers with permanent breastfeeding contraindications
- Babies with permanent breastfeeding contraindications.

Disadvantages of bottle-feeding

- High costs: it requires more money, time, and effort than breastfeeding.
- Milk flows more freely and steadily from the bottle than the breast (which has a natural ebb and flow due to milk ejections, or let-downs), so babies tend to consume more milk from the bottle at a feeding. Before this reflexive suckling is outgrown (at the age of 3-4 months), babies fed by bottle are at greater risk of overfeeding so they have a tendency to be overweight.
- Increased risk of infections- diarrhea, pneumonia, otitis.
- Higher risk of allergies: atopic dermatitis, asthma, intolerance to cow's milk protein, shock.
- Higher odds of malnutrition if the formula is too diluted.
- Increased risk of dehydration if the concentration of the formula is too high.
- Nitrite intoxication if the well water used to prepare the formula is polluted.

Infant formulas

1. Baby formulas

They try to get close to breast milk. The most commonly used infant formulas contain purified cow's milk whey and casein as a protein source, a blend of vegetable oils as a fat source, lactose as a carbohydrate source, a vitamin-mineral mix, and other ingredients depending on the manufacturer. They have nucleotides, probiotics, carnitine, essential polyunsaturated fatty acids added; some of them also include prebiotics and postbiotics.

2. Special formulas

- Premature infant formulas
- Low phenylalanine formula developed for infants with phenylketonuria
- Low lactose formulas used to feed babies with lactose intolerance- be it inborn or related to an acute diarrhea
- Hypoallergenic formulas, with hydrolyzed proteins, for infants with cow milk protein allergy
- Elemental formulas, with amino acids, glucose, simple lipids, and minerals, meant for babies with severely impaired digestive tolerance
- Anti-reflux formulas, thickened with carob powder, for babies with gastroesophageal reflux disease (backward leak of the gastric content into the esophagus).

Bottle-feeding requires great care to the following issues:

- Quality of the water used to prepare the formula- attention has to be paid to the risk of its pollution and/or contamination with germs

- Strict observance of hand, bottles, teats and preparation hygiene, asepsia and antisepsia
- Correct formula powder- water proportion.

Pharmacology of the Neonatal Age

Pharmacology deals with the absorption, distribution, metabolism, action, and clearance of drugs in newborn babies. The medication panel used in neonatology is not wide, due to the particular features of the newborns and the lack of pertinent data regarding the usage of many drugs during the first days of life.

Pharmacokinetics (the movement of drugs into, through, and out of the system) has distinctive features in newborns and there are differences in all of the pharmacokinetic phases between infants and older children.

- Drug absorption by the digestive system is low and inconstant as the digestive tract structures, motility and enzymes are immature, particularly in premature babies.
- Drug absorption after intramuscular administration is very poor, especially in preemies, as newborns have a low muscular mass.
- Drug absorption via the intrarectal route is reduced.
- Drug binding by plasma proteins is diminished; some drugs - vitamin K, Cotrimoxazole, Ceftriaxone, Nalidixic acid- can displace conjugated bilirubin, thus generating risk of brain damage in jaundiced babies.
- The immature liver metabolizes drugs slower than in older children, hence drug effects last longer, particularly in preemies.
- Renal drug clearance is slower and the immature kidney is remarkably sensitive to the side effects of drugs like aminoglycosides- Gentamycin, Kanamycin, Amikacin. There is also an increased and prolonged risk of other toxic effects of aminoglycosides, i.e. involvement of the cochlear nerve with permanent hearing loss.
- Some immature systems are remarkably vulnerable. Toxic effects of medication can harm the hematopoietic bone marrow (anemia, leukopenia- low leukocyte count- and thrombocytopenia- low platelet count- after Chloramphenicol), the myocardium (arrhythmia , i.e. irregular heart rate after high doses of Digoxin), the epiphyseal plate responsible for bone growth (Ciprofloxacin), the ear (hearing loss after Gentamycin, Amikacin, Tobramycin, Furosemide), and the teeth buds (Tetracyclin).

These features of the newborn baby call for age-dependent distinct ways of administering medication and monitoring its effects.

- The intravenous route is the only most adequate way to administer drugs due to the difficult absorption via the oral, intramuscular, and intrarectal routes.
- The number of drug doses is one every 12 hours in full-term babies and one every 18- 24- 36 hours in preemies aged 0-7-10 days and one every 12 hours in older premature infants.
- Some drugs must not be given to newborn infants because of their deleterious side effects: Chloramphenicol (gray baby syndrome: cyanosis, ashen-gray color, vomiting, abdominal distension, circulatory collapse, and death), Tetracycline, Cotrimoxazole, Ciprofloxacin, and Nalidixic acid. Babies with jaundice must not receive ceftriaxone as it can increse the risk of brain injury (kernicterus).
- Doses of some drugs are smaller than in older children.
- Proper drug dosage implies adequate drug dilution; the number of drug milligrams per milliliter of the dilution and the date the dilution was prepared must be understandably written. Extra care is needed when preparing and giving the medication with a high risk of very serious side effects- Insulin, Adrenalin, Digoxin.

Drugs taken by the mother during pregnancy, labor, and breastfeeding can also have an impact upon the baby.

The influence of maternal medication during pregnancy upon the fetus depends upon the gestational age: organogenesis is vulnerable to the risk of malformations while during labor the child is prone to respiratory depression due to analgesic and anesthetic drugs. The hazard depends upon the ability of the drug to cross the placenta and on its clearance.

Great caution is needed when choosing drugs for pregnant women. There are some definite no-no-s: cytostatics, estrogens, testosterone, and radiotherapy carry a very high risk of malformations, antithyroid drugs impair development, and Aspirin, Phenobarbital, Hydrazide, thiazides (Nefrix, Ufrix), and Thrombostop increase the odds of bleeding.

The same caution must be observed during labor- anesthetics, intravenous analgetics or local perineal Lidocaine accidentally administered into the scalp of the fetus can cause respiratory depression in the newborn.

The other side of the coin is that some maternal medication can prevent some fetal and neonatal conditions. Central nervous system defects as anencephaly and spina bifida can be prevented by folic acid and zinc supplements if given some months before conception and during the first 3 months of pregnancy. Dexamethasone or Betamethasone administered at least 24 hours before a premature delivery lowers the risk of respiratory distress syndrome in the baby.

Several factors affect the effect of maternal medication during breastfeeding upon the baby: drug passage into the breast milk, duration of treatment, the quantity of breast milk the infant receives, the time between the moment of drug administration and the next nursing session, and the vulnerabilty of the newborn to drug toxicity.

Great caution is needed when choosing a medication for a breastfeeding mother. Some drugs call for the cessation of breastfeeding: cytostatics, antithyroid drugs, antipsychotics, Chloramphenicol, Tetracycline, Cotrimoxazole, Aspirin, low molecular weight heparins- they are too toxic for the baby. One may try to replace them if the condition of the mother allows, or the mother will resume breastfeeding after completion of the treatment.

Some drugs inhibit lactation, thus must be avoided during breastfeeding- estrogens, thiazides.

Self-medication is to be discouraged during breastfeeding. Observance of drug dose and follow- up of baby's tone, behavior, skin discoloration (jaundice, pallor, greyish tone), way of

feeding, and also the assessment of the stool and urine aspect are needed. Taking the medication right after the nursing session may help.

High - Risk Babies

The condition of the infant bears the influence of many factors related to his mother, the course of the pregnancy and labor, the childbirth type, his gestational age and birth weight, and his family history. Medical teams of the delivery room, neonatal intensive unit, premature babies ward, and well babies nursery must be aware of these risk factors to get ready for the adequate, prompt management of the infant. A good partnership with the obstetrics healthcare team is valuable in this respect.

1. Risk factors related to the mother and associated risks for her baby

A. Age

- Underage mothers: prematurity, small for gestational age babies, birth asphyxia, birth trauma, intrauterine growth restriction, increased cesarian section rate, child abuse, neglect, and abandonment.
- Mothers over 40 years: genetic issues (Down syndrome, Edward syndrome, Patau syndrome, etc.) malformations, intrauterine growth restriction.

B. Maternal medical history

- Preeclampsia (hypertension, edema, and seizures in pregnancy): fetal demise, intrauterine growth restriction, birth asphyxia, prematurity.
- Diabetes mellitus: respiratory distress syndrome, neonatal hypoglycemia, large for gestational age babies, birth trauma, birth asphyxia, fetal demise, malformations.
- Urinary tract infections: neonatal sepsis.
- Group B hemolytic streptococcal vaginitis: prematurity, respiratory distress syndrome, neonatal sepsis.
- Infections - syphilis, rubella, mumps, toxoplasmosis, cytomegalovirus: fetal demise, prematurity, intrauterine growth restriction, malformations, congenital infections.
- Isoimmunisation: prematurity, fetal demise, severe neonatal jaundice, severe neonatal anemia.
- Peripartum fever: neonatal infections.
- Obstetric history of miscarriages, infertility, uterine surgery, uterine malformations, abortion, premature labor: prematurity, intrauterine growth restriction, birth asphyxia, birth trauma, increased rate of cesarian section.

C. Alcohol consumption during pregnancy: fetal alcohol syndrome (malformations, developmental delays, intrauterine growth restriction, behavior problems), child abuse, neglect, or abandonment.

D. Smoking: intrauterine growth restriction, prematurity, sudden infant death syndrome.

E. Drug abuse: prematurity, intrauterine growth restriction, birth asphyxia, withdrawal syndrome, child abuse, neglect, or abandonment.

F. Family history of children with respiratory distress syndrome, bleeding disorders, isoimmune disease, congenital issues: same risks for the newborn baby.

2. Risk factors related to the fetus, placenta, umbilical cord, membranes, amount of amniotic fluid, and associated fetal hazards

A. Fetal issues

- Intrauterine growth restriction: fetal demise, birth asphyxia, hypoglycemia, hypocalcemia(low serum calcium), malformations.
- Large for gestational age infants: birth asphyxia, birth trauma, increased rate of cesarian section, hypoglycemia polycythemia (elevated red blood cell count with severe neonatal jaundice, and respiratory distress due to cardiac failure).
- Multiple pregnancies: prematurity, intrauterine growth restriction, birth asphyxia, birth trauma, congenital anomalies, fetal demise, placental vascular shunts with severe anemia, growth restriction, and respiratory distress in the donor twin and polycythemia (high red blood cell count) with cardiac failure, respiratory distress syndrome, severe neonatal jaundice and thrombosis in the recipient twin.
- Abnormal fetal presentations-(breech, front, face, shoulder): birth asphyxia, birth trauma.

B.Issues related to the amount of amniotic fluid

- Polyhydramnios (an excessive amount of amniotic fluid): malformations of the digestive system (esophageal atresia, duodenal atresia) central nervous system anomalies (anencephaly), severe isoimmune disease, severe congenital infections, genetic syndromes (Down, Edward), congenital diaphragmatic hernia.
- Oligohydramnios (low amount of amniotic fluid): pulmonary hypoplasia with severe respiratory distress, renal abnormalities.

C. Pathology of the placenta (abruption, placenta praevia, etc.) - and umbilical cord(a nuchal cord, an umbilical cord prolapse): birth asphyxia.

D. Issues depending on membranes

- Prelabor rupture: neonatal sepsis, premature birth, birth asphyxia
- Prolonged rupture: neonatal sepsis.

3. Risk factors related to the gestational age and correlated neonatal and child pathology

A. Prematurity is the most important risk factor and it is accompanied by a host of complications (3,4,5, 9,12,13).

- Neonatal problems: hypothermia, birth asphyxia, birth trauma, respiratory distress syndrome, cardiac issues (persistent ductus arteriosus that can lead to cardiac failure), digestive problems (necrotizing enterocolitis - a severe bowel condition, gastroesophageal reflux disease (backward leak of the gastric content into the esophagus), anemia, metabolic issues: (hypoglycemia, hypocalcemia, i.e. low serum calcium, severe neonatal jaundice), brain damage, sepsis, retinopathy of prematurity, apnea spells (cessation of breathing longer than 20 seconds and brady-

cardia), growth restriction, increased death rate.

- Long term issues - respiratory disease (bronchopulmonary dysplasia, asthma), sensory impairments (visual deficits, even blindness, permanent hearing loss), neurological issues (neuromotor impairment, chronic infantile encephalopathy), psychological issues (developmental delays, autism, attention deficit, learning difficulties, speech problems, difficult social insertion, behavioral problems, anxiety, depression), cardiac problems (hypertension), growth restriction, sudden infant death syndrome, metabolic bone disease (osteopenia of prematurity), impaired thyroid function.

- Social issues: marginalization, child neglect or abandonment, and distress of the entire family- child, parents, and siblings.

B. Post-term birth (later than 42 weeks of gestation) delivery: respiratory distress (meconium aspiration syndrome).

4. Risk factors that depend upon the labor course and their effects on the newborn

- Obstructed labor, prolonged labor, precipitous labor, baby- maternal pelvis disproportion, uterine hypertonus: birth asphyxia, birth trauma, increased rate of the cesarian section, or instrumental delivery.

5. Risk factors related to the way of delivery and their impact on the infant

- Cesarean section: respiratory distress due to delayed amniotic fluid clearance, birth asphyxia, birth trauma.

- Instrumental delivery: birth trauma, birth asphyxia.

Prematurity is the foremost risk factor during the first days of life; it is the leading cause of death and disease in newborns, and it also is a major source of disability in children.

Preemies are prone to many neonatal issues, thus they need special care.

- The birth of a preemie carries a high risk of birth asphyxia and birth trauma; the infant needs an incubator and may require soon after birth respiratory support and complex care. Therefore he should be born in a well-equipped hospital with an experienced team. Up transfer exposes him to considerable risks and finding a place for him may be tricky, so the transfer of his mother before the premature birth is the right and best thing to do.

- Immaturity of the defensive barriers and mechanisms of preemies and their need for invasive procedures (ventilation, intubation, insertion of catheters, gavage feeding, and so on) calls for a strict observance of asepsia and antisepsia when caring for them. The importance of this issue cannot be overemphasized.

- The fragile premature brain has not completed its development yet; it is also exposed during a crucial stage of its growth to a host of harmful factors: lack of oxygen, pain, noise, stress, uncomfortable positioning, and isolation in the incubator. Therefore neurodevelopmental care is priceless. This way of nursing is a touch of gentleness. It prevents and treats the pain caused by invasive procedures, lowers the intensity of the stimuli (light, noises, manipulation) to minimize stress, helps the infant maintain a fetal posture by preparing him a " nest" of blankets or linen, and clusters the diagnostic, therapeutic and daily care maneuvers to minimize stress and promote rest and sleep.

- The preemie is very prone to hypothermia and its side effects, consequently keeping him warm at all times is paramount.

- Preemies often have severe conditions and undeveloped suck reflex and suck – swallow - respiration coordination thereupon enteral feedings may be delayed. Priming of the digestive tube (very small aliquots of milk given by gavage) should be started as soon as possible. Low birth weight preemies cannot tolerate breastfeeding, so they need gavage or spoon-feeding.

- Getting parents involved as soon as possible in the care of their premature child is extremely helpful, useful, and beneficial both for them and for the infant.

- Before their discharge from the hospital preemies, particularly the neonatal intensive care graduates, should undergo beside the usual newborn screening tests (the inborn metabolic diseases tests, hearing screen, and pulse oximetry test for critical congenital heart disease) one or more eye screenings for retinopathy of prematurity and one or more head ultrasounds.

- Follow up is an essential part of the management of preemie ward and neonatal intensive care graduates. It needs to assess the overall growth, head growth, respiratory function, feeding, thyroid function, bone formation (markers as serum calcium, phosphate, alkaline phosphatase, serum vitamin D3, bone radiographs), motor development, cognitive development, speech, behavior, psychological development, social insertion, hearing, sight, blood pressure, quality of life, and also the way the family copes. It takes a whole team to complete this follow up: pediatricians, neurologists, psychiatrists, ophtalmologists, ENT specialists, psychologists, speech therapists, kineto therapists, nurses, social workers, teachers.

- Vaccines should be offered to preemies according to their chronological age; the BCG vaccine is to be scheduled for the moment the baby weighs 2500 grams.

Former preemies, particularly those with respiratory problems, need prophylaxis against the respiratory syncytial virus infection during the cold season.

Quite oftentimes premature birth occurs after an uneventful pregnancy, yet there are some preventable causes of prematurity. Knowing and addressing them before and/or during the actual pregnancy can ease the burden of this painful health and social issue. These sources belong to many major areas, so it takes a multidisciplinary approach to have consistent results: local administrations, policymakers, lawmakers, community leaders, majors, healthcare administrators, healthcare team (general practitioners, obstetricians, nurses, midwives), teachers, social workers, media.

1. Lifestyle of the mother-to-be: low social status, lack of tuition, poverty, unbalanced diet, alcohol or/and drugs consumption, smoking, lack of access to proper medical care, poor nutritional status or overweight, many pregnancies, a short time between births, elective abortion, and extreme ages- too young (under 20) or too old (over 35).

2. Chronic conditions of the expectant mother: heart diseases, hypertension, diabetes mellitus.

3. Uterine issues of the mother-to-be: malformations, previous surgery, abortions.

4. Infectious illnesses during pregnancy: urinary tract infections, vaginitis, toxoplasmosis, syphilis, listeriosis, brucellosis, genital herpes, cytomegalic disease.

5. Diseases related to the actual pregnancy: pathology of the placenta (abruption, placenta praevia), preeclampsia (high blood pressure, significant amount of protein in urine, edema, kidney and liver damage, and low platelet count) gestational diabetes, urinary tract infections, and vaginitis.

6. Issues related to the healthcare system: assisted reproductive technologies, elective cesarean section scheduled before 39 weeks gestation.

Many thorny ethical issues arise when caring for premature infants, particularly the tiniest ones [13,14]. Difficulties start in the delivery room: the extent and duration of the resuscitation of the infant. They go on in the neonatal intensive unit: how far to go? For how long? How aggressive can we be? How can the quality of the life of these tiny infants be improved? How will their future life look like? When and how to switch to palliative care?.

Follow up of former preemies arises new issues: the accessibility of the complex support they need after the discharge from the hospital and how their family affords it. Not to mention the resources available for the tiniest humans are all too limited.

Parents have their say, and their resolutions have to be respected. However, these decisions should observe the baby's best interest and be made based on open communication with the medical team and thoroughly understandable, reliable data, as complete as they can be. Healthcare administrators ought to ensure to all infants at risk adequate access to appropriate care, as well as suitable work conditions and ambient for the medical staff caring for premature babies - that would ease the way all of them face daily a host of painful dilemmas.

Delivery Room Care of the Newborn

The first step into a new world matters so much to the future of each baby.

Most births are uneventful, yet there are some issues to check and get ready for use on all occasions.

- Warm, draught-free delivery room with closed windows and doors.
- Working overhead warmer far from windows, doors, or walls.
- Sterile, warm linen.
- Suction devices.
- Warm, humidified oxygen supply.
- Ventilation bag and mask of appropriate size - preemies need smaller sizes than full-term babies.
- Endotracheal uncuffed tube of adequate size.
- Laryngoscope with a straight blade of suitable size.
- Sterile scissors.
- Betadine.
- Vitamin K1 vials.
- Sterile umbilical cord clamps.
- 1% Adrenaline vials.
- Normal saline vials.

Delivery room care is meant to gently and harmlessly assist the transition of the baby to his new world. All maneuvers must be performed gently and promptly, observing the thermal comfort of the baby at all times.

- Place the baby slightly lower than his mother.
- Delay umbilical cord clamping for at least one minute.
- Place the baby under a working overhead warmer.
- Wipe him, discard the wet linen and replace it with a warm one.
- Give preemies and low birth babies a warm cap.
- Wrap preemies and low birth babies in a plastic bag.
- Section and clamp the umbilical cord and apply some betadine to the stump.
- Observe the baby: skin color, breathing effort, tone, and reactivity.
- Clear his airway, if needed- first the mouth and then the nose; do not pass the suction tube to his pharynx during the first two minutes of life- there is a risk of apnea (respiratory arrest) and bradycardia (low heart rate) due to a vagal reflex!
- Evaluate the Apgar score at 1, 5, and, if needed, at 10 and 15 minutes of life.

Criteria	Apgar 0	Apgar 1	Apgar 2
Appearance (skin color)	Blue or pale all over	Acrocyanosis- blue at extremities, pink body	No cyanosis, pink all over
Pulse rate	Absent	Under 100 bpm	Over 100 bpm
Reflex irritability grimace	No response to stimulation	Grimace on suction or aggressive stimulation	Cry on stimulation
Activity	None	Some flexion	Flexed arms and legs that resist extension
Respiratory effort	Absent	Weak, irregular, gasping	Strong, robust

Figure 1: Acrocyanosis (www.SlideShare.net)

Perform resuscitation of the newborn, if needed- evaluation of the Apgar score at 1 minute after birth must not be awaited!

- Carry out a quick complete evaluation of the baby, assess his gestational age, and spot certain congenital malformations. Some of them require emergency surgery.
- Omphalocele (exomphalos): protrusion of abdominal organs into the umbilical cord base.
- Gastroschisis: abdominal wall defect with herniation of the intestines through the umbilical ring (the umbilical cord is normal).
- Esophageal atresia: abundant oral secretions, choking, and respiratory distress at feedings; a feeding tube inserted into baby's mouth cannot pass down into his stomach- it stops after a few centimeters.
- Anal atresia: absent anus or impossible passage of a feeding tube into the rectum.
- Choanal atresia: cyanosis and dyspnea that are relieved when the baby begins to cry, failure to introduce a feeding tube through both nostrils into the throat.
- Congenital diaphragmatic hernia: diaphragm defect that allows abdominal organs (stomach, liver, colon) to herniate into the chest; this displaces the heart and impairs lung development. Life-threatening respiratory distress starts at birth, with rapidly increasing severity, scaphoid abdomen, absent unilateral breath sounds, replaced by bowel sounds; apex beat and heart sounds are displaced to the right.
- Congenital defects of the spine and skull: spina bifida, meningocele, encephalocele.
- Ambiguous genitalia call for further investigations: karyotype, serum electrolytes, blood urea nitrogen, creatinine, 17 hydroxyprogesterone and testosterone, abdomen, and pelvis ultrasound, and maybe magnetic resonance imaging too.

Other congenital malformations are apparent from birth but do not need immediate correction.

Figure 2: Central Cyanosis (www.SlideShare.net)

- Congenital hydrocephalus: enlarged fontanelles, enlarged head circumference, separated cranial sutures.
- Hip dysplasia.
- Cleft lip.
- Cleft palate.
- Polydactyly: supernumerary fingers and/ or toes.
- Syndactyly- two or more fingers or toes are fused.
- Clubfoot and other birth defects of the feet.
- Congenital limb defects.
- Weigh the baby, measure his length, head circumference, and chest circumference.
- Assess the gestational age of the baby.
- Perform a birth weight- gestational age classification of the baby as appropriate for gestational age, small for gestational age, or large for gestational age.
- Pay attention to the first voiding of the baby in the delivery room- if any.
- Prepare identification bracelets for the baby and his mother and the identification card of the baby.
- Allow the infant and his mother to enjoy skin-to-skin contact. During the first golden hour of life, the newborn is very alert and able to start building a relationship with his mother; when the baby is placed on his mother's tummy he will eventually crawl toward the maternal breast and try to latch onto it.
- Administer intramuscular K1 vitamin to the baby to prevent the hemorrhagic disease of the newborn.
- Get the neonate dressed and hand him to his mother for his first nursing session– if their condition allows that.

Figure 3: Omphalocele (www.Surgery4children.com/diagnoses-and-treatment)

Figure 4: Gastroschizis (www.medicalfoxx.com)

Figure 5: Myelomeningocele (www.emedicine-medscape.com)

Figure 6: Encephalocele (www.ruralneuropractice.net)

Figure 7: Encephalocele (www.dermatologyadvisor.net)

Figure 8: Encephalocele (www.ispn.guide)

Figure 9: Encephalocele (www.en.wikipedia.org)

Figure 10: Encephalocele (www.medicaldictionary.com)

Figure 11: Encephalocele (www.NaturalHealthNews.com)

Birth Asphyxia

Peripartum hypoxia is one of the leading causes of neonatal mortality and morbidity; it also has long term effects, particularly on the brain, the most vulnerable organ if oxygen lacks.

Risk factors

- Maternal issues: hypertension, diabetes mellitus, eclampsia, cardiac conditions, anesthetic drugs during labor.
- Multiple pregnancies - the risk of the second twin is higher.
- Abnormal presentation of the fetus: breech, front, brow, shoulder.
- Abnormal labor: uterine hypertonus, dystocic labor, cephalopelvic disproportion, prolonged labor, precipitous labor, obstructed labor.
- Pathology of the umbilical cord and placenta: placenta praevia, placental abruption, umbilical cord prolapse, nuchal cord.
- Fetal issues: Prematurity, intrauterine growth restriction, congenital heart defects, congenital diaphragmatic hernia, malformations of the lungs, maternal-fetal infections, Rh isoimmune disease.

Both the duration and severity of hypoxia are important.

Management [1,3,4,5,9,12].

Anticipation is the key. Skilled staff and adequate equipment ought to be available for every birth, particularly for the high -risk ones.

Resuscitation maneuvers have to be gentle and prompt. Apgar score at one minute must not be awaited!

- Place the newborn on a working warming table, far from draughts, windows, and walls, his head slightly extended, in a "sniffing" position, with a roll under his shoulders.

Figure 12: Head position for neonatal resuscitation (Neonatal Resuscitation Programme. NRP,SlideShare.nrt)

- Gently dry him and replace the wet linen with a warm, dry one.
- Give preemies and low birth babies a warm cap.
- Attach a pulse oximetry sensor to his right hand.
- Wrap preemies and low birth babies in a plastic bag.
- Clear the mouth and nose of the newborn- mouth first. If

the amniotic fluid is stained and the infant is not breathing spontaneously clear his airway using a laryngoscope with an adequate blade; this must be done before starting the stimulation of the infant.

- Observe the baby: skin color, breathing effort. The best place for the one performing resuscitation is at the baby's head or his right.

  An extensive resuscitation requires more than one expert pair of hands, so call for help.

- If the baby is cyanotic but his respiratory effort is present and his breathing is not labored assess his heart rate for 6 seconds and multiply it by 10; if this is over 100 beats per minute gently rub the infant's back and soles of his feet and give blow- by heated humidified oxygen.

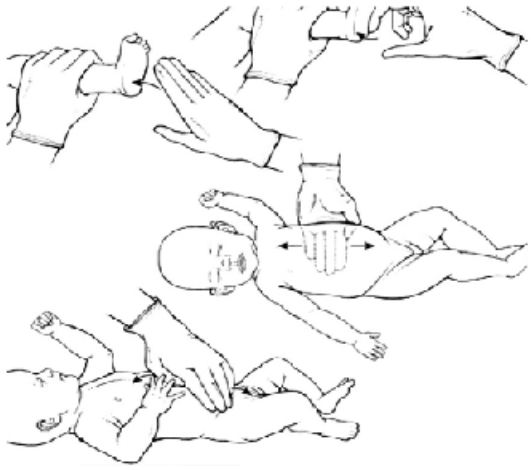


Figure 13: Tactile Stimulation during newborn resuscitation (American Acadamy of Pediatrics)

- If the child's heart rate is below 100 beats per minute begin bag and mask ventilation. The mask must be of appropriate size -it should cover the chin and nose and leave the eyes untouched. Assessment of ventilation is to be made by follow-up of the symmetry and amplitude of chest and abdomen, skin color, and heart rate. The bag has to be handled gently, using the fingertips, not the palm, to avoid the risk of pneumothorax.

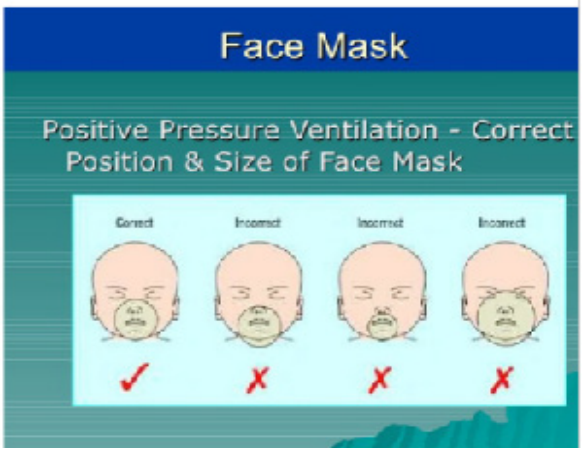


Figure 14: Bag and mask ventilation - correct size and position of the face mask (www.SlideShare.net)

In full-term newborns bag and mask ventilation is to be started with room air and continued afterward with oxygen in rising percentage. In premature babies, resuscitation may be started with 30% oxygen and the oxygen concentration may be increased if needed. Resuscitation of preemies in the delivery room is best performed using a T piece resuscitator that provides both oxygen concentration control and continuous positive airway pressure (CPAP) that prevents the end respiratory collapse of the alveoli.

- Reassess the respiratory effort, skin color, and heart rate of the baby after 30 seconds of ventilation. If he begins to breathe spontaneously and efficiently stop ventilation and give him blow-by oxygen.

- If the baby does not breathe spontaneously and his heart rate rises continue the ventilation.

- If the baby's heart rate stays low or becomes slower another member of the team has to start chest compression. Two methods may be used.

I Both hands encircle the newborn's chest, both thumbs side by side or overlapping on the lower sternum, between the nipples.

II Tips of two fingers (middle finger and index) on the lower sternum and the other hand supporting the back.

The depth of compressions should be approximately 1,5- 2 cm.

A compression- ventilation rate of 3:1 is recommended.

Tips of the fingers must remain on the sternum; allow complete chest recoil after each compression.

Do not interrupt chest compressions for more than a few seconds, during endotracheal intubation.

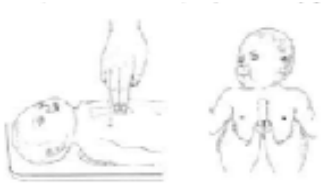


Figure 15: Chest compressions techniques (www.ijaweb.org)

- Reassess the baby's respiratory effort, color and heart rate after 30 seconds of ventilation and chest compressions. If his heart rate is above 100 beats per minute stop chest compressions and go on with the bag and mask ventilation. If the baby begins to breathe spontaneously stop ventilation and give blow-by oxygen.

- If ventilation is needed for more than 2 minutes a tube should be passed into the baby's stomach to avoid stomach distension that may compromise ventilation by pushing the diaphragm upwards.

- If bag and mask ventilation is ineffective, despite an appropriate technique, in newborns that require prolonged resuscitation and in children with suspected congenital diaphragmatic hernia endotracheal intubation is warranted. A laryngoscope with a straight blade (appropriate for the baby's birth weight) and an uncuffed endotracheal tube of adequate size are used. Each attempt to intubate the newborn should be limited to some seconds and before it, the baby should be stabilized by bag and mask ventilation.

Endotracheal tube placement is assessed clinically and by paraclinical means. Auscultation of the epigastrium and both sides of the chest ascertains the air passes to both lungs and not to the stomach if noises are heard symmetrically in the axillae but not in the epigastrium. Observation of the amplitude and symmetry of chest movements and their synchrony with ventilation assesses both the tube placement and the efficacy of ventilation. Fogging of the tube is helpful. A carbon dioxide detector attached to the endotracheal tube confirms proper tube placement by changing its color. Chest X-ray is also used to verify tube placement.

- If the baby is still apneic and his heart rate does not increase go on with the ventilation and chest compressions and give him intravenous or endotracheal 0,1% Adrenaline. A second dose can be repeated after at least 5-7 minutes; a maximum of 3 doses can be given.
- In deliveries with important maternal bleeding newborns with a poor response to resuscitation, persistent pallor despite oxygenation, weak pulse but adequate heart rate and capillary refill time above 3 seconds may benefit from intravenous volume-expanders: a slow push of normal saline.
- Infants who are sleepy, hypotonic, with poor respiratory drive and poor reactivity due to anesthetic or analgesic drugs their mother received during labor may need intravenous Naloxone.
- Preemies with a very low gestational age benefit from a dose of intravenous caffeine very soon after birth.
- Oxygen should be used in the lowest efficient concentration and for the shortest possible time span, particularly in premature infants.
- Strict observance of asepsia and antisepsia at all times is paramount.
- Resuscitation is a tense circumstance where every second is vital. It is meant to save the life of the frail baby and it uses flammable, explosive oxygen and drugs with high-risk side effects (adrenalin); that's why adequate safety measures must be established and observed to protect both the baby and the healthcare team members.

What may cause the failure of resuscitation maneuvers?

- Airway obstruction: head hyperflexion, airway malformations, mucus or meconium blocking the airways, inadequate size or placement of the ventilation mask, improper size or placement of the endotracheal tube.
- Technical failures of the equipment, heating system, suction system, oxygen supply.
- Diseases of the newborn: congenital heart and respiratory system malformations, maternal-fetal infections.
- Communication mistakes and panic of the health professionals. Smooth, understandable, concise, efficient, and prompt communication is crucial to the success of resuscitation. Synchrony of the medical team is also fundamental. Everyone caring for the baby in the delivery room must know and observe his role, duty, and place. Composure is an absolute must for all of them.

Cardiopulmonary resuscitation should be limited to a maximum of 30 minutes; lack of response within this time frame is associated with minimal odds of spontaneous breathing and efficient circulation in the baby and carries an extremely high risk of very severe neurological impairment.

To decrease the odds of neonatal encephalopathy whole-body cooling may work for full-term babies - when started within the first hours of life for best results.

When to withhold neonatal resuscitation?

- Malformations with no chances of survival: anencephaly, complex congenital anomalies.
- Extreme prematurity- gestational age under 24 weeks and birth weight less than 500 grams.

Monitoring of the baby with birth asphyxia:

1. Temperature - these babies are prone to hypothermia.

2. Respiratory function:

- Clinical assessment: respiratory effort, respiratory drive, respiratory rate, skin color, signs of respiratory distress (nasal flaring, expiratory grunt, intercostal and/ or subcostal retractions, xyphoid retraction, respiratory lag, seesaw respiration), tachypnea (fast breathing), shallow breathing, irregular breathing, increased work of breathing.
- Evaluation by paraclinical means
- Blood gas analyses- pH, pO2 (partial pressure of oxygen), pCO2 (partial pressure of CO2), base excess.
- Pulse oximetry – assesses the peripheral oxygen saturation and heart rate. It is helpful, non-invasive, and convenient when it comes to judging the seriousness of the baby's condition and guiding the oxygen therapy. It also has the advantage of displaying results continuously; these results must be corroborated with the results of the blood gas analyses. Swelling of the sensor placement area, peripheral circulation compromise in shock, and child movements may distort the pulse oximeter readings.
- Chest X-ray

3. Circulation

- Evaluation by physical exam:
- Weight
- Urine output (this should be at least 1ml/ kg/ hour)
- Blood pressure
- Skin color
- Capillary refill time (apply fingertip pressure on the sternum for 5 seconds, remove the pressure and note the time needed for the color to return; this should be under 3 seconds; it is prolonged in shock).
- Evaluation by paraclinical means:
- Pulse oximetry
- Blood gas analyses

4. Neurologic status

- Clinical assessment:

- Consciousness
- Fussiness
- Consolability
- Sleep-wake cycle
- Reactivity
- Presence of seizures: tonic, clonic, myoclonic, tonic-clonic, or subtle: nystagmus, grimaces, sucking, yawning, singultus (hiccups).
- Evaluation by paraclinical means:
- Head ultrasound
- Near-infrared spectroscopy (non-invasive monitoring of brain oxygenation)
- Amplitude-integrated electroencephalography, electroencephalography.

5. Kidney function

- Clinical evaluation: weight, urine output.
- Paraclinical evaluation: blood urea nitrogen and creatinine.

6. Metabolism assessment: blood sugar, serum calcium, serum bilirubin.

Complications of birth asphyxia [3,4,5,9,12]:

1- Death

2- Neurological conditions

A- Short term disorders: neonatal encephalopathy– irritability, seizures, coma, apnea spells (cessation of breathing longer than 20 seconds and bradycardia). Babies require oxygen therapy, sometimes by CPAP (continuous positive airway pressure) devices or non-invasive or invasive ventilation. They also need seizure control with intravenous Phenobarbital or Diazepam- these two drugs should never be given simultaneously, due to the risk of apnea (respiratory arrest)!

B- Long term disorders:

- Cerebral palsies
- Seizures
- Developmental impairment
- Chronic infantile encephalopathy
- Sensory impairment vision deficits, even blindness, permanent hearing loss.

3 - Heart failure manifests as absent or little weight loss during the first 3 days of life, cyanosis, low blood pressure, respiratory distress. This condition requires oxygen therapy, fluid intake restriction, intravenous Furosemide, intravenous inotropic agents (Dopamine, Dobutamine) in continuous infusion on a separate intravenous line.

4 - Respiratory distress: grunting, intercostal or subcostal recessions, tachypnea (fast respiratory rate), increased work of breathing, cyanosis, low peripheral saturation of oxygen in pulse-oximeter readings, abnormal blood gas analyses: low pO2 (partial pressure of oxygen) and high pCO2 (partial pressure of CO2). This severe condition may require respiratory support: CPAP (continuous positive airway pressure) or non-invasive/invasive ventilation.

5- Renal failure: low urine output, edema, abnormal weight gain, and elevated blood urea nitrogen and creatinine; fluid restriction is required as well as intravenous Furosemide.

6- Hypoglycemia (low blood sugar): the baby may be asymptomatic or jittery, irritable, hypotonic (with increased muscle tone) or hypertonic, and may have seizures. Blood sugar level must be brought to normal by intravenous 10% dextrose bolus or continuous infusion.

7- Hypocalcemia (low serum calcium): hypotonia (low muscle tone) or hypertonia (increased muscle tone) and seizures occur; 10% calcium gluconate given very slowly intravenously under heart rate continuous monitoring is required.8- Prolonged, intense neonatal jaundice that may require phototherapy.

Outcome of birth asphyxia:

- Short-term outcome bears the impact of a high death rate, particularly in preemies.
- Long-term prognosis depends upon the risk of neurological or/and sensory impairment. Disclosing the baby's long-term outcome with caution and common sense matters very much to the child- parents relationship and bond, as the first days of the baby’s life are very sensitive and important for the foundation and development of these crucial features of family life.

Appendix

Cardiorespiratory and respiratory arrest outside the delivery room

Cardiorespiratory or respiratory arrests also occur in the intensive care unit. Forewarning signs may herald these emergencies: bradycardia (low heart rate), shallow breathing, repeat apnea spells (cessation of breathing longer than 20 seconds and bradycardia), decreased expiratory effort.

This emergency must be managed as a delivery room resuscitation.

Risk factors for cardiorespiratory and respiratory arrest:

- Respiratory distress syndrome
- Very low gestational age
- Apnea spells (cessation of breathing longer than 20 seconds and bradycardia) (over 20 seconds) accompanied by bradycardia (heart rate above 80/minute); preemies are prone to this problem
- Neonatal sepsis
- Malformations: Pierre- Robin sequence (a small lower jaw with a risk of asphyxia due to tongue ptosis, i.e. swallowing of the tongue), congenital heart defects, lung malformations
- Severe neonatal encephalopathy with marked hypotonia, coma, seizures
- Need for respiratory support- invasive/ noninvasive ventilation or CPAP (continuous positive airway pressure) with baby's spontaneous breathing. The risk is higher in too fast weaning off the respiratory support and after the

weaning.

- Need for surgery
- Need for invasive maneuvers: intubation, venous or arterial catheter placement, pneumothorax drainage, exchange transfusion (partial replacement of baby's blood with adequate donor blood)
- Stress caused by noise, pain, excessive manipulation, succussions, bright light
- Hypothermia: preemies and asphyxiated infants are very prone and sensitive to this issue
- Gavage feeding
- Birth asphyxia
- Hypoglycemia occurring in preemies, asphyxiated infants, inborn errors of metabolism
- Hypocalcemia (low serum calcium) appearing in preemies and asphyxiated babies
- Gastroesophageal reflux (backward leak of the gastric content into the esophagus).

Respiratory distress syndrome

This condition is the inability to sustain efficient gas exchanges. It accounts for a large part of neonatal mortality and morbidity.

Causes

1. Lung diseases:

- Surfactant deficiency in premature babies
- Meconium aspiration syndrome
- Neonatal pneumonia
- Lung malformations
- Delayed fetal lung fluid clearance.

2. Heart conditions: congenital heart defects: hypoplastic left heart syndrome, neonatal tetralogy of Fallot, transposition of the great vessels, patent ductus arteriosus, complex heart defects, and neonatal coarctation of the aorta.

3. Persistent pulmonary hypertension of the newborn: blood pressure in the lung circulation does not lower after birth. Risk factors for this condition are meconium aspiration syndrome, congenital heart defects, lung illnesses, and congenital diaphragmatic hernia.

4. Birth asphyxia.

5. Neonatal encephalopathy.

6. Congenital diaphragmatic hernia.

7. Choanal atresia.

Risk factors for respiratory distress syndrome:

- Prematurity
- Birth asphyxia
- Intrauterine growth restriction
- Fetal distress- meconium-stained amniotic fluid
- Maternal-fetal infections
- Prelabor (premature prolonged) rupture of membranes
- Birth by cesarian section
- Maternal diabetes mellitus.

Clinical presentation [1,3,4,5,9,12].

The earlier the disease onset the greater its seriousness.

The peak of the severity of this illness is reached at days 3- 5 days of life.

1. Respiratory signs:

- Subcostal and/or intercostal retractions
- Nasal flaring
- Expiratory grunting, be it spontaneous or triggered by baby handling
- Increased work of breathing
- Seesaw respiration
- Tachypnea (fast breathing)
- Irregular breathing.

Silverman score is used in the clinical assessment of the severity of respiratory distress syndrome.

Feature	Score 0	Score 1	Score 2
Chest movement	Equal	Respiratory lag	Seesaw respiration
Intercostal retraction	None	Minimal	Marked
Xyphoid retraction	None	Minimal	Marked
Nasal flaring	None	Minimal	Marked
Expiratory grunting	None	Audible with stethoscope	Audible

2. Cyanosis, pallor, edema; mottled skin, and sclerema (firm, indurated, waxy skin lesions) occur in shock.

3. Cardiovascular signs: tachycardia (rapid heart rate), bradycardia (slow heart rate – in severe respiratory distress), hypotension (low blood pressure), and prolonged capillary refill time.

4. Neurological symptoms: irritability and lethargy, poor reactivity, seizures in critical respiratory distress.

5. Tendency to hypothermia.

6. Low urine output in severe forms of respiratory distress.

Paraclinical findings [1,3,4,5,9,12].

1. Chest X-ray

A. It can offer clues to the underlying cause of the respiratory distress syndrome.

- In surfactant deficiency, there are diffuse ground glass lungs and air bronchogram.
- In congenital diaphragmatic hernia there are intestinal loops inside the chest cavity, small lungs, heart, and mediastinum shift to the left, interrupted diaphragm dome.
- Some congenital heart defects have specific findings: global heart enlargement in the hypoplastic left heart syndrome, or egg-shaped heart lying on the diaphragm in the neonatal Fallot disease.
- Patchy or confluent opacities in neonatal pneumonia.

B. Chest X-ray also spots some complications of the respiratory distress syndrome: air leaks- pneumothorax (presence of air between the lungs and the chest wall) or pneumomediastinum (presence of air in the mediastinum, the central area, or the chest), and also pneumonia.

C. Chest X-ray is helpful to assess the severity of the surfactant deficiency.

D. In babies with mechanical ventilation chest X-ray is useful for assessing the endotracheal tube placement.

2. Blood gas analyses show low pO2 (partial pressure of oxygen- hypoxemia) and high pCO2 (partial pressure of CO2- hypercarbia); low pH (acidosis) is present in severely ill babies. They are crucial for assessing the seriousness of respiratory distress syndrome and guiding oxygen therapy. They are also essential to the choice and adjustment of the respiratory support strategy.

3. Pulse oximetry is the continuous monitoring of the peripheral oxygen saturation and heart rate. It is useful for judging the seriousness of the disease and monitoring oxygen therapy. It is noninvasive and convenient; it gives continuous readings that may be distorted by the swelling of the sensor placement area, impaired peripheral circulation in shock, and baby movements. Pulse oximeter readings must be corroborated with the results of the blood gas analyses.

To prevent oxygen toxicity in premature infants pulse oximeter alarms should be set at 92%- 96% (high limit) and 85% (low limit).

4. Complete blood count- anemia or polycythemia (high red blood cell count) may cause respiratory distress; both may increase the seriousness of the respiratory distress syndrome.

5. Transfontanellar ultrasounds are mandatory as they can observe an intraventricular hemorrhage, a serious complication of the respiratory distress syndrome.

6. Cardiac ultrasound pinpoints congenital heart defects causing respiratory distress and spots some complications of this disease: patent ductus arteriosus and heart failure.

Complications of respiratory distress syndrome [3,4,5,9,12].

A. Short term issues

1. Apnea spells (cessation of breathing longer than 20 seconds and bradycardia)

2. Shock

3. Lung conditions: hemorrhage, pneumonia, pulmonary hypertension

4. Heart conditions: heart failure, patent ductus arteriosus

5. Brain damage: neonatal encephalopathy, intraventricular hemorrhage

6. Kidney failure

7. Prolonged, severe neonatal jaundice

8. Hypoglycemia – low blood sugar

9. Issues related to ventilation:

- Air leaks: pneumothorax (presence of air between the lung and the chest wall), pneumomediastinum (presence of air in the mediastinum, the center of the thoracic cavity), pneumopericardium (presence of air in the pericardium covering the heart)
- Ventilator acquired pneumonia.

B. Long term consequences of respiratory distress syndrome

- Neuromotor impairment: cerebral palsy, developmental delays, chronic infantile encephalopathy.
- Bronchopulmonary dysplasia: babies wheeze, need oxygen long after their due date, have feeding difficulties, and a slow rate of growth. Infants requiring mechanical ventilation are at greater risk.
- Retinopathy of prematurity, caused by the long-term action of high oxygen levels on the vessels of the retina; this may lead to vision deficits, even blindness.
- Permanent hearing loss.

Management of the respiratory distress syndrome [1,3,4,5,9,12].

A. Prophylaxis

- Prevention of premature labor: mothers-to-be should avoid physical overexertion and physical as well as psychological trauma; elective cesarian section before 38 weeks of gestation is a no-no. Bed rest and tocolytic agents are helpful. Appropriate assessment of fetal gestational age is paramount.
- Prevention of maternal-fetal infections: an adequate cure of maternal infections, antibiotherapy in pregnant women with prolonged premature rupture of membranes.
- Dexamethasone given to mothers at risk of premature labor at least 24 hours before delivery enhances fetal lung maturation.
- Prompt, adequate neonatal resuscitation.
- Prevention of meconium aspiration syndrome in babies with fetal distress: Clear baby's airway right after the birth of his head and if he does not breathe spontaneously suction his trachea by laryngoscope blade before wiping him and starting ventilation.

B. Therapy of the respiratory distress syndrome

1. Maintaining the thermal comfort of the baby and keeping

his heat loss to a minimum are vital.

2. Reduce the stress level as much as possible: gentle, minimal handling, dim the light, lower the noise and cluster the daily care, diagnostic and therapeutic maneuvers to allow the newborn to rest and recover. Sick babies do not agree anyway with stress and hypothermia: they become cyanotic, their oxygen saturation decreases, apnea spells (cessation of breathing longer than 20 seconds and bradycardia) occur, and their condition worsens.

3. Maintain adequate gas exchanges

A . Oxygen therapy

Its duration should be limited to a minimum as there is an increased risk of retinopathy of prematurity and bronchopulmonary dysplasia.

To reduce these hazards use the lowest inspired oxygen percentage able to maintain a good clinical evolution, as well as adequate blood gas values and pulse oximetry readings. Pulse oximeter alarms should be set at 92% and 96%, especially in preemies.

Oxygen received by babies must be humidified and heated.

- The first step of oxygen therapy is an oxygen source close to the infant's face in the incubator, followed by oxygen by headbox.
- If the clinical symptoms are not too marked, the pO2 (partial pressure of oxygen) of the blood gas analyses and the oxygen saturation readings of the pulse oximeter are low CPAP – continuous positive airway pressure by nasal prongs or nasal mask- needs to be started. It prevents end-expiratory alveolar collapse and sustains spontaneous breathing; the earlier the CPAP initiation the better its results.
- If CPAP does not work, the clinical findings are severe, pO2 is very low, pCO2 (partial pressure of CO2) is high, apnea spells (cessation of breathing longer than 20 seconds and bradycardia) occur on CPAP, then non-invasive nasal ventilation should be started.

If this type of ventilation does not work invasive ventilation is necessary; conventional ventilation is the first choice and high-frequency ventilation is used in babies failing conventional ventilation.

Efforts should be made to avoid intubation and ventilation because of their side effects and the difficulty of weaning the baby off the ventilator.

If ventilation is required it should be as gentle as possible, synchronized with the newborn's breaths. The lowest efficient parameters should be used. The length of ventilation has to be kept to a minimum to prevent the complications related to it.

Neurally adjusted ventilatory assist (NAVA) uses the electrical activity of the diaphragm (measured by an intraesophageal electrode) to adjust ventilation parameters to the baby's respiratory effort.

Figure 16: A ventilated premature baby (wwww.re.rejournal.com)

Figure 17: CPAP device (wwww.device.com.au/shop)

Once the infant's condition and gas exchanges improve ventilator weaning can be started by gradually lowering the ventilator settings and subsequently replacing invasive ventilation with non-invasive ventilation; ventilation is later on followed by CPAP and afterward by oxygen by headbox. Adjustments of FiO2 (the percentage of oxygen the infant breathes), both increments and decrements, call for clinical monitoring (skin color, respiratory symptoms, respiratory rate, heart rate, capillary refill time) and also for paraclinical monitoring- blood gas analyses and pulse oxymetry. Changes in Fi O2 must be stepwise, in 5% - 10% steps.

The sudden collapse of a ventilated newborn may be caused by:

- Technical failures of the ventilator or oxygen supply
- A dislodged or clogged endotracheal tube
- A pneumothorax
- An intraventricular hemorrhage
- Infections.

The first thing to do to stabilize the baby if a sudden worsening occurs is to check the endotracheal tube position and patency: watch the chest movements and listen to the lung sounds. If the chest movements and lung sounds are heard symmetrically on both sides clear the endotracheal tube and baby's mouth

and pharynx. If the endotracheal tube is clogged (baby's chest does not move adequately, lung sounds are inaudible, and the suction tube can pass only for a short distance when trying to clear the endotracheal tube) remove it, start bag and mask ventilation to stabilize the newborn and reintubate him.

Babies with particularly severe respiratory distress may require ECMO (extracorporeal membrane oxygenation), a therapy that provides heart and lung support outside the body, using a pump to circulate the blood through an artificial lung back into the infant's bloodstream. ECMO is not adequate for very low birth weight and very low gestational age neonates; intracerebral hemorrhages are also contraindications to ECMO. Children on ECMO need anticoagulation (unfractionated heparin is the standard medication) so their risk of bleeding or thrombosis is high.

Complications of oxygen therapy and ventilation:

- Retinopathy of prematurity
- Bronchopulmonary dysplasia
- Air leaks: pneumothorax, pneumomediastinum
- Infections: pneumonia, sepsis.

Monitoring of the oxygen therapy

1. Clinical assessment

- Skin color
- Respiratory symptoms
- Heart rate
- Respiratory rate

- Capillary refill time: apply fingertip pressure on the sternum for 5 seconds, remove the pressure and note the time needed for the color to return; this should be under 3 seconds; it is prolonged in shock.

2. Evaluation by paraclinical means

- Blood gas analyses: pH, pO2, pCO2.
- Pulse oxymetry; to reduce the risks of oxygen therapy peripheral saturation readings ought to be kept between 92% and 96%, particularly in preemies
- Near-infrared spectroscopy: non-invasive assessment of brain oxygenation.

B. Surfactant is required to complete oxygen therapy and respiratory support in premature babies with a low gestational age.

C. Premature babies require intravenous caffeine given in slow intravenous push; the first dose must be administered as soon as possible after birth.

D. Management of apnea spells:

- Tactile stimulation
- Intravenous caffeine
- Oxygen therapy- blow-by oxygen or bag and mask ventilation
- Respiratory support- CPAP or non-invasive/ invasive ventilation.

3. Maintain adequate circulation by

- Fluid intake restriction
- Inotropic agents: Dopamine or Dobutamine on a separate intravenous line.

4. Nutritional support

Oral feedings may not be feasible and may pose certain risks during the first days of life of unstable infants requiring respiratory support, be it CPAP or mechanical ventilation, and/or inotropic agents. However, nutrition is crucial for these infants. Parenteral nutrition has to be started from the first day of life with intravenous 10% dextrose, 10% amino acids, and 10% calcium gluconate. 5,85% NaCl is added later, on day 3 of life, and also 7, 45% KCl if the child's urine output is normal. Intravenous lipids are also added on a separate line if there are no contraindications (jaundice, thrombocytopenia, severe respiratory distress, sepsis) and the newborn is stable.

Parenteral nutrition monitoring

A. Clinical assessment:

- Weight
- Urine output
- Length
- Head circumference

B. Evaluation by paraclinical means:

- Blood sugar
- Blood urea nitrogen, creatinine, electrolytes, proteins, bilirubin, ALAT, ASAT
- Complete blood count.

Once the baby’s condition improves and he is weaned from ventilation oral feedings with his own mother's milk can be gradually started, initially by gavage. Later, as the infant becomes more and more able to put up with effort gavage is replaced by spoon-feeding and afterward by breastfeeding.

The importance of breast milk for the sick premature newborn is outstanding, therefore the imperious need to support his mother’s lactation during the parenteral nutrition of her child is obvious. Oral feedings of the neonate should be started as soon as possible.

5. Support the renal function by

- Adequate fluid intake
- Intravenous Furosemide.

6. Prevent and treat the pain caused by invasive procedures by:

- Non-pharmacologic means: sucrose, pacifiers, facilitated tuck, positioning, caressing the baby, and talking or singing to him
- Analgesics.

7. Reduce the intensity of the stimuli- light, noises, smells, manipulation.

8. Cluster the diagnostic, therapeutic, and daily care maneuvers to minimize stress and promote rest and sleep.

9. Help the infant maintain a fetal posture by preparing him a " nest" of blankets or linen.

Outcome

The short-term outcome is affected by a high death rate.

The long-term outcome depends upon the risk of long term complications:

- Neurological impairment
- Developmental delays
- Cognitive difficulties
- Seizures
- Autism
- Psychological issues
- Sensory deficits (permanent hearing loss, vision deficits, even blindness)
- Chronic lung conditions (bronchopulmonary dysplasia).

Follow- up of children with respiratory distress syndrome

- Clinical assessment of neuromotor and psychological development, sight, hearing, and growth.
- Evaluation by paraclinical means:
- Transfontanellar ultrasounds
- Screening for retinopathy of prematurity
- Screening for hearing loss.

Children who survived the respiratory distress syndrome need a complex follow-up team including pediatricians, pulmonologists, ophthalmologists, ENT specialists, psychiatrists, neurologists, psychologists, speech therapists, kineto therapists, teachers, and social workers.

Neonatal sepsis

This is a severe neonatal infection with the presence of a pathogen in the baby's blood culture; it has a high death rate and a significant risk of neuromotor sequelae.

Types:

- Early-onset sepsis emerging during the first 7 days of life
- Late-onset sepsis developing on days 8-28 of life.

Risk factors

1. For early-onset sepsis:

- Maternal fever right before labor, during labor or soon after delivery

- Chorioamniotitis

- Group B -beta-hemolytic streptococcal colonization of the maternal vagina

- Maternal infections: urinary tract infections, vaginitis, etc.

- Prolonged rupture of membranes

- Premature birth

- Baby's low birth weight

- Multiple gestation.

2. For late-onset sepsis:

- Prematurity

- Low birth weight

- Neonatal pathology: respiratory distress syndrome, neonatal jaundice, birth asphyxia, malformations

- Invasive intensive care- endotracheal intubation, ventilation, umbilical and central venous catheters, intravenous lines, surgery, exchange transfusion, gavage

- Prolonged neonatal intensive unit stay

- Premature ward, neonatal tensive care unit, isolation ward, and/or well babies ward overcrowding

- Neonatology and obstetrics department understaffing

- Faulty, dysfunctional patient, staff, waste products, medical instruments, medication, visitors, and medical material pathways in the neonatal intensive unit, premature babies ward, well babies nursery, and delivery rooms

- Single-use medical materials and instruments paucity

- Cleaning, antiseptic, and sterilization agents and devices scarcity

- Staff acute skin, respiratory or digestive pathology

- Antibiotic agents misuse and overuse.

Clinical presentation

Onset symptoms may be very subtle: the baby does not look well and does not thrive.

The following signs and symptoms develop quite rapidly (1, 3, 4, 5, 9, 12).

1. General signs

- Altered general condition

- Temperature instability

- Hypothermia- fever occurs seldom

- Static or downward weight curve

- Prolonged bleeding at intravenous or capillary puncture sites.

2. Skin signs: pallor, cyanosis, mottled skin in shock, jaundice, petechiae (pinpoint, small red spots on the skin that do not lose color when you press them occurring in congenital and/ or neonatal infections with a low thrombocyte count- thrombocytopenia), pustules, papulae, omphalitis (foul-smelling and bad looking umbilical stump, redness around the umbilical stump).

3. Cardiovascular signs: bradycardia/ tachycardia, low blood pressure, prolonged capillary refill time, shock.

4. Respiratory signs and symptoms

- Respiratory distress syndrome: intercostal and/ or subcostal recessions, expiratory grunting, be it spontaneous or triggered by baby manipulation, fast respiratory rate.
- Apnea spells (cessation of breathing longer than 20 seconds and bradycardia).

- Difficulties in weaning the newborn off the ventilator or CPAP, his need for an upward adjustment of the ventilator settings.

5. Digestive symptoms and signs: low feeding tolerance/ feeding intolerance, bilious/ hemorrhagic/ cloudy gastric residuals, meteorism (abdominal distension) with edema (swelling) or erythema (redness) of the abdominal wall, diarrhea, or foul-smelling stools.

6. Renal signs: low urine output.

7. Central nervous system symptoms: poor feeding, poor reactivity, hypotonia, high pitched cry, irritability, seizures (tonic, clonic, tonic-clonic, generalized or limited to one or more limbs), subtle seizures (grimaces, hiccups, sucking, yawning, chewing, nystagmus).

Paraclinical findings [1,3,4,5,9,12].

- Various cultures of the baby, sampled at birth or transfer and later, bring out the causative pathogen: hemoculture (blood culture), skin, and external acoustic meatus cultures, gastric aspirate culture, urine culture, intravenous catheter cultures, endotracheal tube cultures, coproculture (culture of feces), cerebrospinal fluid culture.
- Maternal cultures (lochia cultures, urine cultures, uterine cervix cultures, hemoculture, and coproculture) are also helpful and necessary, particularly during the infant's first week of life.
- Serial complete blood count: there may be leukopenia (decreased leukocyte count) or leukocytosis(increased leukocyte count), leukocyte formula left shift(increased number of immature elements), thrombocytopenia(decreased platelet count).
- Serial serum procalcitonin and C reactive protein have elevated values that decrease if there is a good evolution.
- Serial serum bilirubin values may be elevated, particularly the conjugated bilirubin ones.
- Serial blood sugar- hypoglycemia (low values) or hyperglycemia(elevated values) may occur.
- Serial blood urea nitrogen and creatinine are elevated in kidney failure.
- Cerebrospinal fluid analyses (culture, Pandy test, glucose, chloride, protein, smear, cultures, cells/ml, and cell types) may point to the diagnosis of meningitis.
- Blood gas analyses are essential for unstable babies who require respiratory support.

Prevention

- Ensure and observe functional newborn, pregnant women, mothers, staff, visitors, waste products, medical material, medical instruments, and medication pathways.
- All staff members must follow proper handwashing rules before and after every daily care, diagnostic and therapeutic maneuver.
- Avoid neonatology and obstetrics ward overcrowding.
- Ensure proper staffing (physicians, nurses, midwives, and administrative staff) of the neonatology and obstetrics ward.
- Staff triage must prevent ward access of persons with acute respiratory or digestive infections, pyodermitis, or other infectious diseases until their treatment is complete.
- Observe asepsia and antisepsia rules before, meanwhile, and after performing daily care, diagnostic and therapeutic maneuvers.
- Limit the number and duration of the invasive procedures.
- Ensure adequate supplies of disinfectants, cleaning agents and devices, soap, single-use medical material and instruments, gloves, gowns, and masks.
- Take sanitation samples and staff members' cultures (throat cultures, nose cultures, and stool cultures)regularly.
- Follow up expectant and new mothers at risk of septic issues and their babies by cultures, C reactive protein, and complete blood count.
- Promote breastfeeding.
- Use antibiotics rationally.
- Treat mothers-to-be for group B streptococcal vaginitis and colonization.
- Use antibiotic prophylaxis in newborns sensibly.
- Maintain a good partnership with pediatricians of the children's hospital- they may point to the rise of septic cases in recently discharged infants.

Management [1,3,4,5,9,12].

1- Ensure the thermal comfort of the baby at all times.

2- Support vital functions :

- Oxygen therapy- by CPAP or ventilation if needed
- Sustain circulation by adequate intravenous fluid intake and intravenous pressor support(Dopamine or Dobutamine) on a separate line in shock.

3- Intravenous antibiotics

- Treatment should last for 14-21 days.
- Start with Ampicillin or a third-generation cephalosporin-Ceftriaxone or Ceftazidime- and Gentamycin.
- Cultures and antimicrobial susceptibility testing results may call for changes in antibiotherapy. A host of hospital germs that cause late-onset sepsis are resistant to many drugs.
- If an anaerobic infection (necrotizing enterocolitis, etc.) is taken into account intravenous Metronidazole can be added.
- In premature babies with a very low gestational age adding an intravenous antimycotic agent (Fluconazole or Amphotericin B) is useful.

4- Intravenous immune globulins and plasma bring anti-infective and clotting factors.

5- Intravenous pentoxifylline may also help.

6- Keep the infant stress level to a minimum: cluster daily care, diagnostic and therapeutic maneuvers, reduce the intensity of the stimuli (light, noise, smells, and handling).

7- Provide nutritional support: at first parenteral nutrition-intravenous 10% glucose, 10% amino acids, 5,45%NaCl, 7,45% KCl and 10% calcium gluconate. As soon as the newborn condition allows it enteral nutrition with own mother milk ought to be initiated, starting by gavage; feeding is continued afterward by spoon-feeding and breastfeeding, depending on the infant's condition.

8- Prevent and treat the pain related to the invasive procedures by:

- Non-pharmacological means: dextrose, pacifier, positioning, facilitated tuck, and use of caresses and talking
- Analgesics.

9- Help the baby maintain a fetal position by building him a « nest» of linen or blankets.

Outcome

- Short -term outcome is rather dim, due to the high death rate.
- Long -term outcome bears the impact of the high risk of neuromotor impairment (cerebral palsy, developmental delays) or/and sensory impairment- permanent hearing loss, vision deficits, even blindness.

Follow up

A complex team is required for the long term clinical assessment: pediatricians, ophthalmologists, neurologists, psychiatrists, ENT specialists, speech therapists, psychologists, kineto therapists, social workers.

Neonatal jaundice

Jaundice is a yellowish discoloration of the skin and sclera that appears when the serum bilirubin level is above 7 mg%.

Causes

1- Physiological jaundice of the newborn occurs due to the postnatal decrease of hemoglobin level and to reduced bilirubin uptake by the liver.

2- Excessive breakdown of red blood cells.

- Isoimmune disease- maternal antibodies that cross the placenta and destroy fetal red blood cells; they may be directed toward the A or B blood type antigens on the fetal red blood cell surface(and may pose a problem at the first pregnancy of baby's mother) or toward the Rh blood type antigen of the fetal red blood cells (and put the offspring of a next pregnancy at risk).
- Polycythemia- elevated red blood cell count that may occur in large for gestational age babies and in infants of diabetic mothers
- Congenital hemolytic anemias with neonatal onset: spherocytosis, alpha thalassemia.

3- Prematurity

4- Birth asphyxia

5- Congenital infections: syphilis, rubella, toxoplasmosis, hepatitis B or C, cytomegalovirus infection

6- Neonatal infections: sepsis, urinary tract infections, hepatitis.

7- Cephalhematoma, large bruises.

8 - Bile ducts malformations.

9- Genetic diseases: cystic fibrosis, Crigler- Najjar syndrome, alpha 1 antitrypsin deficit.

Physiological jaundice must be distinguished from pathological jaundice.

Telling pathological jaundice from physiological jaundice has to take into account several factors.

- Jaundice onset time: days 2 to 4 of life in physiological jaundice and within the first 2 days of life in pathological jaundice.
- Jaundice intensity as assessed by discoloration spreading and shade, transcutaneous bilirubin assessment, and serum bilirubin level. Baby's skin tone is best assessed in bright daylight by gently pressing his skin.

Figure 18: Neonatal jaundice (wwww.newkidscenter.com)

Transcutaneous bilirubin assessment by a bilirubinometer is noninvasive and reliable; this tool gives accurate readings if used on covered skin. Physiological jaundice is limited to the face and no more than two-thirds of the body; its subdued to moderate shade reaches a peak between the third and sixth days of life. The serum bilirubin level does not exceed 12 mg%.

Pathological jaundice has a darker tone and progresses to the whole body, limbs (palms and soles of the feet too in severe forms); serum bilirubin level is above 5 mg% at birth, 10 mg% on the first day of life, and 15mg% later.

- Jaundice duration: no more than up to days 10-14 of life in physiological jaundice but longer in pathological jaundice.

- Baby's general condition is good in newborns with physiological jaundice: they feed well, grow well, are active, maybe a little sleepy sometimes. Infants with pathological jaundice may be unstable, hypotonic, irritable or hyporeactive, even comatose.

Clinical presentation [1,3,4,5,9,12]

- Yellowish discoloration of the skin and sclera. Its shade may give diagnostic hints: jaundice and pallor point to ex-

cessive breakdown of red blood cells, and jaundice with a greenish tone may suggest a liver or biliary tree condition.

Petechiae (pinpoint, small red spots on the skin that do not lose color when you press them) occur in congenital and/ or neonatal infections with a low thrombocyte count (thrombocytopenia).

- Palpation and percussion of the abdomen bring out the liver enlargement in isoimmune diseases, congenital infections, neonatal sepsis, neonatal hepatitis, and inborn hemolytic anemias. Sometimes the spleen is enlarged, too.
- Urine color can change to dark yellow to light brown in infants with an excessive breakdown of red blood cells, neonatal hepatitis. or bile tree malformations due to the increased urobilinogen level.
- Stools may be discolored in babies with neonatal hepatitis or bile tree malformations.
- The presence of cephalhematomas or/ and large bruises gives a clue to the cause of neonatal jaundice.

Paraclinical findings [1,3,4,5,9,12].

- Serum bilirubin level is high. Unconjugated (free) bilirubin is increased in excessive red blood cell breakdown, prematurity, birth asphyxia. Conjugated bilirubin level is high in congenital and neonatal infections, neonatal sepsis, neonatal hepatitis, and congenital hemolytic anemias.
- Complete blood count

1. Anemia and high reticulocyte count are seen in babies with isoimmune diseases and neonatal-onset congenital hemolytic anemias. Distinct red cell aspect may point to a form of congenital hemolytic anemia- spherocytosis, for instance.

2. Anemia, low platelet count and high or low leukocyte count, and left shift of the leukocyte formula are seen in congenital or neonatal infections.

- Mother, father, and baby OAB and Rh blood types are very important for the diagnosis and cure of isoimmune diseases.
- Coombs test yields positive results in infants with isoimmune diseases.
- Serologic assays of congenital infections help diagnose congenital syphilis, rubella, hepatitis B, toxoplasmosis, cytomegalovirus infection (high immunoglobulin M levels).
- Cultures (blood culture, urine culture, gastric aspirate, etc.) are positive in babies with neonatal sepsis and infections.
- Abdomen ultrasound shows changes in liver, intrahepatic or extrahepatic bile ducts or gallbladder aspect in congenital bile tree malformations.
- Bromsulphtaleine (BSP) test is also useful for the diagnosis of the aforementioned conditions.
- Serum ALAT and ASAT are elevated in babies with neonatal hepatitis.
- Genetic assays and immune trypsinogen are needed to diagnose genetic issues- cystic fibrosis, etc.

Complications [3,4,5,9,121,3,4,5,9,12]

Short term problems

- Kernicterus- seizures, hypotonia, poor feeding, lethargy, poor reactivity, coma, and high death rate. Premature babies and the ones with birth asphyxia and respiratory distress syndrome are at higher risk.
- Secondary anemia due to excessive breakdown of red blood cells.

Long term issues

- Permanent hearing loss.
- Visual impairment.
- Cerebral palsy.
- Ataxia (incoordination of hands, arms, and legs, difficulties with eating, affected balance).
- Neuromotor delay.
- Developmental delays.

Prevention

- Give anti-D immune globulin during the first 72 hours after the birth to primigravida, primipara Rh-negative blood type mothers with Rh-positive blood type babies. AntiD immune globulin may be administered again to the mother after the next birth of an Rh-positive infant or miscarriage.
- Treat expectant mothers at risk of congenital infections: syphilis, toxoplasmosis.
- Give anti-hepatitis B and antirubella vaccines to little girls.
- Give anti-hepatitis B immune globulin within the first 12 hours of life to babies born to mothers carriers of hepatitis B virus; these newborns ought to be born by cesarian section.

Treatment [1,3,4,5,9,12].

1. Phototherapy- this therapy is based on the observation of a nurse who was the first to notice the effect of indirect sunlight on jaundiced babies.

The efficacy of phototherapy depends upon the area of the exposed skin.

The baby's eyes must be shielded while the phototherapy lamp is on.

The baby must enjoy thermal comfort and adequate hydration; a suitable breast milk intake is very valuable to bilirubin clearance.

Figure 19: Phototherapy (wwww.fastcomdesign.com)

2. Intravenous albumin increases bilirubin conjugation, thus decreasing the bilirubin passage to the newborn's brain and the risk of kernicterus.

3. Exchange transfusion- an invasive procedure that involves removal by aliquots of 2/3 of the baby's blood and its replacement with compatible donor blood; this therapy is required in severe neonatal jaundices.

- Indications- most frequently related to severe OAB or Rh isoimmune disease.

A. Serum bilirubin level above 5mg% at birth, over 10 mg% during the first day of life, and higher than 20 mg% later or rapidly rising to these threatening values

B. Severe anemia- hemoglobin level under 10 mg%.

- In Rh isoimmune disease baby's OAB blood type Rh-negative blood type donor blood is used.
- In OAB isoimmune disease OI infant's Rh blood type donor blood is necessary.
- An umbilical venous catheter is used to remove 10 ml aliquots of the baby's blood and replace it with the same aliquots of compatible donor blood; up to 120 ml of donor blood are required for every kilo of the newborn.
- The procedure must be gentle and the infant's thermal comfort has to be maintained during this maneuver.
- Full-blown resuscitation devices and oxygen supply ought to be handy.
- Asepsia and antisepsia rules must be strictly observed.
- Continuous heart rate and peripheral oxygen saturation by pulse oximetry and monitoring of the respiratory rate are mandatory.
- Risks:
- Septic issues: sepsis, necrotizing enterocolitis, hepatitis C
- Metabolic issues: hypocalcemia, hypoglycemia, acidosis-low blood pH
- Heart failure due to heart overload
- Blood clot or gas embolism
- Cardiac arrest
- Mechanical issues affecting the catheter- dislodging, etc.

4. Antibiotherapy is needed in congenital and neonatal infections.

Penicillin G is given in syphilis.

In neonatal infections start with Ampicillin and Gentamycin, afterward choose the drugs according to the antimicrobial susceptibility of the pathogen.

5. Prevention of secondary anemia of isoimmune disease: oral folic acid and B6 vitamin.

6. Surgery of bile tree malformations or liver transplant.

7. Prevention and treatment of the pain related to the invasive maneuvers by:

- Non-pharmacological means: sucrose, pacifier, facilitated tuck, caresses, and talking to the baby
- Analgesics.

Outcome

It carries the burden of kernicterus.

It depends upon the cause of jaundice and the presence of other risk factors: birth asphyxia, prematurity.

Follow up

A clinical and paraclinical assessment has to be performed regularly by a team comprising a pediatrician, an ENT specialist, an audiologist, a psychiatrist, a neurologist, and a speech therapist.

Neonatal seizures

Seizures happen because of an abnormally rapid firing of some brain neurons. They are a major emergency and may have a grim vital and developmental outcome.

Causes

- Birth asphyxia.
- Respiratory distress syndrome.
- Intracranial hemorrhages occur frequently in hypoxic preemies and also in babies with a low platelet count.
- Traumatic brain injury at birth.
- Neonatal strokes.
- Metabolic issues

1. Transient disorders: hypocalcemia (low blood calcium), hypoglycemia(low blood sugar), hyponatremia(low serum sodium), hypernatremia (elevated serum sodium), kernicterus.

2. Inborn errors of metabolism: disorders of aminoacids metabolism (phenylketonuria, leucinosis), urea cycle defects, acidemias, pyridoxine dependent epilepsy.

- Infections

1. congenital infections: syphilis, TORCH (toxoplasma, rubella, cytomegalovirus, herpes, other) syndrome, and group B hemolytic streptococcus infection

2. neonatal infections: E. coli, Pseudomonas, Klebsiella meningitis, herpes meningoencephalitis, sepsis.

- Maternal drug abuse: ecstasy, heroin, methadone, etc.

- Idiopathic seizures: benign familial neonatal seizures,fifth-day seizures.
- Brain malformations.

Clinical presentation [1, 3, 4, 5, 9, 12].

- Clonus- rhythmic, repeated contractions of the limbs, face, or torso. They have to be differentiated from jitteriness. Jitteriness does not occur spontaneously but after some stimuli. This is limited to one limb, is not accompanied by abnormal eye movements, and stops when the limb is bent by the observer.
- Tonic: fixed posture, stiffness of the whole body, limbs, head, or torso.
- Tonic-clonic- a combination of the above-mentioned seizures.
- Subtle seizures- chewing, swallowing, blinking, tongue thrust, yawning, lip pursing, nystagmus, staring, periodic fixed upward gaze, boxing movements, pedaling movements.
- Autonomic nervous system symptoms: apnea spells (cessation of breathing longer than 20 seconds and bradycardia), bradycardia (slow heart rate) or tachycardia(fast heart rate), hypertension.

Paraclinical findings [1,3,4,5,9,12].

A Mandatory tests

1. Complete blood count:

- Low or high leukocyte count and a left shift of the leukocyte formula in congenital or neonatal infections
- Low platelet count in congenital or neonatal infections and neonatal thrombocytopenia with the risk of intracranial hemorrhages

2. Blood sugar: hypoglycemia can cause seizures.

3. Serum electrolytes: hypocalcemia (low serum calcium), hyponatremia (low serum sodium), and hypernatremia (elevated serum sodium) can cause seizures.

4. Blood gas analyses:

- Low oxygen pressure, high carbon dioxide pressure +/- low pH (respiratory acidosis) in birth asphyxia or respiratory distress syndrome
- Low pH, normal or low p CO2 (metabolic acidosis) in some inherited metabolic defects.

5. OAB and Rh blood type.

6. Head ultrasound observes the white matter and/ or ventricles pathology that occurs in prematurity, respiratory distress syndrome, birth asphyxia, or central nervous system malformations.

B. Lab tests for particular groups of babies

1. Babies at risk of neonatal infections ought to undergo:

- Cerebrospinal fluid tests: Pandy assay, glucose, protein, cell number, Gram stain
- Cultures: blood culture, skin culture, throat culture, endotracheal tube culture, catheter cultures, gastric aspirate, urine culture; maternal cultures (lochia culture, uterine cervix culture, urine culture) are relevant and helpful during the first week of the life of the baby
- Serum procalcitonin and C reactive protein.

2. Babies at risk of congenital infections require besides the aforementioned lab tests serum and cerebrospinal VDRL test, maternal VDRL test, and maternal and infant TORCH panel- IgG anti rubella, anti cytomegalovirus, anti toxoplasma antibodies both in the mother and the child point to the diagnosis of congenital infection.

3. Jaundiced infants need serum bilirubin tests- both conjugated and unconjugated bilirubin- and Coombs assay.

4. Children born to mothers with suspected or overt drug addiction need serum and urine toxicology screen.

5. Babies with traumatic brain injury need a cranial X-ray or cranial CT scan.

Treatment [1,3,4,5,9,12].

It is an emergency.

1. Maintain the thermal comfort of the baby: keep him in a servo-controlled incubator or overhead warmer. Incubator settings must be adjusted according to his birth weight, gestational and postnatal age.

2. Support the vital functions:

A- Breathing

- Clear the airway, if needed.
- Oxygen therapy must be adjusted to the severity of respiratory distress syndrome and guided by pulse oximetry and blood gas analyses. Oxygen may be given by headbox, CPAP, or noninvasive/ invasive ventilation.

B- Circulation:

- Ensure secure intravenous access.
- Correct hypotension (low blood pressure), if necessary with an intravenous bolus of normal saline; this bolus can be repeated 30 minutes later.
- Some babies may need pressor support (continuous infusion of Dobutamine or Dopamine) on a separate intravenous line.

3. Management of metabolic seizures

A. Correct hypoglycemia by:

- An intravenous bolus of 10% dextrose; this bolus can be repeated
- Continuous intravenous infusion of dextrose; if more than 12,5% dextrose is required to maintain adequate blood sugar levels a central venous catheter is mandatory.

B. Correct hypocalcemia by very slow intravenous push of 10% calcium gluconate; continuous monitoring of the baby's heart rate is a must, because of the risk of bradycardia.

4. Treat other causes of seizures

A- Pathological jaundice:

- Phototherapy
- Intravenous albumin

- Exchange transfusion with compatible donor blood: baby's OAB blood type Rh-negative blood type in Rh isoimmune disease or OI blood type baby's Rh blood type in OAB isoimmune disease.

B. Infections

1. Neonatal infections: start antibiotherapy with Ampicillin and Gentamycin and adjust further choices according to the results of the cultures and antimicrobial susceptibility of the pathogen.

2. Congenital infections:

- Intravenous Penicillin in congenital syphilis.
- Pyrimethamine, Sulfadiazine, and folinic acid in congenital toxoplasmosis.

5. Anticonvulsants

A. In seizures: intravenous or intramuscular Phenobarbital or intravenous Phenytoin in seizures that do not respond to Phenobarbital; the infusion ought to last 30 minutes; high doses may require respiratory support, due to the risk of apnea (respiratory arrest). Drug association may be required for medication-resistant seizures.

B. Maintenance therapy:

- Oral or intramuscular Phenobarbital starting 24 hours after the loading dose.
- Intravenous Phenytoin- a 30 minutes infusion starting 12 hours after the loading dose.

6. Vitamin B6 in pyridoxine dependent epilepsy; start with an intravenous dose and continue with oral vitamin.

7. Prevention and treatment of the pain caused by invasive procedures: facilitated tuck, oral sucrose, pacifier, gentle caresses, talking, and songs.

8. Keep stress level to a minimum: avoid excessive, brutal manipulation and intense stimuli- light, noise, and smells.

9. Cluster daily care, diagnostic and therapeutic maneuvers to reduce stress level and promote sleep and rest.

10. Keep the newborn in a "nest" made up of linens and blankets-this will support him to maintain a fetal posture.

Outcome

It depends upon the underlying cause of seizures.

Short term outcome may bear the impact of death risk and recurrent seizures.

Long term severe consequences of neonatal seizures are epilepsy and chronic infantile encephalopathy.

Follow-up

It requires a multidisciplinary team; neurologist, psychiatrist, pediatrician, neurologist, ophthalmologist, ENT specialist, psychologist, speech therapist, and kineto therapist.

Necrotizing enterocolitis

This bowel condition is the most common gastrointestinal emergency in the newborn; it carries a significant risk of death and complications.

Babies at risk

- Preemies, particularly the ones with a very low gestational age.
- Formula-fed preemies.
- Premature babies with other conditions: intrauterine growth restriction, birth asphyxia, patent ductus arteriosus, congenital heart diseases.
- Premature infants receiving Ranitidine for stress ulcer prophylaxis (as in severe respiratory distress) or gastroesophageal reflux (backward leak of the gastric content into the esophagus).
- Prolonged antibiotherapy in preemies.

Prevention

- Give Dexamethasone to pregnant women at risk of premature labor.
- Feed the preemies, especially the tiniest ones, exclusively own mother milk.
- Do not use Ranitidine in preemies requiring ventilation.
- Use antibiotics sensibly and for the shortest possible time.
- Oral probiotics, lactoferrin, polyunsaturated long-chain fatty acids, and zinc may be useful in decreasing the odds of necrotizing enterocolitis.

Clinical presentation [3,4,5,9,12].

- Systemic signs: Poor feeding, temperature instability, altered general condition, severe bleeding disorders.
- Respiratory signs: apnea spells (cessation of breathing longer than 20 seconds and bradycardia), respiratory distress.
- Cardiovascular signs: bradycardia, low blood pressure, prolonged capillary refill time, shock.
- Changes in behavior: lethargy, irritability, poor feeding.
- Digestive signs: abdominal distension and tenderness, gastric residuals (bilious or/and bloody), abdominal wall erythema or induration, vomiting, decreased or absent bowel sounds, presence of fresh blood in the stool, palpable abdominal mass, visible intestinal loops.

Figure 20: Necrotising enterocolitis.

Paraclinical exams [3,4,5, 9, 12]

-Imaging studies point to the diagnosis and severity of the illness.

1. Abdominal ultrasounds show the presence of air within the portal vascular system, ascites (fluid accumulation in the peritoneal cavity i.e. the space between the layers of the peritoneum- the membrane lining the abdominal cavity and covering most of the intraabdominal organs), loop perforation.

2. Abdominal radiographs show bowel wall thickening, pneumatosis (presence of gas within the wall of the bowel), pneumoperitoneum (gas accumulation in the peritoneal cavity), dilated bowel loops filled with gas, fixed and dilated loop in serial exams, portal or hepatic venous air, presence of gas within the biliary tree.

- The complete blood count shows thrombocytopenia and low leukocyte count.
- Blood gas analyses show metabolic acidosis: low/ normal pH and low bicarbonate; they are also very valuable to the guidance of respiratory support the baby needs,
- Serum electrolytes, urea, creatinine, glucose, calcium, ALAT, and ASAT are very useful for guiding parenteral nutrition.
- Cultures (gastric aspirate culture, blood cultures, stool cultures) are helpful for the management of antibiotherapy.

Complications [3,4,5, 9, 12]

- Intestinal necrosis.
- Sepsis.
- Intestinal perforation with pneumoperitoneum (presence of gas in the peritoneal cavity).
- Short bowel syndrome: surgical removal of a large portion of the small intestine causes malabsorption (imperfect absorption of nutrients) with chronic diarrhea, dehydration, growth impairment, anemia, and vitamin deficiencies.
- Intestinal strictures i.e. narrowings in the intestines which can make it difficult for food to pass.
- Death.

Management [3,4,5, 9, 12]

- Keep the infant nil by mouth and provide parenteral nutrition.

Oral feeds should be started as soon as possible. Trophic feeds (low volume feeds) are offered first; feeding is continued depending upon the baby's condition, need for surgery, and the extent of bowel involved.

- Perform gastric decompression with a nasogastric tube.
- Support respiration by oxygen therapy and respiratory support: CPAP or ventilation.
- Support circulation by adequate intravenous fluid intake and intravenous inotropes (most often Dopamine) if needed.
- Start intravenous antibiotherapy with broad-spectrum drugs. The treatment has to be guided by the antimicrobial susceptibility of the germ grown in cultures.

Intravenous antimycotics (Fluconazole, Amphotericin B) are useful.

- Surgical treatment is required in severe cases.

Outcome

- Short term outcome is affected by the high death rate.
- Long-term outcome depends upon the risk for complications as a short gut syndrome or intestinal strictures.

Neonatal cardiac disorders

Patent ductus arteriosus

Ductus arteriosus is a fetal blood vessel that ensures the communication between the pulmonary circulation and systemic circulation during intrauterine life; it connects the pulmonary artery to the aorta and closes after birth. Its patency poses problems.

Babies at risk: preemies, particularly the ones with a very low gestational age, newborns with respiratory distress syndrome, and neonates with congenital rubella.

Clinical findings [3,4,5, 9, 12]

- Babies may be firstly asymptomatic- their respiratory distress gets better but they cannot be weaned off the ventilator.
- A distinctive cardiac murmur can be heard and the difference between the systolic and diastolic blood pressure is increased.
- Cardiac failure occurs in symptomatic infants: tachycardia (fast heart rate)/ bradycardia(slow heart rate), need for increased ventilation parameters, prolonged capillary refill time, pulmonary hemorrhage in premature babies, and an enlarged liver.

Premature infants have apnea spells (cessation of breathing longer than 20 seconds and bradycardia).

Patent ductus arteriosus increases the risk of intracerebral hemorrhage, necrotizing enterocolitis, and chronic lung disease.

Neurological development of children with patent ductus arteriosus may be impaired.

Paraclinical investigations [3,4,5,9,12]

- Echocardiography pinpoints the patent ductus arteriosus and its impact upon hemodynamics.
- Chest X-ray shows an enlarged heart and more radiopaque lungs in hemodynamically significant ductus arteriosus.
- Blood gas analyses guide oxygen therapy and respiratory support.
- Head ultrasound is useful for spotting intracerebral hemorrhages.

Management [3,4,5,9,12].

- Fluid restriction.
- Watchful waiting.
- Respiratory support: CPAP or non-invasive/ invasive ventilation.
- Pharmacological closure of the ductus with intravenous Indomethacin or oral/ intravenous Ibuprofen. Renal function impairment, necrotizing enterocolitis, and a low thrombocyte count are contraindications to these drugs.

Intravenous/ oral Acetaminophen may also be given.

- Surgical ligation is necessary for babies with hemodynamically significant ductus failing pharmacological closure.

The outcome depends mainly on the gestational age of the baby. His other additional risk factors (intracerebral hemorrhage, necrotizing enterocolitis, renal failure) also matter.

Critical congenital heart diseases in newborn babies

Congenital heart diseases are a great public health issue; advances in fetal echocardiography, neonatal intensive care, life support devices, and open heart surgery have considerably improved the survival rate and outcome of children with this pathology. Still, the addressability of these babies is hampered by the all too limited number of units able to provide them with adequate care., i.e. cardiac surgery.

Screening babies for critical congenital heart defects at 2-3 days of life is useful for the timely referral of children with severe cardiac malformations to a pediatric cardiologist; they consequently may benefit from prompt diagnosis and proper management, with better outcome. Some infants born with critical heart diseases may appear healthy at first but are soon at risk of having severe complications that require adequate emergency care and have high death or disability rates.

Screening for critical heart malformations consists of 2 pulse oximetry tests. An oximeter sensor attached to the baby's right hand reads the saturation in the body region receiving blood from preductal arteries, that emerge from the aorta before the connection of the ductus arteriosus to the pulmonary artery. A sensor placed on his left hand or any foot reads saturations in an area irrigated by postductal arteries, emerging downstream the ductus arteriosus. Normal readings are above 95%, with a difference between preductal and postductal values of 3% or less. Babies who fail this test must promptly undergo an echocardiogram and be timely referred to a pediatric cardiologist. They may have heart defects that can soon manifest as a very severe cardiac failure that requires adequate emergency care and their death and disability rates can be high.

There are critical congenital heart defects with systemic or pulmonary blood flow depending upon a patent ductus arteriosus. A cardiovascular collapse that can soon be fatal occurs after duct closure.

Clinical findings [3,4,5,9,12]

- Severe general condition with rapid deterioration.
- Skin: cyanosis; mottling, ashen, gray color in shock.
- Cardiovascular system: audible heart murmurs, delayed capillary refill in shock, low blood pressure; weak femoral pulse and systolic pressure gradient (higher pressure in the upper body compared to the lower body) are specific to aortic arch abnormalities.
- Severe respiratory distress.
- Low urine output.

Paraclinical tests establish a definitive anatomic diagnosis [3,4,5,9,12]. One important thing: the emergency treatment of shock has to precede a complete diagnosis!

- Hyperoxia test might be used to tell the difference between cyanosis in heart defects and cyanosis in lung conditions in settings where neither a pediatric cardiologist nor cardiac investigations are available. This test consists of monitoring the peripheral oxygen saturation of the baby before and after administration of 100% oxygen for 10 minutes; a rise in pulse oximeter readings above 95% (85%) suggests the cyanosis has a pulmonary origin; a negative test implies the likelihood of congenital heart disease.
- Echocardiography is the most useful tool for diagnosing congenital heart defects as it assesses the anatomy of the heart and the hemodynamic impact of the malformation.
- Chest R ray can identify distinctive features of the cardiac silhouette in some congenital heart defects, tell something about the pulmonary blood flow, and helps in the differentiation of lung and heart disease.
- Blood gas analyses guide oxygen therapy and respiratory support.

Management

- Prompt stabilization:
- Establish and maintain a stable airway; these infants very often need intubation.
- Provide respiratory support; invasive ventilation is very frequently required. Use the lowest FiO2 (percentage of oxygen the baby receives) that ensures the best oxygenation of the infant.
- Establish and maintain safe, reliable vascular access; umbilical catheters are the best option. Inotropes (Dopamine or Dobutamine) in continuous infusion should be administered on a separate line if needed.
- Maintain ductus arteriosus patency. Intravenous prostaglandin E1 in a continuous infusion on a separate line is useful for ductal - dependent critical heart diseases as bridging therapy for further interventions (up transfer to a specialized center, interventional catheterization, and cardiac surgery). Any infant in whom critical congenital

heart disease is strongly suspected needs to be started on prostaglandin E1 pending transfer. Pay attention to the side effects of this drug: hypotension (low blood pressure), apnea spells (cessation of breathing longer than 20 seconds and bradycardia), fever, and hypoglycemia.

- Refer the infant for further investigations (to establish a definitive anatomic diagnosis) and correction of the defect.

The outcome of these newborns depends on the timely availability of adequate care.

Short term outcome bears the influence of the high death rate.

Children with critical congenital heart defects are at high risk of further neurodevelopmental impairment.

Birth Trauma

Birth traumas are injuries of the tissues and/or organs of the baby caused by trauma during childbirth.

Birth trauma may coexist with birth asphyxia, thus increasing both issues' severity.

Risk factors for birth trauma

- Cephalo- pelvic disproportion: large fetus, infants of diabetic mothers, small or abnormal maternal pelvis.
- Oligohydramnios (an insufficient amount of amniotic fluid).
- Extreme prematurity.
- Obstructed labor.
- Prolonged labor.
- Precipitous labor.
- Dystocic presentations of the fetus: breech, brow, face, shoulder.
- Obstetrical procedures: version, instrumental delivery (forceps, vacuum extraction).

1. Craniocerebral injuries [3,4,5, 9, 12]

A. Caput succedaneum- a serosanguineous extraperiosteal fluid collection with poorly defined margins that resolves within some days.

Figure 21: Caput succedaneum (wwww.medical-dictionary.thefreedictionary.com)

B. Cephalhematoma – a subperiosteal collection of blood, always confined by suture lines. It may sometimes be associated with pathological jaundice. Small parietal fractures may seldom underline a cephalhematoma. The resolution occurs over 1 to 3 months. Neurosurgical procedures are not needed.

Figure 22: Cephalhematoma (wwww.pedclerk.bsd.uchicago.edu)

C. *Facial nerve palsy*- is caused by the antenatal or intrapartum (forceps blades) compression of the nerve. Baby's mouth is drawn to the affected side and downward; the newborn has an asymmetric crying face. Resolution occurs over weeks.

Figure 23: Facial Palsy.

2. Neck and clavicle injuries [3,4,5,9,12].

A. Clavicle fracture- occurs quite frequently, particularly in shoulder dystocia, large babies, and cephalo pelvic disproportion.

- Clinical presentation: crepitus (spongy feeling) on collar bone palpation; babies sometimes experience limitation of arm movements and pain, expressed by fussiness and crying when moving the arm or with limb manipulation. 7-10 days after birth healing of the bone may cause a lump to develop at the area of the fracture.
- Paraclinical assessment: The chest X-ray confirms the fracture.
- Management - the newborn must have his sleeve pinned to the shirt to keep the arm and shoulder from moving until the bone heals (7-10 days).

- Both short-term and long-term ourcome are excellent.

B. Brachial plexus palsy- is an injury involving the nerve root, caused by excessive traction on the shoulder, neck, and arm during birth.

- **Clinical findings**: flaccid upper limb, with diminished reflexes and movements, asymmetric Moro reflex, stiff arm extended at the elbow and rotated inward with the wrist fully bent and extended fingers, weak even absent grip, and diminished sensibility.

- **Paraclinical assessment**

Chest X-ray is mandatory to rule out humerus fracture or phrenic nerve paralysis; the latter presents as a respiratory distress syndrome with asymmetric breathing movements(decreased movement of the affected hemithorax) and chest X-ray showing clear lung fields and normal heart shape but asymmetric diaphragm domes (elevation of the affected hemidiaphragm).

Management

The affected upper limb must be fixed against the chest for 1-2 weeks; it ought to be periodically let free during these weeks. Afterward, physical therapy and joint mobilization are to be started and continued for 3-5 months. Some babies may require hand splints.

Primary or secondary surgical treatment may be necessary for some infants.

Long term outcome: Full recovery may take 3 months or longer; some children may be left with a various degree of motor deficit of the affected upper limb.

Figure 24: Brachial plexus palsy (wwww.orthobullets.com)

C. *Congenital torticollis* is the consequence of an antenatal or birth injury of the sternocleidomastoid muscle.

Clinical findings- head tilt to the side of the lesion, presence of a palpable mass in the sternocleidomastoid region, and reduced head mobility; facial asymmetry may be present.

Prompt treatment is required.

- Position the baby in lateral decubitus (the uninvolved side).
- Stretching of the affected muscle several times a day.
- Physical therapy.
- Surgery is required in a few cases of torticollis that persists after the age of 6 months.

Outcome: recovery usually occurs within 3- 4 months.

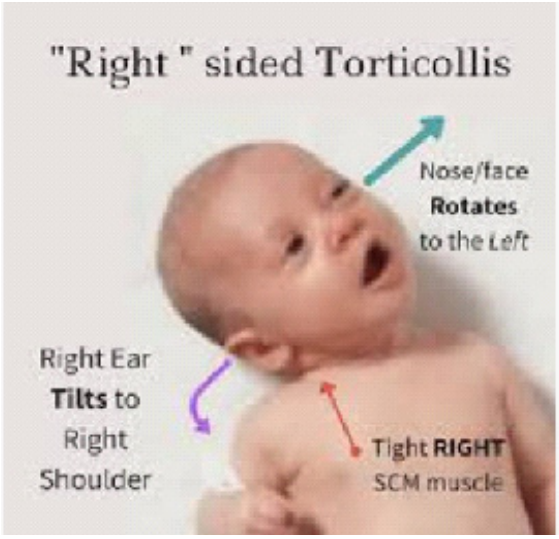


Figure 25: Torticollis (wwww.pinterest.com)

D. *Phrenic nerve injury* is a birth trauma that may coexist with brachial plexus palsy.

Clinical presentation:

- Cyanosis
- Respiratory distress
- Decreased movement of the affected hemithorax.

Paraclinical assessment:

Chest X-ray shows an elevation of the affected diaphragm.

Management

- Lateral decubitus on the affected side.
- Respiratory support: oxygen therapy, prevention of atelectasis by a regular clearing of baby's airways, and CPAP or noninvasive/invasive ventilation, if needed.
- Nutritional support: parenteral nutrition, gavage feeding.

Outcome: Recovery occurs in most babies within 1-3 months. Some infants may need surgery.

3. Abdominal organs injury [3,4,5, 9, 12].

These are quite rare and occur particularly in babies in breech presentation; newborns with enlarged liver due to isoimmune disease or congenital syphilis are also prone to these injuries.

The liver and spleen are the most frequently affected organs.

Clinical presentation: pallor, hypotension, shock, tachycardia, respiratory distress, jaundice.

Paraclinical tests:

- Complete blood count shows anemia.
- Abdominal ultrasound highlights the hemoperitoneum(presence of blood in the peritoneum) and liver or spleen lesions.

Management

- Emergency surgery.
- Circulation support: blood transfusion, pressor support(intravenous infusion on a separate line of Dopamine) if

needed.

- Respiratory support: oxygen therapy- ventilation.

4. Long bone injuries [3,4,5, 9, 12].

A. Humerus fracture

- Clinical presentation: decreased movements of the affected upper limb, crying on the passive motion of the limb, swelling of the arm, sometimes bruises, and seldom presence of an obvious deformity.
- **Paraclinical examinations**- arm X-ray shows the fracture line.
- Management- arm strapping to chest or shoulder – elbow cast for 2 weeks.

Figure 26: Humeral fracture (wwww.orthobullets.com)

Both short-term and long-term outcome are good.

B. Femur fracture

It occurs in babies in breech presentation.

Clinical findings may sometimes become obvious at 1-2 days of life: limited active movements of the affected lower limb, crying on its passive motion and palpation, swelling of the affected thigh.

The lower limb X-ray shows the fracture line.

Management: Pavlik harness or groin- toe splinter used for 10- 14 days.

Short term and long term outcome are good.

Figure 27: Femur fracture (wwww.orthobullets.com)

Neonatal Bleeding Disorders

These are diseases with bleeding occurring spontaneously or on minimal trauma.

Some clotting factors have not reached their mature levels in newborns, particularly preemies; infants also have an increased vascular fragility; a vitamin K deficiency exists as well, due to the low vitamin content of breast milk, absent vitamin reserves, and lack of gut bacteria involved in vitamin K synthesis.

Risk factors

- Lack of vitamin K administration at birth.
- Lack of further vitamin K prophylaxis in premature babies.
- Family history of bleeding disorders: hemophilia, thrombocytopenia.
- Maternal diseases: diabetes mellitus, hypertension, severe hemorrhages.
- Maternal medication during pregnancy or childbed: anticonvulsants (Phenobarbital), Anticoagulants (Thrombostop, Fraxiparine, Aspirin), diuretics (Nefrix, Ufrix).
- Severe birth asphyxia.
- Severe congenital infections.
- Neonatal sepsis.
- Prematurity.
- Severe isoimmune disease.
- Shock.
- Placental pathology: infarctions, abruption.
- Giant hemangiomas.
- Birth trauma.

Clinical presentation

A. Hemorrhage is a distinctive feature of bleeding disorders.

1. External bleeding:

- At puncture and injection sites
- Bruises
- Hematomas
- Petechiae (pinpoint, small red spots on the skin that do not lose color when you press them occurring in congenital and/ or neonatal infections with a low thrombocyte count- thrombocytopenia).

2. Exteriorized bleedings:

- Melena- dark, sticky stools due to the presence of digested blood
- Hematemesis- vomiting of blood
- Hematuria- bloody urine
- Umbilical hemorrhage
- Pulmonary hemorrhage.

3. Internal bleedings :

- Intracerebral hemorrhages: seizures, lethargy, coma, paresis

– liver hemorrhage: pallor, jaundice, hypotension (low blood pressure), tachycardia, shock, and distension of the abdomen

- Adrenal bleeding: severe shock, circulatory collapse.

B. Thrombosis at fingers, toes, auricle, nose occurs in disseminated intravascular coagulation.

Paraclinical findings [3,4,5, 9, 12].

1. Complete blood count :

- Low platelet count in maternal or neonatal thrombocytopenia: congenital platelet disorders, congenital infections, neonatal sepsis, consumptive coagulopathy (disseminated intravascular coagulation) in shock, and isoimmune thrombocytopenia (presence of maternal antibodies directed toward fetal platelets).

- Anemia in isoimmune diseases, congenital infections, neonatal infections, or after losing an important amount of blood.

- Low or high leukocyte count with a left shift of the leukocyte formula (predominance of immature elements) in congenital and neonatal infections.

2. Elevated D dimer levels in consumptive coagulopathy.

3. Prolonged bleeding time.

4. Prothrombin time is increased in disseminated intravascular coagulation, vitamin K deficiency, and congenital or neonatal infections.

5. Partial thromboplastin time is elongated in hemophilias and consumptive coagulopathy.

Prevention

- Vitamin K1 at birth and every 10 days during the first month of life in very low birth weight premature babies.

- Avoid risky medication in pregnant women and mothers who breastfeed their babies.

- Prompt, adequate management of birth asphyxia, respiratory distress, shock, congenital and neonatal infections.

Management [3,4,5,9,12].

- Intravenous or intramuscular vitamin K1.

- Intravenous fresh frozen plasma (baby's OAB and Rh type) brings clotting factors.

- Platelet transfusion in thrombocytopenia. The baby and the donor should be of the same OAB and Rh blood type unless there is isoimmune thrombocytopenia.

- Respiratory support: maintain airway patency, start oxygen therapy (CPAP or noninvasive/invasive ventilation) if needed.

- Circulatory support: ensure safe intravenous access, fluid therapy, start an infusion of pressors (most often Dopamine) on a separate line if needed.

- Prevent and treat the pain caused by invasive procedures by non-pharmacological means (pacifier, dextrose, positioning, gentle touch, talking to the baby, facilitated tuck) or analgesics.

Outcome

This is good in full term newborns with vitamin K deficiency but the death and disability rate may be high in babies, particularly preemies, with intracranial hemorrhage or sepsis with consumptive coagulopathy.

Neonatal Transport

Neonatal transport aims to offer equal chances of survival and adequate management opportunities to all newborns, regardless of their birthplace.

Newborns needing up transfer

1. Babies with severe neonatal diseases:

- Respiratory distress syndrome with respiratory failure

- Complications of respiratory distress syndrome: air leaks (pneumothorax, pneumomediastinum), apnea spells cessation of breathing longer than 20 seconds and bradycardia)

- Severe heart failure

- Critical neonatal encephalopathy

- Serious neonatal infections

- Renal failure needing dialysis

- Severe neonatal shock

- Resistant hypoglycemia

- Necrotizing enterocolitis needing surgery.

2. Babies with malformations requiring emergency surgery or extensive investigations:

- Anomalies of the digestive system: esophageal atresia, anal atresia, congenital bowel obstructions, congenital diaphragmatic hernia, and biliary tree atresias

- Urinary tract malformations

- Congenital heart defects

- Abdominal wall defects: gastroschisis (baby's intestines protrude through the umbilical ring, with an intact umbilical cord), omphalocele (abdominal organs protrude into the base of the umbilical cord), prune belly syndrome (urinary tract malformations, partial or complete loss of abdominal wall muscles, musculoskeletal abnormalities, undescended testicles)

- Central nervous system malformations: myelomeningocele.

3. Infants born outside of level III maternity wards:

- Premature babies with gestational age under 32 weeks and birth weight less than 1500 grams- the best option ought to be the transfer of the expectant mother at risk of preterm labor before birth!

- Infants with respiratory distress syndrome of various causes

- Newborns who require exchange transfusion
- Neonates with birth asphyxia

Contraindications of neonatal transfer

- Infants with congenital malformations with no survival rate or no available therapeutic solutions.
- Neonates with a gestational age less than 24 weeks,
- Newborns with a birth weight under 500 grams.
- Babies with no response to adequate 30 minutes of full-blown resuscitation at birth.
- Unstable infants.

Neonatal transport may worsen the baby's condition therefore the following rules must be observed:

1. Monitor the baby continuously

A. Clinical assessment:

- Heart rate
- Respiratory rate
- Capillary refill time
- Blood pressure
- Presence and severity of the respiratory distress syndrome – intercostal and subcostal recessions, grunting, nasal flaring, seesaw respiration, shallow breathing
- Pay attention to the symmetry of vesicular breathing and chest movement
- Reactivity
- Urine output
- Temperature.

B. Evaluation by paraclinical means:

- Complete blood count
- Blood gas analyses
- Peripheral oxygen saturation
- Blood sugar
- Serum electrolytes
- Chest and abdomen X-ray.

2. Baby's stabilization before the transport is mandatory.

3. Safe transport requires optimum conditions: adequate equipment and medication and skilled staff.

4. The staff of the hospital where the baby is being transferred must be prepared in due time to receive him adequately.

Infant's parents have to give their informed consent for the transfer; after receiving clear, understandable, complete data about their child's condition and therapeutic solutions they must weigh the risks and benefits of the transfer.

Baby's stabilization before the transport [1,3,4,5,9,12].

1. Respiratory stabilization

- Maintain airway patency by suction and tracheal intubation if necessary.
- Oxygen therapy, if needed: headbox, bag, and mask ventilation, CPAP or invasive respiratory support- mechanical ventilation; always use heated, humidified oxygen.
- Drain any existing pneumothorax.

2. Cardiovascular stabilization

- Obtain safe vascular access; an umbilical venous catheter is helpful; children with shock need two intravenous lines.
- Maintain adequate blood pressure:
- Hypotension in hypovolemic shock calls for normal saline bolus infusion that can be repeated after 30 minutes if the blood pressure does not rise;
- Pressure support (infusion of Dopamine or Dobutamine on a separate line) is required in all types of shock.

3. Maintain thermal comfort of the baby:

A. Prevent heat loss during care maneuvers

- Place the newborn in an incubator with servocontrol; its temperature is to be set according to the baby's birth weight, gestational age, and postnatal age.
- Wash hands with warm water before every maneuver.
- Dress the baby adequately as long as he does not need resuscitation or other therapeutic or monitoring maneuvers that require access to him.

B. In hypothermia- rectal temperature below 36, 4^{o} C:

- Gradual warming of the baby- the initial temperature of the incubator ought to be 1-1,5 o higher than the infant's temperature.
- Perform clinical monitoring of the baby: temperature, heart rate, blood pressure, respiratory rate, presence, and severity of the respiratory distress syndrome.
- Carry out the paraclinical evaluation of the newborn: peripheral oxygen saturation, blood gas analyses, blood sugar.
- Heating rhythm must not exceed 1-1,5^{0} C per hour.
- Observe the baby for risks of too rapid warming; tachycardia, heart rhythm problems, worsening of respiratory distress, low blood pressure, low blood sugar.
- Infants cared for in incubators have to be safeguarded from burns.

4 Help the infant maintain a normal blood sugar level: preemies, hypoxic, and/or hypothermic babies are prone to hypoglycemia (low blood glucose). Many of them do not enjoy a condition that allows them to receive oral feeds; what's more, feedings are a big no before the transport due to the risk of vomiting with aspiration pneumonia or cardiac arrest hazards. Thus a 10% dextrose infusion is needed to keep these babies' blood sugar normal. Hypoglycemia calls for 10% dextrose intravenous bolus followed by 10% dextrose infusion.

In nonresponsive hypoglycemia a higher dextrose intake, hence a greater concentration of dextrose solution for infusion

is necessary; if more than 12,5 % dextrose is needed the infusion is to be administered only via a central venous catheter or venous umbilical catheter.

Communication between the referring hospital and the referral hospital

Data regarding the baby to be transferred offered to the referral hospital have to be complete. They must include:

- The newborn's family history: parents' age, OAB, and Rh blood types and medical history, as well as siblings' medical history and Rh blood type;

- The infant's personal history: rank, pregnancy course, maternal medication during pregnancy, course of labor, how was the baby delivered, what was the indication for cesarean section(if any), gestational age, birth weight, Apgar score, infant's length, head circumference, chest circumference, and ponderal index at birth;

- A detailed, complete description of the clinical findings regarding the present illness: onset time and mode, evolution, infant's condition at the time of transfer;
- A complete, detailed account of paraclinical data;
- A complete, comprehensive, sequential report of baby's management: medication, diagnostic and therapeutic maneuvers;
- The name of the referring physician and of the referral hospital staff members having okayed the transfer;
- The time the physicians of the two hospitals got in touch;
- The time the newborn left to the referral hospital;
- The evolution of the baby's condition and paraclinical data during his transport;
- The time the infant arrives at the referral hospital;
- The baby's condition and paraclinical data at his admission to the referral hospital.

Parents - Staff Dialogue in the Neonatal Intensive Unit and Premature Babies Ward

Parents - staff communication in the neonatal intensive care unit and premature babies ward matters much to the way both parents and medical team members face the difficult first days of a frail baby. It has a deep, long term effect on all partners and their relationship.

Communication involves several partners who are considerably dissimilar from many points of view- education, socio-cultural background and level, cognitive and emotional cast, ability to act for the interest of the baby, and competence. All of them have one main aim, one responsibility, and one central concern: to choose what's best for the infant.

The way to disclose the diagnosis and prognosis of a sick newborn may have upon his parents the impact of the words the fairy godmother utters at the baptism of the little one. Parents are highly interested in their infant's welfare so they are easily affected by these words. They are also the ones entitled and responsible to give their informed consent for the investigations and care the infant needs. Moreover, the first days of the child's life are very special - a critical time for the foundation of the parent-child bond. The degree of satisfaction parents experience and their openness to collaborate with the nursing team of their baby depends considerably upon how their dialogue with the healthcare team develops. Their decision- making ability depends too on the quality of this data and ideas exchange. Efficient, balanced communication can impact positively- this means parents have a higher degree of satisfaction, come to co-operate better with the nursing team, and manage to make smoother and faster the best possible decisions. Contrarywise, dysfunctional communication might make them feel disappointed, discontented, disheartened, excluded. They may experience a pervasive sense of uselessness and find the collaboration burdensome. They can feel the decision-making process difficult, may be prone to change quite abruptly and frequently their resolutions, may become abusive and legal issues can occur. The way the data flow runs between parents and health staff also bears an influence upon the way parents will face and assume later, at home, the tricky task and demanding responsibility of raising and caring for their high- risk child with special needs.

Communication with parents matters much to the health professionals as well: they need information and feedback from the parents concerning their expectations, their perception of the condition and needs of the baby, the way they cope with the hardships of his first days of life, the way they feel about their infant, and also the manner they collaborate with the nurses and the physicians caring for their newborn. Medical staff members may feel more motivated and might experience a sense of professional fulfillment thanks to successful communication with the parents. On the other hand, they can be more often and deeper affected by burn-out and could feel harassed if miscommunication occurs.

Communication also influences the parents- baby nursing team relationship and shapes the quality of their partnership. One essential and valuable consequence of well-balanced parents- neonatal intensive care unit staff communication is trust. Parents trust the healthcare team of their baby does the best for their newborn, and physicians and nurses accredit parents will know how to adequately and successfully raise a child in whom they invested effort.

The paternalistic pattern of parents- medical personnel way to communicate is outdated. Present-day parents wish and are entitled to be involved in the decision-making process concerning their child. Most of them, especially when they are up against complex, sensitive, thorny issues, seek and feel the need for a reference authority and emotional support. They expect to receive these from the physicians and nurses; consequently, a non-judgmental approach of the health team is outstanding- even if it is not always an easy thing to do.

Parents-health professionals communication comprises a cognitive component and part related to emotions.

The cognitive level sets the foundation of this dialogue and matters much to the degree and way parents understand and process the data concerning the disease of their child [2,6,8,10, 12,13,14,15,16].

This information exchange is crucial to the decision-making of both parents and nursing staff regarding the investigations, treatment, and outcome of the baby. To be efficient and useful this data flow has to be bilateral. Parents are to inform the medical team about issues that may affect their baby- their pathology, blood type, medication, alcohol or drug abuse, consanguin-

ity, course of the pregnancy and birth, tests performed during pregnancy, pathology of siblings, and so on. They are also responsible for and entitled to give their informed consent to the diagnostic and therapeutic procedures their baby need. Nursing team members, for their part, provide parents with data about the condition, evolution, diagnostic tests, treatment, and short and long- term outcome of their baby.

The cognitive features of parents- healthcare team communication in the neonatal intensive care unit and premature babies ward depend upon several factors related to the staff and the parents.

A. Issues depending upon the health professionals

1. The quality of the information they offer to parents

Good quality data, stemming from the most appropriate investigations, is paramount; there may sometimes be no accordance between the severity of the disease as assessed by the medical team and the one estimated by the parents: they may overstress the seriousness of physiologic jaundice, toxic erythema, malformations like lip cleft or talipes valgus, cephalhematoma or a fractured clavicle but underestimate the severity of genetic diseases, inborn errors of metabolism, Rh or OAB isoimmune hemolytic disease, congenital infections, intrauterine growth restriction or prematurity.

Repeating the information is very helpful and useful.

Updating information when changes in the condition of the baby occur is also important.

2. The amount of data parents get: both too much or too little hinder the way the message is understood.

3. The accessibility of the language: a highly specialized speech is difficult to understand.

4. Timing of communication - the sooner, the better. Emergencies occurring in the neonatal intensive care unit may not allow the physicians and nurses to take their time to do this with no delay. On the other hand, some lab tests results needed to establish an accurate diagnosis (cultures, karyotype, genetic tests) may take time to come.

5. Laying stress upon the short and long-term outcome of the infant matters much to the understandability of the message.

6. Highlighting what both the medical team and the parents can do for the child makes things more comprehensible.

7. Eliciting feedback from the parents and assessing it are paramount.

8. Parents need a time-lapse for thinking and dealing with the data. This "respiro" may be useful for them to understand the information provided, gather more data and opinions from family members, friends, media, or the internet (but these data and opinions may as well be contradictory). However, emergencies of neonatal pathology may not always allow this recess.

9. Healthcare team consistency- coherent data provided by nurses and physicians with different specialties (neonatology, obstetrics, surgery, pediatrics, genetics, etc.) improve communication with parents, particularly in complex cases.

10. Addressing both parents increases the efficiency and understandability of data flow and feedback.

B. Cognitive issues depending on parents

1. Their cognitive matureness needed to realize the importance of the pathology of the child.

2. Rank of the newborn- parents with more than one child are more aware of the infant's needs and risks than those having their first child.

There are quite enough cognitive differences between parents and medical staff able to render the communication difficult and distort it. Thus repeating the information, as well as eliciting feedback, are essential both for parents and the medical team to make sure the communication is successful and helpful.

Emotional features of parents- baby nursing staff communication have a powerful impact upon this exchange [2,6,7,8,14,15]. The child in the neonatal intensive care unit or the premature newborn is the son or daughter of parents deeply involved emotionally. What's more, the birth of a baby is always a poignant moment for all the family, heavily charged with emotions- the more so as the baby is sick, frail, premature, threatened by death or disabilities.

This part of the dialogue varies a lot between different parents and undergoes various changes during time. It bears a considerable influence upon the way parents understand and deal with the data concerning their baby and the manner they cope with their infant's disease- thus upon their decision-making process. It also affects the way parents- child bond is established and the parents- medical staff collaboration. That's why eliciting and assessing emotional feedback from the parents are very important.

Emotional features of parents- neonatal healthcare team communication depend upon issues regarding the parents and the health professionals.

A. Issues related to the parents

1. They need emotional discretion to perceive and put up with their baby's disease.

2. The manner parents acknowledge emotionally their infant's pathology. They may experience shock, pain, confusion, followed by anxiety, depression, frustration, guilt, a sense of uselessness, feelings of inadequacy, helplessness, and disappointment. The feeling of helplessness, sense of uselessness, and depression can make parents aloof, unapproachable by their baby and his nursing staff, avoidant, less able to communicate and make decisions- particularly the difficult ones.

3. The way parents cope with their baby's illness. They may face it adequately, supporting the infant, getting involved in their child's care, making the best choices for him, accurately understanding the data concerning him. However, sometimes dysfunctional ways of coping may appear and develop: depression, denial of the disease, aloofness, avoidance, fond hopes or unfounded pessimism, frustration related to the infant's response to treatment and evolution. Frustration, unrealistic hopes, and anxiety may lead parents to put pressure upon the medical team of their newborn or eventually may make them abusive.

4. Neonatal pathology type: sudden-onset pathology - perinatal hypoxia due to a retroplacental hematoma, for instance- does not allow parents to take their time to fully realize the ex-

tent of the problem and set up means of coping. Slower-onset fetal conditions (intrauterine growth restriction, several malformations, and genetic diseases) may enable parents to understand better their baby's illness and face it in a timelier manner.

5. Time: parents need more or less time after the disclosure of their child's diagnosis and outcome to overcome the first difficult moments. They must get over the mourning of their ideal child, get accustomed to their real frail son or daughter, and accept him or her.

6. Pointing out what parents can do for their baby is helpful and useful.

7. Getting involved in their child's care as soon as possible helps parents overcome the first burdensome moments, fight the feeling of inadequacy and uselessness while promoting a healthy start of the parents- baby and parents- medical staff communication. while their baby is still in the intensive care unit they can provide him with support, breast milk, "kangaroo mother" care, and afterward, in the rooming-in ward, they can gradually assume their baby's daily routine care.

B. Issues concerning health professionals

1. Addressing both parents makes communication with them more satisfactory and emotional feedback more adequate.

2. Physicians and nurses can considerably help parents: emotional support and encouragement to get involved in their child's care mean so much to them. Parents are irreplaceable when providing breast milk and "kangaroo mother'' care in the neonatal intensive care unit and daily care in the rooming-in ward. Healthcare workers caring for the infant can set examples for them: direct communication with the newborn during diagnostic, therapeutic, and daily care maneuvers, addressing directly to the baby in simple, sincere words, calling him by name, paying attention to signs proving he is ready for a procedure and to his answers, and adjusting the rhythm of their actions accordingly show the child is regarded as someone valuable, a human being with full rights, thus making it easier for the parents to get in tune with their child. Parents of a sick baby need help to understand their child is not just a mere patient: he is, first of all, a human being, who needs to be accepted and loved by them, is entitled to respect and is valuable even if he is different due to a congenital disease, a malformation or another neonatal pathology.

The nursing personnel's empathy is all too understandable, highly appreciated by parents, and may ease a lot the opening of communication channels, the understanding, and assimilation of medical data by the infant's parents; it also smoothes their decision-making process.

Nonverbal messages (the tone of nurses' and physicians' voices, their mimicry, their posture, their glances, and their gestures) are also important to parents. Since parents are conscious of these signals they tend to establish connections between them and their baby's outcome, the seriousness of his condition, and the confidence medical staff has in the data they convey. Parents are likely to associate a flat voice, a scarce mimicry, a stiff posture or avoiding to look in their eyes to a bad outcome, a severe condition, or incomplete information (keeping away the worse); they may mistrust what the nursing staff tells them or believe their baby's condition and evolution are worse than they really are. On the other hand, a calm attitude of the medical team may inspire hope and trust. It may help them cope with the hardships of the first difficult days of their child and collaborate better with their baby's nurses and physicians- but some parents may sometimes consider it unconcern or deception, especially when hopes don't come true.

On the contrary, burn- out affecting deeper and deeper more and more physicians and nurses hinder their ability to listen to the parents with empathy, to answer their worries, and to assist them in helping their child. No wonder that quite oft times when it comes to judging the condition of a baby in the neonatal intensive care unit or the premature babies ward there are two separate truths, both from the cognitive and the emotional standpoints: the parents' one and the one of the medical staff. These two realities may frequently mismatch initially, but they must align afterward- the more efficient the communication process, the sooner.

Besides the features of the ones involved in the communication process, there also are system-related issues able to affect the quality of the parents- baby healthcare team interaction.

First of all, parents meet the baby's health team for the first time in life -and, what's more, in unexpected, critical, thorny, complex, and risky circumstances. They are unprepared for and greatly surprised by this threatening situation. Moreover, they have to deal fast with a bulk of data, belonging to a totally new and unfamiliar field. This information is hard to understand, complicated, rapidly updated, yet important, and calling for their immediate, utmost attention because significant, difficult decisions to be quickly made depend upon this data flow.

What's more, the neonatal intensive care unit is a high-tech medium crammed with intimidating devices, alarms, lights, and sounds they don't understand; the professionals' hasty actions increase their anxiety. These facts explain why they find it quite tricky to establish and develop an interaction with the staff caring for their baby.

Conversely, the nursing staff of the neonatal intensive care unit has to deal with hectic, challenging, life-threatening circumstances requiring immediate, prompt action or/and complex conditions with uncertainties needing time to elucidate. Hence its members may find it hard to manage to share both their time and readiness between caring for an unstable baby, communication with his parents, and offering them emotional support.

However NICU team also has several ways to make a positive change [7,13,14] - these are some helpful and important steps.

- Get the parents involved in the care of their baby and the decision- making process concerning him.
- Address both parents.
- Elicit and assess their cognitive and emotional feedback.
- Use understandable, straightforward language.
- Ensure timely communication and update regarding the infant's condition and evolution.
- Convey a comprehensible amount of data - neither too much, nor too little.
- Have a respectful and empathic approach to the baby.
- Emphasize the baby's short and long-term prognosis, and also what can be done for the infant by his parents.

- Avoid criticism; this issue may be difficult with abusive parents, families which do not support their babies in the NICU, or mothers who give birth to a child whose severe pathology could have been avoided or at least rendered less severe by antenatal treatment and follow-up; mothers who leave the hospital shortly after their premature babies are admitted in the NICU in serious condition and don't keep in touch with the medical team are also a serious issue as they later take home a high-risk child they're not familiar with, a child with special needs they are not aware of and thus the baby is neglected and suffers a life-threatening event requiring re-hospitalization in the intensive care unit.

- Meet the couples with high- risk pregnancies before their baby's delivery; these may be families with different conditions: maternal pathology that can affect the fetus(preeclampsia, diabetes mellitus, thyroid disorders, maternal infections which may harm the fetus, isoimmunization, pathology of the uterus), multiple pregnancies, pregnancies with intrauterine fetal growth restriction, pathology of the placenta, premature labor, abnormal results of fetal tests during pregnancy; in this respect cooperation with obstetricians is paramount.

One important and valuable consequence of a well-balanced interaction and relationship in the NICU and the preemies ward is trust; parents trust their baby's nurses and physicians do what's best for him and medical team members trust parents will know how to adequately and successfully raise a child in whom they invested effort and hopes.

All in all, parents- baby medical staff dialogue is an important issue, which has a strong, dual, long-lasting effect upon all the ones involved in it. This complex experience is prone both to progress during the baby's hospital stay and to interference affecting everyone taking part in it. Nurses and physicians can do much (prophylactically and also therapeutically) to help make this process balanced and efficient.

Infant Care in the Well-Baby Unit

Rooming-in is the best choice for the optimum care of healthy infants. This system is beneficial to both the baby and his mother.

Advantages of the child

- He mainly interacts with one person- his mother- not with several nurses, therefore the same care style and rhythms are maintained. This consistency has a positive influence on his psychological adjustment to the extrauterine life and further development. His stress level is lower, his basic sleep-wake and feeding rhythms are established faster and more smoothly and the communication with his mother is way better.

- The opportunity to conveniently breastfeed on-demand, without restrictions helps breast milk flow establish more readily. The baby feeds better, his postnatal weight loss is reduced and physiological jaundice occurs seldom, lasts less, and is milder.

- Last but not least infant's microbiota, all the bacteria that colonize the newborn gut and skin, having a great both short-term and long-term impact upon his health, consists of saprophytic bacteria that belong to the maternal flora; the newborn is exempt from the risk of colonization with pathogenic hospital germs.

Benefits of the mother

She gets to know better her child, hence she adjusts faster and more readily to his needs, enjoys a heightened self-confidence and a lesser anxiety level; she grows attached faster and more easily to her baby, she gets accustomed more quickly and less effortlessly to her child and her motherhood, she communicates better with the newborn and interacts better with him.

Rooming-in is more demanding for mothers having given birth by cesarian section or affected by various pathologies during their childbed, but also for premature babies or infants with different neonatal illnesses.

Physical assessment of the baby is to be carried out daily when grooming him and during rounds. This exam must follow some basic and essential steps.

1. Make sure both the baby and his mother have their identification bracelets when leaving the delivery room. Identity bracelet check must be repeated when the baby is admitted to the neonatal intensive unit, premature babies ward, or rooming-in room ward and afterward during rounds and baby's grooming.

2. Inspect the color and aspect of the skin and mucosae in bright daylight.

A. Color

1. Acrocyanosis (bluish discoloration of the extremities) is quite frequent in newborns and does not necessarily have a negative meaning. Contrarywise, central or generalized cyanosis, be it triggered by feeding and/or crying, or occurring at rest is pathological.

Figure 28: Acrocyanosis (wwww.grepmed)

Figure 29: Central cyanosis (wwww.researchgate.net)

2. Erythrodermia- a reddish discoloration of the skin- is quite frequent during the first days of life.

Both pallor and a dark reddish hue are pathological: the first one suggests anemia and the second one polycythemia- elevated red blood cell count with a risk of severe neonatal jaundice or heart failure.3. Mild jaundice developing after 48- 72 hours of life and limited to the face and upper body (no involvement of the sclera) is usually physiological. Jaundice with onset before day 2-3 of life is pathological and so is also jaundice with a dark or greenish shade and the one accompanied by pallor.

B. Look for rashes

- Toxic erythema (erythema neonatorum) is quite common in full-term babies; it appears as red macules (spots) that can cover more or less of the body area and may have a central white vesicle. This rash disappears spontaneously within a few days.

Figure 30: Toxic erytheme of the newborn (wwww.skinsight.com)

- Pustules draw attention to an infection.

Figure 31: Pustules.

C. Ascertain skin desquamation.

- Physiological desquamation is quite common in full-term newborns; it is furfuraceous, bran like and covers the body and limbs. Babies born after 42 weeks of gestation have more intense desquamation.

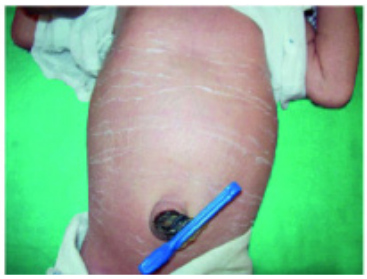


Figure 32: Physiological scaling.

- Generalized lamellar desquamation occurs in ichthyosis - a congenital skin disease.

Figure 33: Ichtyosis

- Lamellar desquamation covering the palms, soles of the feet, and the body may point to a serious congenital infection- syphilis.

Figure 34: Neonatal syphilis.

D. Assess for edema.

- Swelling occurs quite frequently in newborn babies at the presentation site: eyelids in infants born in cranial presentation, genitalia in those born in breech presentation; this edema resumes within a few days.

- Edema of the abdominal wall may be associated with necrotizing enterocolitis.
- Edema of a limb may point to birth trauma.

E. Look for bruises.

- Bruises at the presentation site (face, front, scalp in babies born in cranial presentation or buttocks and/ or genitalia in infants born in breech presentation) are not uncommon; they resolve within days.
- Bruises occurring at minimal trauma may be related to bleeding disorders.

F. Mottled skin is associated with sepsis or hypothermia.

Figure 35: Mottled skin.

3. Check out the umbilical cord stump and periumbilical skin; sticky, moist umbilical stump with a foul smell and redness or/ and induration of the periumbilical area suggest omphalitis.

4. Assess respiration.

A. Respiratory rate- it should be 40- 50 breaths/ minute. Both tachypnea (respiratory rate over 60/minute) and bradypnea (respiratory rate under 40/minute) are pathological.

B. Breath rhythm-this should be constant, with no periods of tachypnea, apnea (cessation of breathing for more than 20 seconds+ bradycardia), or bradypnea.

C. Appreciate the work of breathing- infants with respiratory distress syndrome have an increased work of breathing and may consequently need respiratory support.

D. Evaluate the respiratory drive. Newborns with neonatal encephalopathy, respiratory distress syndrome, or sepsis may have a low respiratory drive, therefore respiratory support is required.

E. Watch for signs of problems:

- Occurrence of grunting, nasal flaring, intercostal and subcostal recessions point to respiratory distress syndrome.
- Apnea spells call for immediate evaluation and action: tactile stimuli, clearing of the airway, oxygen therapy, bag and mask ventilation, respiratory support.

5. Assess the feedings:

- Frequency
- Duration
- The way the infant latches onto the breast
- Suck-swallowing coordination
- Suck- breathing coordination
- How energetic the suck is
- Appetite
- Feeding tolerance
- Feeding effort tolerance
- Occurrence of spitting, vomiting.

6. Evaluate the behavior and neurological status; they are affected by his gestational age-dependent central nervous system maturation.

1- Appraise his

- Reactivity
- Behavior
- Consolability
- Level of consciousness
- Sleep-wake cycles

Reactivity and level of consciousness mature with growing gestational age; sleep-wake cycle develop during the first weeks of life and bear the influence of baby's daily routine.

2- Assess his

- Posture
- Muscle tone
- Physical activity
- Reflexes
- Cry.

Healthy newborns have symmetric resting posture, all four extremities flexed and symmetric reflexes, and spontaneous physical activity. Muscle tone and resistance to passive motion increase with gestational age.

3. Look for problems:

- Hypotonia (floppy infants) and hypertonia (increased muscle tone) call for further investigations for neuromotor and general issues (sepsis, hypoglycemia, hypocalcemia, etc.).

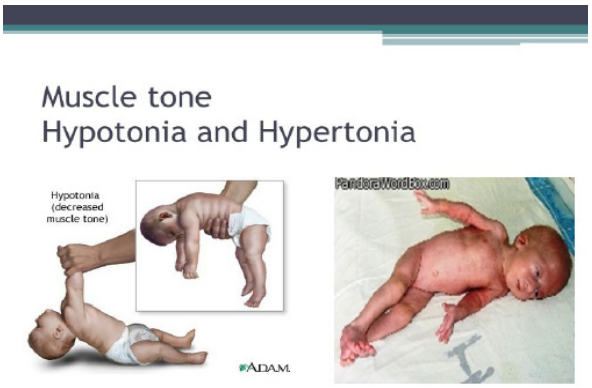


Figure 36: Hypotonic and hypertonic newborn.

- Changes in behavior and cry (irritability, lethargy, weak cry, high pitched cry) call for investigations for neurological and general issues: sepsis, hypoglycemia, hypocalcemia, etc.
- Various types of seizures are emergency issues that occur in neurological illnesses (neonatal encephalopathy, brain abnormalities, intracerebral hemorrhages, neonatal stroke), metabolic conditions (hypoglycemia, hypocalcemia, hypernatremia, hyponatremia, inborn errors of metabolism, kernicterus), septic issues (congenital infections, neonatal infections), etc.

8. Assess voiding and stools

A. Voiding

Infants usually pass their first urine in the delivery room or within their first 24- 48 hours of life; children having not done so ought to be referred to a pediatric surgeon due to their risk of urinary system anomalies.

A well-fed baby usually « fills » 5 diapers per day.

Normal urine leaves a slightly yellow stain on the diaper. Babies with insufficient milk intake have urates in their urine that leave a red mark on the diaper.

Babies with pathological jaundice may have excess urobilinogen in their urine so its color may become dark yellow or light brown.

B. Stools

Newborns usually pass their first stool during the first days of life.

Stools of the first two days of life (meconium) have a dark, blackish color and are sticky. As the infant receives more breast milk his stools become lighter (yellow) and softer, resembling the scrambled eggs.

Black, tar-like, shiny stools (melena) occur in gastro-intestinal hemorrhages from neonatal bleeding disorders.

Underfed newborns pass dark greenish, dry stools.

Newborns may pass from one stool per day to one stool after every nursing session.

9. Some babies- both girls and boys- may have swollen breasts and sometimes develop small breast lumps due to maternal hormones that pass through the placenta. This problem disappears within days. Newborn‘s breasts must not be pinched due to the risk of infection.

Some newborn girls may also experience a vaginal discharge that may be white or sometimes slightly bloody.

10. Measure the baby's temperature.

11. Weigh the infant

His physiological weight loss should not exceed 10% of his birth weight and should not last more than 3 days.

The daily growth rate should not exceed 50 grams. A higher rate rises the suspicion of heart failure.

Physical examination of the baby is to be done together with the assessment of parents' interaction with him.

Daily care of the well newborn:

Groom him with lukewarm water followed by a gentle massage with protective ointments. Nappy rash can be prevented by a frequent diaper change, use of protective ointments, and giving the baby's bottom some time without a diaper.

Umbilical cord stump care with local disinfectants is required during the first days of life. Keep it dry, out of baby’s pampers.

Dress the infant adequately.

Offer parents information about their child and how to look after him as well as support and nurture.

Limit infant formula usage to the shortest possible time and give it only to newborns who really need it.

Give the baby his first vaccines- the one against hepatitis B during his first day of life and Bacille Calmette- Guerin against tuberculosis in babies older than 2-3 days weighing more than 2500 grams.

Babies aged 2-3 days undergo screenings for inborn errors of metabolism, congenital disorders of the endocrine system, inherited disorders of hemoglobin, critical congenital heart disease, and hearing loss.

Screening for inborn errors of metabolism, endocrine, and hemoglobin disorders is a simple blood test from a small amount of blood obtained by pricking the baby's heel. Diseases included in screening programs are conditions that are not obvious from the first days of life and are not so rare. They may soon become life-threatening, carry a very high risk of severe disabilities, and have a good outcome with pharmacologic treatment and/or adequate diet started very timely. This list varies in different countries and states. Test results are ready within some days; if the test is positive for a disease parents will be notified.

Screening for critical heart malformations consists of 2 pulse oximetry tests. An oximeter sensor attached to the baby's right hand reads the saturation in the region receiving blood from a preductal vessel that emerges from the aorta before the ductus arteriosus connection to the pulmonary artery. A sensor placed on his left hand or any foot reads saturations in an area irrigated by postductal arteries, emerging downstream the ductus arteriosus. Normal readings are above 95%, with a difference between preductal and postductal values of 3% or less. Babies who fail this test must promptly undergo an echocardiogram and be timely referred to a pediatric cardiologist- they can have heart defects that can soon manifest as a very severe cardiac failure requiring adequate emergency care and may also have high death or disability.

Newborn hearing tests use devices with a soft earpiece placed in the ear canal of the baby. Test results come immediately; they may be affected by the movements of the infant, environmental noise, or dysfunction in the middle or external ea (i.e. debris in the external ear canal). A ''Pass'' result is reassuring. This test must be repeated in children who fail it.

Hearing screening must be reiterated before the discharge from the hospital in babies at risk for hearing loss: preemies, neonatal intensive care graduates, infants with pathologic neonatal jaundice, congenital infections, abnormalities of the outer ear, family history of permanent hearing loss, and personal history of ototoxic medication (Gentamycin, Amikacin, Tobramycin, Furosemide). Children who fail the second test must be timely referred to an ENT specialist so they can have normal language development.

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