Common Conditions, Concerns, and Equipment in the NICU

Babies in the NICU are carefully monitored because of their health risk. While the following is a comprehensive list of common conditions found in the NICU, it is by no means meant to scare parents. Not all preemies will have these problems, but, if your baby does have a common condition, the following explanation is meant to help you understand what is happening and calm your fears.
General Conditions

Prematurity

Babies born before 37 completed weeks of gestation (or before the 37th week of pregnancy) are called “preterm” or “premature.” Preterm babies are at risk for a variety of problems, including the following:

- Breathing
- Feeding (and breathing and feeding at the same time)
- Infection
- Staying warm

Premature babies need special medical care that is offered only within Neonatal Intensive Care Units (NICUs) or Special Care Nurseries (SCNs).

Heart and blood pressure monitors

In the NICU, a baby’s heart rate, respiratory (breathing) rate, blood pressure, and temperature all will be monitored. Small sticky pads are placed on the baby’s skin and these detect information and send it to a screen at the baby’s bedside. A small blood pressure cuff is used to measure blood pressure. This is also hooked up to the machine. Sometimes blood pressure is monitored through a thin tube inserted into an artery. An alarm will sound whenever the baby needs to be checked by a nurse but some alarms are “false alarms” caused by the baby’s movements.

Central line

When your baby is born, the health care team may place a thin tube, called a central line or catheter, in the umbilical vein. This line is used to give your baby intravenous nutrition and medicine. The line also can be used to check how your baby is breathing. Later, your baby might need to have the umbilical line replaced with a PICC (peripherally inserted central catheter) line, which is placed in one of the major blood vessels. Other types of central lines, such as Hickman and Broviac catheters, also may be needed.

Hyperbilirubinemia (Jaundice)

Hyperbilirubinemia or jaundice occurs when there is too much of a chemical called bilirubin in the blood. Bilirubin is made when red blood cells (RBCs) are broken down after normal use, as is common after a baby is born, or from an infection or problem with the blood. High levels of bilirubin cause the skin to become yellow or pink-yellow in color. The more bilirubin, the more yellow (or jaundiced) the skin. If the bilirubin level becomes very, very high, it can cause more serious problems, like brain damage or hearing loss.
In a healthy baby, bilirubin moves through the blood to the liver and then leaves the body in the urine and stool. Because preemies have immature livers, there is a delay in how fast the bilirubin leaves the body. This can result in higher levels of bilirubin in a preemie than in a more mature baby. Bilirubin levels also can be higher in babies who are sick.

Bilirubin levels are measured in the blood shortly after birth and then every day until the levels begin to drop. Treatment for high bilirubin levels depends on the baby's weight and age. It usually includes using special blue lights, called phototherapy or “bili lights.” These lights change the bilirubin to make it more soluble so it can easily leave the body in the urine. During this treatment, the baby will lie under the lights. His eyes will be protected and his position will be changed frequently to expose all skin areas. How high the bilirubin levels are determines the number of lights a baby needs. If the phototherapy lights don’t adequately decrease bilirubin levels, another treatment, called an exchange transfusion, can be done. This procedure is only rarely needed and involves exchanging some of the baby's blood with donated blood to lower the bilirubin level.

**Infection (Sepsis)**

Sepsis is an infection of the bloodstream. Usually, it is caused by germs (bacteria). In some cases, it is caused by a virus or fungus.

Sepsis can be very serious and often requires additional care or longer hospital stays. When babies get ill in the first week after birth, the infection might have started before birth or during delivery. Babies who become ill after 7 days of age have what is known as late-onset sepsis. This infection is usually caused from germs the baby is exposed to in the hospital. Premature babies are at risk for infection because of their fragile skin and poor ability to fight off germs. Possible signs of sepsis include the following:

- Body temperature that is too high or too low
- Breathing problems (such as apnea, or the need for oxygen or ventilator)
- Change in blood pressure (especially low blood pressure)
- Low activity level or decreased movement
- Feeding problems

Treatment for sepsis includes

- Antibiotics
- Blood tests to check for signs of infection
- Fluids or medicine to increase blood pressure
- Giving oxygen or using a ventilator to help the baby breathe
How long this treatment is needed depends on how sick the baby is and what caused the sepsis.

**Temperature control**

Healthy full-term babies have a layer of fat under the skin that protects them from heat loss. Babies who are born early have not had the chance to put on weight and do not have this fat layer under their skin. The best way to keep preterm babies warm is through the use of an isolette (or incubator). This a special crib that provides extra heat to preemie or sick babies. As the baby gets bigger and more mature, he will be able to move into an open crib. This is one of the main criteria used to determine when a baby is ready to go home.

**Radiant warmer**

This is an open bed with a heat source over the baby. It may be used instead of an incubator, especially for babies who need frequent handling or care.

**Late Onset Hearing Loss: Extended Stay in NICU**

Left undetected, hearing loss in infants can negatively impact speech and language acquisition, academic achievement, and social and emotional development. If detected early, however, morbidity can be diminished and even eliminated through early intervention services. The following will review some of the risk factors associated with hearing loss that accompany an infant’s extended stay in the NICU.

**Very Low Birth Weight (<1,500 g)**

The risk for sensorineural hearing loss increases as the birth weight decreases. Babies who weigh less than 3,000 g are also at an increased risk for hearing loss compared with babies weighing more than 3,000 g.

**Ototoxic Drugs**

Ototoxic drugs can cause toxic reactions to structures of the inner ear that can result in loss of hearing and/or balance. Following is an example of an ototoxic drug:

- Aminoglycoside antibiotics may be ototoxic when administered to a child, or to the fetus when administered to a pregnant woman. Sensorineural hearing loss results from damage to the hair cells of the vestibular and cochlear organs (components of the inner ear).
Low Apgar Score (0-4 at 1 minute or 1-6 at 5 minutes)

Newborns with low Apgar scores are at an increased risk for hearing loss because of their existing condition or because of consequential medical procedures.

Postnatal Infection Associated With Sensorineural Hearing Loss (Sepsis, Bacterial Meningitis)

Bacterial meningitis and sepsis are severe invasive disease. These infections can lead to sensorineural hearing loss. In addition, antibiotics used to treat the infections may be ototoxic.

Hyperbilirubinemia Requiring Exchange Transfusion

Hyperbilirubinemia, or jaundice, occurs in 50% to 60% of all newborns. It is often without consequence, but it can cause damage to the nervous system if severe. In cases of severe hyperbilirubinemia, the auditory neural pathways (cochlear nuclei of the brain stem) and/or the cochlea may be affected, leading to neonatal hearing loss. Babies with hyperbilirubinemia at a serum level requiring exchange transfusion should have additional auditory brainstem response (ABR) testing.

Mechanical Ventilation for >5 Days

By the time a baby has been put on mechanical ventilation, he may have already sustained a high level of oxygen deprivation. A lack of oxygen can accelerate the deterioration of the sensory cells of the inner ear. Mechanical ventilation also could indicate other possible problems associated with hearing loss, such as bronchiopulmonary dysplasia or persistent pulmonary hypertension.

Condition at Birth Requiring Use of Extracorporeal Membrane Oxygenation (ECMO)

Babies who need ECMO may experience levels of oxygen deprivation sufficient to cause damage to the sensory cells of the inner ear. About one-fourth of ECMO graduates develop sensorineural hearing loss. Roughly one-half of ECMO graduates with sensorineural hearing loss have a progressive type of loss, which reinforces the importance of follow-up screening.

(Permission to use information from Risk Factors for Late Onset Hearing Loss: Extended Stay in NICU was granted by Washington State Department of Health/Early Hearing Loss, Detection, Diagnosis, and Intervention Program.)
Breathing Conditions

Apnea and Bradycardia

It is normal for premature babies to have breathing pauses. Any pause in breathing that lasts for more than 20 seconds is called apnea. A decrease in the heart rate below a normal level is called bradycardia. These conditions are common in preemies and usually go away when they are between 35 and 40 weeks’ corrected age. However, apnea might take longer to go away in infants born very preterm (23-27 weeks’ gestation). These conditions are common in preemies because the part of the brain that controls breathing is not fully developed. They can cause the baby to become pale purple or dusky blue in color. The baby also might become limp and the heart rate might slow down.

Babies in the NICU are watched closely for apnea and bradycardia (often called A’s and B’s). When a baby stops breathing or the heart rate drops below a certain number, a monitor will alarm.

There are several types of treatment. First, if the apnea and bradycardia are mild, the baby simply may need to be observed or gently reminded to breathe by touching the baby or changing his position. If the baby is very premature or the apnea and bradycardia are severe, medicine (usually caffeine) is used. Otherwise, babies are treated with oxygen or air blowing in a little tube under the nose or with breathing support, such as CPAP or a ventilator.

Early Lung Conditions

Respiratory Distress Syndrome (RDS)

Another term that you may hear is respiratory distress syndrome (or RDS). It also might be called by its old name (hyaline membrane disease) or its biological cause (surfactant deficiency). RDS is very common in preemies. It affects babies whose lungs have lower than normal amounts of a body substance called surfactant. This substance helps make breathing easier by holding open the air sacs of the lungs. If these sacs do not open easily, the lungs cannot take in air, get oxygen into the bloodstream, or get rid of carbon dioxide. Babies with RDS breathe fast, causing the chest and ribs to pull in and out. They also may make grunting or soft crowing sounds when they breathe.
Tests to diagnose RDS include a chest x-ray and blood tests to measure oxygen and carbon dioxide levels (this test is called a “blood gas”). Any baby with trouble breathing should be checked for RDS.

Treatment includes giving the baby oxygen. This can be done with an oxygen hood or with CPAP (continuous positive airway pressure). CPAP is a scuba-like mask or nasal prongs that keep air sacs open and helps the baby breathe. If oxygen isn’t enough, a ventilator (breathing machine) is needed. To breathe on a ventilator, a tube must be placed into the baby’s airway (trachea). This tube is needed both to give surfactant and help with breathing. There are a number of different ventilators that may be used. Some give the baby regular breaths, others allow the baby to breathe on his own, and still others use gentle vibration to help the lungs. Up to 4 doses of surfactant can be given over the first 2 days after birth.

Complications of RDS can include lung collapse (or pneumothorax), intraventricular hemorrhage (IVH), developmental delay, and chronic lung disease (CLD), also called bronchopulmonary dysplasia (BPD).

**Pneumothorax (Air Leaks or Lung Collapse)**

A pneumothorax is an event that occurs when the breathing sacs in the lungs break and air leaks into and gets trapped in the space between the lung and the chest wall. If this happens, air cannot get back into the lungs for normal breathing. It can cause collapse of the lung as well. This condition is common in preemies or babies whose lungs lack surfactant. Babies who breathe in meconium (the first stool) while still in the womb are also at high risk for pneumothorax.

There are 3 types of air leaks that are seen in babies.

- “Spontaneous” pneumothorax, which occurs for no known reason in healthy babies and may or may not cause a problem.
- “Tension” pneumothorax, which is more common in babies who are on ventilators. This is a medical emergency because the lung collapse puts pressure on the heart, interfering with heart function and circulation.
- Pulmonary Interstitial Emphysema (PIE), which is a condition involving air leaking within the lung tissue itself. This type of air leak also puts the baby at increased risk of a pneumothorax and often requires the use of a special ventilator, especially the high frequency ventilator.

Tests include the use of fiber-optic lights (transillumination) to look for trapped air in the lungs and chest x-rays.
Treatment includes giving the baby high amounts of oxygen. A tension pneumothorax is treated with a chest tap (called a thoracentesis) to remove the air. If the air leak is severe, a chest tube is placed between the lung and chest wall to refill the lungs and allow them to heal over a few days.

**Persistent Pulmonary Hypertension of the Newborn**  
(Also Known as PPHN or Persistent Fetal Circulation)

Before birth, babies get oxygen from their mothers through the placenta. Therefore, they do not use their lungs to breathe air (although they make breathing movements, even when they are in the womb). When a baby is born, blood flows to the lungs and the baby breathes on his own. There are a number of conditions that can interrupt this process. These include

- Infection
- Meconium aspiration (when a baby breathes in a small amount of stool while still in the womb)
- Low oxygen levels
- Lack of surfactant in the lungs

If blood does not go to the lungs, the baby does not have enough oxygen. This causes the baby’s skin color to be bluish-gray.

Tests include checking the baby’s blood oxygen, pH, and carbon dioxide (blood gases), chest x-rays, and a special study of baby’s heart called an echocardiogram (echo). This test checks the structure of the heart and lungs and blood pressure.

Treatments include using a ventilator to help the baby breathe, blood pressure medicine, a medicine that relaxes the lung blood pressure (called nitric oxide), and, in some cases, heart-lung bypass (extracorporeal membrane oxygenation).

**Transient Tachypnea of the Newborn (TTN)**

Tachypnea is the medical word for fast or rapid breathing. Rapid breathing that gets better over the first few hours or days and does not recur is called Transient Tachypnea of the Newborn (TTN). TTN occurs because fluid in the baby’s lungs is not absorbed after birth. The symptoms of TTN are similar to RDS, but are usually milder. Some babies with TTN need oxygen, but only rarely will a baby with TTN need to be on a ventilator.
Oxygen Hood and Nasal Cannula

An oxygen hood is a clear plastic box that goes over a baby's head. A nasal cannula is a thin tube with 2 small prongs that fit into a baby's nostrils. Both give oxygen to help with breathing.

Pulse Oximeter

To measure a baby's pulse, a small stretchy bandage with a sensor in it is wrapped around the baby's foot, hand, or wrist. The oximeter uses a light sensor to make sure there is enough oxygen in the baby's blood. The sensor does not hurt the baby and it helps the health care team know if the baby needs more or less oxygen.

Later Lung Conditions

Bronchopulmonary Dysplasia (BPD)

This also is known as chronic lung disease (CLD) of prematurity. BPD is most common in newborns who

- Lack surfactant in their lungs
- Have very underdeveloped lungs
- Need high amounts of oxygen
- Are on a ventilator

The highest rates of BPD are among newborns born at 23 to 26 weeks of gestation (14-17 weeks before their due date). However, it can occur in other preterm newborns as well. Rarely, BPD can affect ill full-term newborns.

Treatment includes giving the baby oxygen, good nutrition, and sometimes diuretics (medicine that increases urine output) or bronchodilators (medicine that helps open the airways). A baby with BPD might need to be on a ventilator for a while before he can breathe on his own. After the ventilator is removed, the baby still will need to get oxygen through a little tube under the nose. Some babies need to go home with this extra oxygen.

A baby with BPD must be protected from catching a cold or the flu. For these babies, a simple cold can turn into a severe, or even fatal, pneumonia. While many babies with BPD outgrow their lung problems, some preemies with BPD will have lung problems that last through young adulthood.
**Pneumonia**: This lung infection is common in premature and other sick babies. A baby's doctors may suspect pneumonia if the baby has difficulty breathing, if his rate of breathing changes, or if he has an increased number of apnea episodes.

The doctor will listen to the baby's lungs with a stethoscope and then do an X-ray to see if there is excess fluid in the lungs. Sometimes, the doctor may insert a thin tube down the windpipe (trachea) to take a sample of the lung fluid. The fluid is then tested to see what type of bacterium or virus is causing the infection, so that the doctor can choose the most effective drug to treat it. Babies with pneumonia generally are treated with antibiotics. They also may need additional oxygen until the infection clears up.

**Heart Conditions**

**Patent Ductus Arteriosus (PDA)**

Before birth, babies get oxygen from their mothers. They do not use their lungs to breathe. Instead, blood goes past the lungs through an opening in a blood vessel just outside the heart called the ductus arteriosus. During the first few hours or days after birth, this opening starts to close, allowing the baby to use the lungs to breathe. However, it is not uncommon for the ductus arteriosus to stay open in sick or premature babies. If that happens, it is called a patent ductus arteriosus or PDA. (The ductus is actually a normal fetal artery connecting the aorta and the pulmonary artery.)

In a PDA, extra fluid builds up in the lungs, making it hard for the baby to breathe. Symptoms include

- Fast breathing
- Need of a ventilator (breathing machine)
- Poor growth
- Presence of a heart murmur

Treatment depends on how the baby is affected by the PDA. A cardiologist (heart doctor) will examine the baby and use a heart test called an echocardiogram to confirm the PDA. A medicine may be used to close the PDA. In some cases, the baby might need to have surgery to close the PDA.
Congenital Heart Defects

Congenital Heart Defects are structural heart problems that are present at birth. They originate in the first weeks of pregnancy when the heart is forming.

Coarctation of the aorta: The aorta is the large artery that sends blood from the heart to the rest of the body. In this condition, the aorta may be too narrow for the blood to flow evenly. A surgeon can remove the narrow part and connect the ends together, replace the constricted section with man-made material, or patch it with part of a blood vessel taken from elsewhere in the body. Sometimes, this narrowed area can be widened by inflating a balloon on the tip of a catheter inserted through an artery.

Heart valve abnormalities: Some babies are born with heart valves that are narrowed, closed, or blocked, and prevent blood from flowing smoothly. Some babies may require placement of a shunt (tube between 2 blood vessels) to allow blood to bypass the blockage until the baby is big enough to have the valve repaired or replaced.

Septal defects: A septal defect refers to a hole in the wall (septum) that divides the 2 upper or lower chambers of the heart. Because of this hole, the blood cannot circulate as it should, and the heart has to work extra hard. A surgeon can close the hole by sewing or patching it. Small holes might close by themselves and not need repair at all.

Tetralogy of Fallot: In this condition, a combination of 4 structural problems keeps the normal amount of blood from getting to the lungs. As a result, the baby has episodes of cyanosis (blue spells) and may grow poorly. New surgical techniques allow early repair of this complex heart defect.

Transposition of the great arteries: Here, the positions of the 2 major arteries leaving the heart are reversed. Each artery arises from the wrong pumping chamber. Surgical advances have enabled correction of this problem in the newborn period.

Intestinal Conditions

Necrotizing Enterocolitis (NEC)

NEC is a serious disease of the intestines that most often affects premature babies; however, sometimes full-term babies also get NEC. Babies who are born very early, are very small, or are very sick are at highest risk. This is because they
often have less blood flow to their intestines and are at higher risk for infection.

NEC usually develops within the first 3 weeks, often after feedings are started. The intestine becomes smaller and weaker, and this can cause a hole to form. If a hole (perforation) develops, bacteria can leak into the baby's blood or abdomen, causing a life-threatening infection.

NEC can happen very quickly—within a few hours. The baby can go from healthy to critically ill. When a baby recovers from NEC, the bowel may still be weak and additional problems can come up when feedings are started again. However, it is rare for NEC to happen again.

Tests include abdominal x-rays and blood tests.

Treatment includes giving the baby IV fluids and antibiotics. Babies with NEC have a tube inserted to drain stomach acid and are fed through an IV to let the bowels rest (often for 1 to 2 weeks). Surgery is needed if the disease is severe or a perforation (hole) is found in the intestine.

### Blood Conditions

**Anemia**

Anemia is the term for a low blood count or low red blood cells. Red blood cells are important because they carry oxygen throughout the body. Preemies are at higher risk for anemia because of their size and because of the number of blood tests they need. If anemia is severe or the baby also has low blood pressure, a blood transfusion is needed. Less severe anemia is treated by giving iron medicine and by adding iron to breast milk or formula.

### Neurological Conditions

**Intraventricular Hemorrhage (IVH)**

An IVH is a collection of blood (hemorrhage) in or around the normally fluid-filled spaces (ventricles) on each side of the brain. It is common in very small and very sick preemies because the blood vessels on their brains are very delicate and can break easily. Babies with breathing problems and low
blood pressure are at especially high risk for IVH. Most hemorrhages occur in the first few days of life. Babies born before 32 weeks’ gestation have a special test of the head (called a sonogram or ultrasound) by the seventh day of age. IVH is divided into the following grades (or degrees):

Grade 1: A small amount of blood outside the ventricles

Grade 2: Bleeding inside the ventricles but the ventricles are normal size

Grade 3: Blood inside the ventricles and the ventricles are large in size

Grade 4: Bleeding outside the ventricles into the surrounding brain tissue

Major bleeding can cause increased pressure on the brain. It also can cause not enough blood to go to the brain tissue. Brain bleeding in premature babies can have a variety of long-term effects. Some babies will not have any permanent damage and will develop normally. Other babies can have mild, moderate, or severe brain damage.

**Brain and Body Imaging**

There are several types of tests that your baby may need to help doctors see inside the body, including the following:

- **Ultrasound:** Takes pictures of the internal organs using sound waves. It does not hurt and can be done at the baby’s bedside.

- **X-rays:** Takes pictures of the lungs, bones, and other internal organs. Several x-rays might be needed depending on what the doctor is looking for. The baby will be exposed to a small amount of radiation during an x-ray. However, x-rays are often needed to help make important decisions about a baby’s care. They also can be done at the bedside.

- **Computed tomography (CT or CAT scan):** Takes more detailed pictures than an x-ray or ultrasound. A beam of energy is focused on a certain area of the body and then shown in detail on a computer. This test cannot be done at the baby’s bedside and involves greater radiation exposure than a regular x-ray.

- **Magnetic resonance imaging (MRI):** Uses powerful magnets and computers to create images of tissue that are even more detailed than a CT scan. This test cannot be done at the baby’s bedside. Some babies need sedation to help keep them still during this test. An MRI does not give the baby any radiation exposure.
Periventricular Leukomalacia (PVL)

PVL is a cyst formation in the brain tissue around the ventricles (chambers) in the brain. PVL may be caused by

- A hemorrhage in the brain
- A brain infection, such as meningitis
- Other infections, including infections during prenatal life

It can occur in premature babies and usually happens without warning. It can be seen with a head ultrasound, although it may take several weeks before PVL shows up. PVL increases the risk of a baby having long-term problems with muscle movement and coordination, vision, or intellectual development.

Retinopathy of Prematurity (ROP)

This is an abnormal growth of blood vessels in the retina (the lining at the back of the eyeball that sends images to the brain). It is seen in some preterm babies, especially those born more than 12 weeks early.

When a baby is born early, the blood vessels in the eyes are not fully developed. If these blood vessels do not grow normally, bleeding and scarring can affect vision. Doctors do not know all the reasons why ROP happens, but being premature and the use of high amounts of oxygen are 2 risk factors. This is why oxygen levels for preemies are tightly controlled.

ROP is more common in very small and very premature babies. If your baby was born before 30 weeks’ gestation, he will need to see a specially trained eye doctor called an ophthalmologist. The doctor will look at the development of your baby’s retina (eye). Regular eye examinations will be needed until the retina is fully developed. Severe ROP can lead to vision problems and even blindness. Treatment may involve laser surgery or cryosurgery to stop the blood vessels from growing abnormally.