Neonatal Sepsis

Neonatal sepsis is a clinical syndrome of systemic illness or infection. Other definitions one may associate with sepsis include

- bacteremia—presence of bacteria in the blood
- septicemia—systemic illness due to bacteria in the blood stream
- meningitis—inflammation of the meninges of the brain and the spinal cord, most often caused by a bacterial or viral infection
- pneumonia—inflammation of the lungs caused by viruses, bacteria, or other microorganisms and sometimes by physical and chemical irritants
- early-onset sepsis—defined by the Vermont Oxford Networks (VON) as sepsis with onset within 72 hours of birth
- late onset sepsis—sepsis occurring after 3 days of age in a NICU patient and after 7 days of age in a term infant.

The incidence of early-onset sepsis is 0.77–1 per 1,000 live births. According to the National Institute of Child Health & Human Development (NICHD) Neonatal Research Network, the incidence of early-onset sepsis in infants with birth weight less than 1,000 g is 26 per 1,000 live births and incidence of early-onset sepsis in infants with birth weight 1,000g–15,00g is 8 per 1,000 live births and late-onset sepsis rates are approximately 21%.

Early-Onset Sepsis

The more common organisms that can cause early-onset sepsis are Group B streptococci (GBS), *Escheria coli* (E. coli), *Listeria monocytogenes*, *Haemophilus influenza*, *Enterobacter*, and *Streptococcus pneumonia*.

In early-onset sepsis, the infant will present with nonspecific symptoms. Premature infants may present with overwhelming systemic illness that can progress rapidly to shock and death.

There are risk factors for early-onset sepsis. These include preterm birth, maternal vaginal colonization with GBS, premature or prolonged rupture of membranes greater than 18 hours, and maternal urinary tract infection or fever, which can be an indicator of maternal infection of inflammation. Early-onset sepsis is usually associated with *vertical transmission*, which is from mother to baby.

Late-Onset Sepsis

The more common organisms that can cause late-onset sepsis include coagulase-negative *Staphylococcus*, *Staphylococcus epidermis*, *Staphylococcus aureus*, *Pseudomonas*, GBS, and *Candida*. Late-onset sepsis is more often associated with *horizontal transmission*, which is from family, hospital personnel, and contaminated or inadequately disinfected equipment. It can also be known as *nosocomial*, or hospital-acquired infection (HAI).

In late-onset sepsis, the infant can present with systemic symptoms and illness that occurr suddenly or with subtle symptoms. Risk factors for late-onset sepsis can include prematurity, low birth weight, and invasive lines or procedures. The infant can present with a wide spectrum of signs and symptoms for both early-onset and late-onset sepsis, which can range from subtle to life-threatening.

Signs and symptoms of sepsis can include

- temperature instability
- lethargy or irritability
- feeding difficulties
- gastrointestinal symptoms (e.g., hepatomegaly, abdominal distention, vomiting, diarrea, and bloody stools)
- seizures
- grunting, flaring, retracting, tachypnea, and apnea
- cyanosis, pallor, mottling, apnea and bradycardia, hypotension, tachycardia, and poor perfusion
- hypoglycemia, hyperglycemia, and metabolic acidosis
- jaundice and petechiae
- decreased urine output (anuria).

These signs and symptoms can be seen in a multitude of disease states, such as meconium aspiration, necrotizing enterocolitis (NEC), respiratory distress syndrome, intraventricular hemorrhage, and drug withdrawal. Therefore, it can be difficult to diagnose sepsis based only on these signs and symptoms.

Laboratory studies may include

- blood tests, which may include a complete blood cell count with differential, acute phase reactants (i.e., C-reactive protein, procalcitonin, nonspecific inflammatory markers)
- blood culture, with 1 mL of blood volume placed in the single bottle
- urine culture, although not recommended for early-onset sepsis
- lumbar puncture (LP), also known as a *spinal tap*. Not all sepsis workups include an LP.
- X rays, especially for symptoms of respiratory distress or abdominal distention.

The management recommendation for early-onset sepsis is to perform the LP when (a) there is a positive blood culture, (b) the infant's clinical course has worsened, (c) lab data strongly suggest bacterial sepsis, or (d) infants worsen even after starting antibiotic therapy. In late-onset sepsis workups, LPs and urine cultures should be considered.

Treatment for sepsis is started before culture results are back from the lab, especially when there is a high suspicion of infection in a symptomatic infant. Providing supportive treatment for any of the symptoms the infant has is essential. For early-onset sepsis, a combination of ampicillin and an aminoglycoside (usually gentamicin) is used for synergy. The use of cefotaxime for inital therapy is not recommended (Clark, Bloom, Spitzer, & Gertsmann, 2006). For late-onset sepsis, determining which antibiotics are selected may be based on the epidemiology data from that particular NICU or hospital. Vancomycin and either gentamicin or tobramycin are the antibiotic combinations most commonly initiated for late-onset sepsis. Length of treatment for early- and late-onset sepsis will vary. Antimicrobial therapy should be discontinued at 48 hours in clinical situations demonstrating low probability of sepsis (improved clinical course, negative blood culture). Confirmed bacteremia is generally treated for 10 days. Uncomplicated meningitis is generally treated for a minimum of 14 days. Gram negative meningitis is generally treated for 21 days or 14 days after the first negative culture. Other focal infections (e.g., osteomyelitis) are treated for longer durations.

Controversy surrounds the duration of treatment for the infant with a negative blood culture. Consideration should be given to how the infant's clinical course is progressing and the risks and benefits of a longer course of antibiotics. Cotten and colleagues (2009) demonstrated a possible association between a prolonged duration of antibiotics (longer than 5 days) and NEC. Kuppala and colleagues (2011) found that a prolonged administration of empirical antibiotic therapy to preterm infants with sterile cultures in early-onset sepsis is associated with subsequent severe outcomes.

Sepsis prevention starts with early intervention. Intrapartum antibiotics are used in maternal treatment for possible infection. Penicillin, ampicillin, or cefazolin are considered first-line treatment options. Clindamycin or possibly vancomycin may be provided to the mother who has a penicillin allergy. Good handwashing is of the utmost importance. Encouraging mothers to provide breast milk is another way to decrease the risk of infection.

References

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Neonatal Sepsis: Information for Parents

Neonatal sepsis (you may hear it referred to simply as "sepsis") is an infection of your baby's bloodstream. The infection can spread throughout the body and can be very serious.

Sepsis can be caused from an infection by bacteria, viruses, and funguses. Your baby could have been infected during the pregnancy, delivery, or after the birth from being in contact with others.

During pregnancy or delivery, an infection from the mother may pass to the baby by way of the placenta or through the birth canal. If the sac around the baby starts to leak, the baby is no longer protected from infection. Once born, the baby also can get an infection from being around people who are sick or objects in the environment. Even normal "good" bacteria that live on the baby's skin may make the baby sick. Remember that your baby is in the neonatal intensive care unit (NICU). Frequently, more procedures are required for NICU babies, so there can be more opportunities for an infection to happen, even while trying to prevent infection. In addition, if the baby is premature, his or her immune system, which fights bacteria, is immature and is not strong enough to fight off the bacteria, virus, or fungus. When the immune system is not strong enough to fight the infection, the baby can become quite sick.

There are many different ways a baby may show that he or she does not feel well, and each baby is different. Some signs that your baby is not feeling well may include

- acting sluggish or more sleepy than usual (also known as *lethargy*)
- decreased breathing or breathing too fast (apnea or tachypnea) or slowing of their heart rate (bradycardia)
- not feeding well (tolerating their tube feedings or not breast/bottle feeding well)
- pale, cool, clammy skin
- not being able to keep their temperature regulated.

The NICU team is observing your baby all of the time. If you notice your baby acting differently, please let one of the team members know (e.g., nurse, provider, respiratory therapist). Don't be afraid to talk with the team if you are concerned.

To determine whether your baby has sepsis, the NICU team may do many different tests: blood tests, urine tests, a spinal tap (also called a lumbar puncture), or X rays. Your baby may stop eating and need an IV and fluids. Your baby may need some help to breathe (such as oxygen or a ventilator). Antibiotics, medications given to fight the infection, may be started. The medical team will watch your baby closely and follow the test results closely. Your baby may need to have some of the tests repeated to make sure the infection is going away.

Here are some ways to help your baby fight against getting an infection:

- Wash your hands every time you are with your baby and especially after changing his or her diaper.
- Stay home if you do not feel well. You can call the NICU staff to check in on your baby until you are feeling better.
- Breastfeeding may help prevent infections. If you are able to supply breast milk for your baby, that is great!