

Neonatal Infections

Possible neonatal infections include:

- Neonatal sepsis
- Meningitis
- conjunctivitis
- necrotizing enterocolitis
- omphalitis (infection of the umbilicus and/or surrounding tissues)
- osteomyelitis, arthritis
- mastitis
- Paronychium (nail bed infection)^[1]

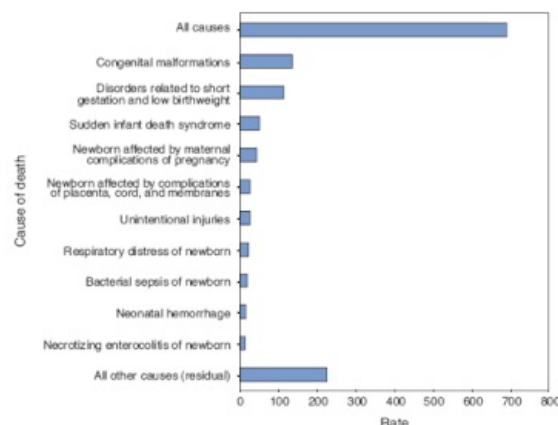
Prenatal infections can also occur in neonates:

- TORCH;
- Congenital syphilis (lues connata)

Risk Factors

The main risk factors are **exposure of the fetus to infection** (acute maternal infection, colonization of the vagina) and **premature immunity of the neonates** (absence of IgM, low complement levels). Furthermore, premature low birth weight, premature amniotic sac rupture, maternal infections during labor (urinary tract infections), turbid amniotic fluid (chorioamnionitis), poor socioeconomic conditions of the mother, children with immune defects, and congenital metabolic disorders will increase the susceptibility of neonates to infections.^[1] **Infection** usually occurs due to infection/colonization of the amniotic fluid (inhalation, mucosal, conjunctival) and umbilical cord.

The most common pathogens: Streptococcus agalactiae (GBS), Enterobacter, Chlamydia, Mycoplasma, varicella-zoster virus (VZV), Herpes simplex virus (HSV), and Enterovirus.



causes of neonatal death

Postnatal Sepsis

 For more information see *neonatal sepsis*.

Neonatal sepsis is a bacterial disease characterized by clinical signs of bacteremia. In 25% of cases, meningitis can also occur, which significantly contributes to neonatal morbidity and mortality. It affects about 2% of all neonates (incidence rate increases with immaturity of the neonate). Incidence rate increases slightly to 3-5% with premature rupture of amniotic sac.^[2]

Early sepsis

Early sepsis manifests by the 3rd day of life and is associated with a high mortality and fulminant course.

Pathogens: most often by GBS and Escherichia coli. Staphylococcus aureus, Streptococcus pneumoniae, and Listeria monocytogenes are also common causative agents.

Late sepsis

Late sepsis manifests after the 3rd day of birth, often while in the ICU. It is most often localized (pneumonia, meningitis, pyelonephritis).

Pathogens: mainly by G - bacteria (E. coli, Klebsiella, Pseudomonas), but also S. aureus, S. epidermidis, Serratia, Candida albicans, Listeria, Haemophilus influenzae.

Risk factors for infections include being a premature neonate, maternal infections, premature rupture of amniotic sac, adrenal infections, CPR (Pediatrics), asphyxia, meconium aspiration, and having undergone invasive procedures. The main way of infection transmission is usually via the hands of medical staff. The infection can spread hematogenously, transplacentally, by aspiration of infected amniotic fluid, colonization on the skin or intestine of the neonates, or by vertical transmission from mother to newborn during childbirth.^[2]

Clinical Manifestations

Signs and symptoms can be non-specific and variable - behavioral changes, thermal instability, tachypnea, tachycardia, hypotension, poor peripheral blood circulation, skin manifestations (paleness, jaundice, bleeding), anorexia, vomiting, diarrhea (pediatrics), and/or metabolic symptoms.

Therapy

Initially it is treated empirically (until the results of cultivation and antibiotic susceptibility tests are out) by

dual combination of ATB (ampicillin + cefotaxime). Additionally, supportive therapy is provided to ensure the maintenance of vital functions (comprehensive intensive care and monitoring) and the stabilization of the internal environment.

For early sepsis - **Aminopenicillin + aminoglycoside** are intravenously administered for 7-10 days (Augmentin + Gentamycin).

For late sepsis - specific colonies of bacteria are targeted, or treated by broad spectrum ATB.

Meningitis

inflammation of the cerebrospinal fluid due to perinatal bacterial, rarely viral (HSV), infection. Neonatal meningitis most often occurs during the 1st month of life. Mortality is 30-60% with over 50% of survivors having permanent sequelae. Important key factors that leads to the development of the disease are being a premature newborn and/or deficiency of cellular immunity and phagocytosis (mainly in premature infants).

The most common pathogens are G- bacteria (**E. coli, Klebsiella**), then G+ cocci (**group B Streptococci** (GBS), rarely by *S. aureus*), **Listeria**, and **HSV-2**. Early clinical symptoms are similar to those in neonatal sepsis. The symptoms which develops later (>48 hours after birth) are: irritability, convulsions, arching of fontanelle, ophthalmoplegia, hemiparesis, cranial nerve palsy, and meningeal phenomena. In addition, pallor, respiratory insufficiency, fever, jaundice, and hepatic lesions are present in viral meningitis.

Neonatal meningitis can result in mental retardation, motor dysfunction, sensory disorders, epilepsy, microcephaly, and even mild behavioral disorders.

The drug of choice for treatment is the dual combination of the antibiotics ampicillin and gentamicin. Later on, the medications are chosen according to the antibiotic susceptibility test (e.g., 3rd generation cephalosporins such as ceftriaxone, cefotaxime). In viral neonatal meningitis, acyclovir is used. Supportive treatment is also provided and includes crystalloids administration, maintenance of homeostasis and fluid balance, ventilation support, and nutritional support. Caesarean section is performed in case of known maternal infection as a precautionary measure.

Conjunctivitis

The most common pathogens are **Chlamydia, Staphylococci, Streptococci, Haemophilus influenzae, E. coli**. Ophthalm-Septonex is administered as a precautionary measure in the delivery room as an eyedrop. Ophthalm-Septonex is administered to treat mucus secretion in conjunctivitis. Antibiotics (pamylon, floxal) are administered locally in case of purulent discharge. In case of long-lasting discharge which is unresponsive to antibiotics, obstruction of the lacrimal duct should be suspected. In case of purulent discharge that poorly responds to local antibiotics, *Chlamydia trachomatis* infection should be considered (treated by the administration of the macrolides).



gonococcal neonatal conjunctivitis

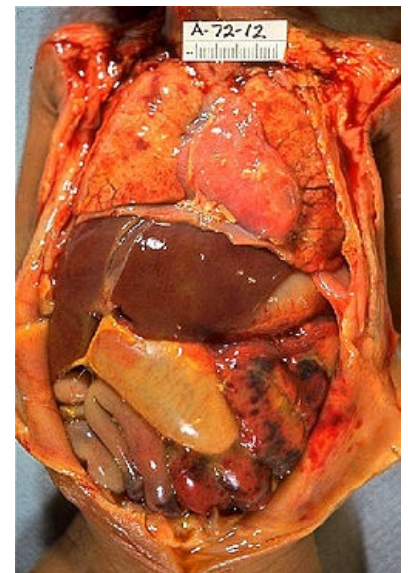
Necrotizing Enterocolitis

Hemorrhagic-necrotic inflammation of the intestine, which arises as a result of an inability of digestive system to adapt to food intake. It is relatively common in premature neonates. The causative agents of inflammations are mainly G- rods (*Pseudomonas, Klebsiella*) and *Clostridia*. It develops during the **introduction of enteral nutrition**. The source of infection is usually the mother or medical staff. It typically manifests 3-7 days after starting enteral nutrition.

It may resemble neonatal sepsis (severe cases). It is manifested by abdominal distension, vomiting, and blood in the stool. The prognosis is usually poor with 10-30% mortality. There can be bowel perforation and peritonitis.

Ampicillin + aminoglycoside (gentamicin) + clindamycin are used for the treatment of necrotizing enterocolitis. Enteral nutrition should be stopped at the same time, which is replaced by parenteral nutrition. Intestinal decompression using NGT is performed as well.

 For more information see *Necrotizing enterocolitis*.



neonatal necrotizing enterocolitis

Other Infections

Omphalitis

Omphalitis manifests as redness and purulent secretion from the umbilicus, and in the disseminated case, the systemic signs of infection are present. The most common responsible pathogen is **S. aureus**. Antibiotics are chosen according to susceptibility testing. The first-line drugs are first generation cephalosporins, penicillin resistant to beta-lactamases, or ampicillin. It is also necessary to clean the base of the umbilicus and hospitalize the patient.

Mastitis

Mastitis occurs most often in 2nd-3rd week after birth. It clinically manifests as redness, swelling, soreness, and purulent discharge of the mammary gland. Antibiotics are administered according to antibiotic susceptibility testing. If an abscess has formed, incising and draining might be necessary. Differential diagnosis: it is essential to distinguish it from a hormonal reaction (Halban's reaction)

Osteomyelitis, Arthritis

The proximal humerus and femur are most often affected. It clinically manifests as limitation of limb mobility, pain, redness, swelling, and/or general symptoms. The erythrocyte sedimentation rate is typically increased, and there can be no abnormal findings in X-ray at first.

Paronychium

Prevention is not to cut nails in the first few weeks of life. In case of isolated occurrence, it is treated locally (wipe with alcohol, baths in high concentration of manganese, Framycoin). In case of multiple infections, first generation cephalosporins are used as a first-line of treatment.

References

Related Articles

- Fungal infections in neonates • Antibiotics (neonatology)

External Links

- JEŽOVÁ, Marta, Sylva HOTÁRKOVÁ a Katarína MŮČKOVÁ, et al. *Hypertextový atlas novorozenecké patologie : Multimediální podpora výuky klinických a zdravotnických oborů* [online]. Portál Lékařské fakulty Masarykovy univerzity [online], ©2010. Poslední revize 27.9.2011, [cit. 26.11.2011]. ISSN 1801-6103. <<http://portal.med.muni.cz/clanek-527-hypertextovy-atlas-novorozenecke-patologie.html>>.

Citations

1. HRODEK, Otto – VAVŘINEC, Jan, et al. *Pediatric*. 1. edition. Prague : Galén, 2002. pp. 82. ISBN 80-7262-178-5.
2. MUNTAU, Ania Carolina. *Pediatric*. 4. edition. Prague : Grada, 2009. pp. 30-31. ISBN 978-80-247-2525-3.

Source

- BENEŠ, Jiří. *Studijní materiály* [online]. [cit. 2010]. <<http://jirben.wz.cz>>.

Literature

- HRODEK, Otto – VAVŘINEC, Jan, et al. *Pediatric*. 1. edition. Prague : Galén, 2002. ISBN 80-7262-178-5.
- ROZSYPAL, Hanuš. *Základy infekčního lékařství*. 1. edition. Prague : Karolinum, 2015. pp. 566. ISBN 978-80-246-2932-2.