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Purpose and Objectives

The purpose of this course is to examine the risk of developing sepsis and infections in the neonatal period. This course will review factors that contribute to neonatal sepsis and immune responses that occur. Assessment data, treatment and interventions for neonatal sepsis will be discussed.

After successful completion of this course, you will be able to:

1. Describe at least 2 principle sources of newborn infection
2. List at least 5 factors that increase neonatal risk of infection
3. Identify 2 types of host defenses
4. List signs and symptoms of neonatal sepsis
5. Describe at least 3 common pathogens in the NICU
6. Discuss diagnostic tests used in diagnosis of sepsis
7. Describe nursing interventions for a septic infant

Introduction

There have been many advances in prevention, assessment and treatment of neonatal sepsis in the past few decades. However, the morbidity and mortality associated with sepsis remains high for susceptible neonates.

Discussion of Sepsis

Sepsis defined

Sepsis is a toxic condition caused by the spread of invading organisms, or their by-products, through the bloodstream or in other tissue in the body. It is also known as septicemia. The definition of sepsis has evolved beyond that of an infection. There is now a spectrum of symptoms of systemic inflammatory response syndrome (SIRS) to septic shock (A.D.A.M. Medical Encyclopedia, 2011; Caple, 2011). Causes of sepsis include viral, fungal, bacterial or parasitic in nature.

Neonatal sepsis differs from adult sepsis in terms of symptoms, diagnosis and treatment, and continues to have a high rate of morbidity and mortality for infants. Neonatal sepsis occurs within the first 30 days of life, although some late-onset sepsis has been described within the first 90 days of life, particularly when related to prematurity (Gardner, 2009).
Incidence of sepsis

According to the World Health Organization (WHO), approximately four million neonates die each year worldwide with nearly 25% to 45% of neonatal deaths occurring caused by severe infections (2006).

In the United States, 1 to 5 of every 1000 live births result in neonatal infection. The Centers for Disease Control and Prevention (CDC) estimates that one in every 141 babies born in the United States each year dies of infection in the first year of life, with approximately 20,000 deaths in the neonatal period (2009). The incidence of neonatal infection is higher for infants with lower gestational age, with premature infants having a three to five times greater risk of developing sepsis. Although the incidence of sepsis is relatively low, the associated morbidity and mortality is high (Gardner, 2009).

Early-onset of sepsis versus late-onset

Early-onset sepsis is classified as occurring in newborns less than 72 hours of age. Approximately 1 to 8 out of every 1000 births result in early-onset sepsis. The causes of infection for early-onset sepsis occur from maternal transmission during pregnancy or delivery, or immediately following delivery. Symptoms may be present at birth, but many infants demonstrate symptoms in the first 24 hours of life (Gardner, 2009; Shrestha, Subedi, & Rai, 2011).

Late-onset sepsis is seen in infants after 72 hours of life. The infections causing late-onset sepsis are from a variety of sources, and are usually hospital-acquired infections (Gardner, 2009; Shrestha, Subedi, & Rai, 2011).

Sources of sepsis: Bacterial

- **Group B Strep (GBS):** Most common cause of early-onset sepsis in North America
- **Staphylococcus aureus:** Most common organism for late-onset and nosocomial infections
- **Escheria coli:** Most common incidence worldwide (25-45% infections)
- **Coagulase-negative staphylococcus**
- **Klebsiella**
- **Hemophilus influenza**
- **Listeria monocytogenes**
- **Neisseria meningitides**
- **Streptococcus pneumonia**
- **Pseudomonas**
- **Enterobacter**
- **Serratia marcescens**
- **Anaerobic species, such as clostridium**
- **Salmonella**
- **Citrobacter**
Sources of sepsis: Viral and Fungal

Sources of sepsis: Viral

TORCH: Toxoplasmosis, Rubella, Cytomegalovirus (CMV), Herpes; “O” stands for other, such as: HIV, Syphilis

Varicella

Sources of sepsis: Fungal

Candida

Malassezia furfur

Bacterial Classifications

The common causes of neonatal infections are from bacteremia. Most bacteria can be divided into 4 groups on the basis of shape and gram stain:

- **Gram positive bacilli**: This is the least common cause of human infection. Gram positive bacilli include the human pathogens - C diphtheriae, C tetani, C botulinum, C difficile, B anthracis and Listeria.

- **Gram negative cocci**: Include the important genus Neisseria (in this category are the human pathogens - Neisseria meningitis and Neisseria gonorrhoea).

- **Gram negative bacilli** (rods): Include the enteric bacteria (E coli, Salmonellae, Shigellae, Vibrio, Campylobacter, and Helicobacter are in this group) and the genus Pseudomonas. Haemophilus, Bordetella, Brucella and Legionella are classified as small gram negative rods.

- **Gram positive cocci**: These are the most common causes of human infection. Gram positive cocci include the genera Streptococci and Staphylococci (in this category are the human pathogens haemolytic streptococci and Staphylococcus aureus).

Bacterial Classifications

Group B Strep

In North America, Group B Strep (GBS) is the most serious cause of neonatal sepsis and associated
mortality. GBS is a normal flora found in the vagina and gastrointestinal tract in up to 20% of women. It does not normally cause any problems for the mothers who are colonized with GBS, but can cause critical health problems for infants.

Because of the high risk and associated mortality with GBS infection in the newborn, prevention and treatment guidelines have been established by the CDC and American Academy of Pediatrics (AAP). The main focus of the guidelines is to promote GBS screening of all pregnant women in their third trimester of pregnancy. This is partially because approximately 25% of GBS infections occur in term infants who are born to mothers without any identified risk factors. When the pregnant woman is tested and is positive for colonization of GBS, she should be treated with antibiotics during labor (AAP, 2011).

Group B Strep

GBS infections can either be an early or late onset infection, but has the highest incidence of early-onset sepsis in the United States. The early onset infection is a consequence of transmission of GBS bacteria from the mother to the fetus, usually during delivery. The infant will begin to present symptoms during the first 48 hours of life. At first, the symptoms may be very subtle and nonspecific. GBS infections are rapidly progressive and the symptoms worsen if treatment is not initiated. Within hours, an infant can deteriorate to septic shock and death. The mortality rate can be 30-50% in infants less than 37 weeks gestation (AAP, 2011).

Late onset GBS infections can occur up to 2 months of age, and are acquired by nosocomial transmission in hospital rather than from a maternal source. Late onset GBS may be less severe than early onset but still involves a 25% mortality rate. Infants with this late form of infection generally present with meningitis as the key symptom (Caple, 2011).

Staphylococcal Infections

Staphylococcal pathogens such as staphylococcal aureus can cause a range from mild infections to severe sepsis. The majority of the transmissions are nosocomial in nature, caused by lack of
Colonization of the staphylococcal pathogen has been seen in 40%-90% of infants within the first five days of life. It is also the most common cause of late-onset infections (American Academy of Pediatrics, 2006; Gardner, 2009; Gardner, Carter, Enzman-Hines, & Hernandez, 2010).

**Escherichia Coli**

Escherichia coli (E-coli) is the pathogen with the highest incidence of neonatal infection worldwide, particularly in developing countries. In the United States, E-coli is the most common cause of gram negative neonatal infection. The bacteria can be transmitted to the neonate through labor and delivery via the maternal genital tract. It can also be acquired through nosocomial means such as poor hand hygiene (American Academy of Pediatrics, 2006; Gardner, 2009; Gardner, Carter, Enzman-Hines, & Hernandez, 2010).

**Risk Factors**

**Maternal Risk Factors**

The following is a list of known maternal risk factors contributing to neonatal sepsis (Caple, 2011; Gardner, 2009; Gardner et al., 2010):

- No prenatal care
- Malnutrition
- Low socioeconomic status
- Substance abuse
- Fever
- Active urinary tract infection (UTI)
- Chorioamnionitis
- Positive or unknown Group B Strep
- Premature rupture of membranes (ROM) or premature labor <37 weeks
- Prolonged ROM >24 hours
- Prolonged or difficult labor
- Multiple pregnancies

**Neonatal Risk Factors**

- Prematurity
- Low birth weight
- Congenital anomalies (especially ones that disrupt first line of defense, such as gastroschisis)
- Male gender
- Newborn errors of metabolism
Environmental Risk Factors

The following is a list of known neonatal risk factors associated with neonatal sepsis (Caple, 2011; Gardner, 2009; Gardner et al., 2010):

- Resuscitation
- Invasive procedures
- Length of hospitalization
- Use of antibiotics

Immunity in the Body

Defense Mechanisms

The body has many ways to prevent and cope with infections, called defense mechanisms or innate immunity. Barriers are one defense mechanism, considered the first line of defense. These barriers include the skin and mucous membranes. Mechanical clearance is another mechanism, where the body attempts to rid itself of foreign substances.

These attempts include coughing and vomiting. Other defense mechanisms consist of an inflammatory response and immunity response. Inflammatory and immune responses are considered a “complement system”, which may trigger and interact with each other (Goldman & Ausiello, 2007).

Inflammatory Response

Localized or systemic infection triggers the body to move nutrients, and inflammatory/immunity cells to the site, to prevent foreign invasion. Inflammation occurs when tissues are injured by trauma, bacteria, toxins, or other causes. The injured cells then release chemicals that cause vessels to leak fluid into the tissues; producing swelling (these chemicals include prostaglandins, histamine, and bradykinin). The swelling assists in isolating the foreign substance from further contact with body tissues (Goldman & Ausiello, 2007).

Premature and compromised infants develop a systemic inflammation, because they cannot localize the source. This can cause a diffuse reaction, including:
• Hypotension
• Third spacing- Third spacing produces edema
• Microthrombi- Microthrombi can obstruct the blood flow to an area, producing further coagulation, which can in turn lead to DIC
• Further cellular activation
• Disseminated intravascular coagulation (DIC) - DIC occurs when the blood clotting mechanisms are activated throughout the body instead of being localized to an area of injury. Small blood clots form throughout the body, and eventually the blood clotting factors are used up and not available to form clots at sites of tissue injury. Clot dissolving mechanisms are also increased. This disorder is variable in its clinical effects, and can result in either clotting symptoms or, more often, bleeding. Bleeding can be severe (Gardner et al., 2010).

Immune Response

The immune response is the last line of defense, and occurs more slowly than the inflammatory response. The chemicals released in response to damaged cells also attract the white blood cells, phagocytes, that "eat" microorganisms and dead or damaged cells. This process is called phagocytosis. The immune response is specific to the type of micro-organism, and is affected by type of serum protein (immunoglobulin) and blood cell (lymphocyte) (Goldman & Ausiello, 2007).

Types of immunity include natural and acquired immunity. Natural immunity refers to the susceptibility of a species to specific infections. Acquired immunity can be through passive or active means. Active immunity occurs with antibody formation and response to an antigen. This occurs from exposure to infection or immunizations, but it may take time to create functional antibodies. Passive immunity is acquired when antibodies are produced by one person, and passed to another. For neonates, passive immunity is from maternal source which has short-term effects but immediate function (Gardner et al., 2010; Goldman & Ausiello, 2007).

Immunoglobulins

Immunoglobulins (Ig) are glycoprotein molecules that are generated by plasma cells in response to an immunogen and which function as antibodies. Immunoglobulins can also be given to neonates as a form of passive immunity. Types of immunoglobulins include:

IgG: This is the major serum Ig, and the only one that crosses the placenta. The half-life is about 24 days, and it is capable of carrying out all of the functions of immunoglobulin molecules

IgA: This is the second highest in the serum, and found in secretions mainly in gastrointestinal and respiratory systems. The main source of IgA for newborns is breast milk

IgM: This is the first to respond to all infections, but only the third highest Ig in serum. It protects from blood-borne infections. High levels indicate congenital infection

IgE: This Ig has small quantities in serum, and has a role with allergic reactions

IgD: This Ig performs antigen binding receptor on B cells. High levels indicate chronic infections (Gardner et al., 2010; Goldman & Ausiello, 2007; Mayer, 2009).
Signs and Symptoms

The clinical signs and symptoms of sepsis and SIRS in the neonate are very different from the adult. These are divided into early and late signs and symptoms. Often, symptoms in the early stage are non-specific, making it difficult to diagnose (Gardner, 2009; Gardner et al., 2010).

Early Signs and Symptoms

The early stage of sepsis development is also known as “warm shock”. The main symptoms are from a decrease in systemic vascular resistance, due to vasodilation.

- **Gastrointestinal**: feeding intolerance, abdominal distention
- **Respiratory**: tachypnea, apnea, grunting, nasal flaring, retractions, increased oxygen requirements
- **Cardiovascular**: widened pulse pressure (the difference between systolic and diastolic pressure), bradycardia or tachycardia, pink flushing, mottling, full pulses
- **Neurologic**: lethargy, hypotonia, temperature instability (hypothermic or hyperthermic), behavioral changes
- **Metabolic**: acidosis, glucose instability (hypoglycemia or hyperglycemia)

Late Signs and Symptoms

The late stage of sepsis development is caused from the body being unable to meet the oxygen demands of tissues. Tissue damage and lactic acidosis can occur, and this is now a hypovolemic state (Gardner, 2009; Gardner et al., 2010).

- **Cardiovascular**: Further decrease in systemic vascular resistance produces a significant decrease in systolic pressure, causing a narrowed pulse pressure
- **Neurologic**: seizures
- **Metabolic**: Decreased perfusion to kidneys (increased BUN, creatinine, renal failure), acidosis, enlarged spleen/liver
- **Multiple organ dysfunction syndrome (causes death)**
- **Complete blood count (CBC) changes**: increase or decrease in white blood cells (WBC), more immature WBC (increased I:T ratio), decreased platelets

Diagnostic Tests

Diagnostic workup is required with suspected sepsis, or infants at risk. Not one specific test can be relied on.
definitively rule out or confirm sepsis with 100% certainty. Therefore, it can take a combination of laboratory tests, imaging, and clinical symptoms to diagnose neonatal sepsis (Caple, 2011; Gardner, 2009; Gardner et al., 2010). Tests include:

- **CBC**: (to be discussed in more detail later in course)
- **Blood culture**: used to identify the organism, and the susceptibility or resistance to specific antibiotics. Cultures may be falsely negative, such as if baby was exposed to antibiotics through maternal treatment. Blood cultures should be drawn prior to initiating antibiotics.
- **Arterial blood gas (ABG)**: ABG is drawn to determine if acidosis or alkalosis is present and accurate oxygen saturation levels.
- **C-reactive protein (CRP)**: CRP is a non-specific indicator of inflammation. CRP responds within 6-8 hours of an inflammatory reaction; over 0.2mg/dL is considered elevated. Many studies have been done of the usefulness of CRP in diagnosing sepsis with contradictory results.
- **Lumbar puncture (LP)**: examination of cerebral spinal fluid (CSF) can show values indicative of meningitis, and a culture should be done. Suspicious CSF includes elevated leukocytes, presence of protein, and low glucose (<50% of serum level), with the presence of micro-organisms. Taking a blood glucose just prior to an LP can be a useful comparison.
- **Suprapubic tap/urinalysis**: Sterile urine sample from a bladder tap is preferred. The urine sample can show if there is a UTI, or abnormalities in protein, or glucose. An UTI is not common with early-onset infection, but if the infant is more than 72 hours old, this can be suspect.
- **X-rays**: Chest x-ray (CXR) and/or abdominal x-ray (AXR) can show pleural effusions, pulmonary edema, necrotizing enterocolitis, etc.

**In-depth Look at a Complete Blood Count**

**Components of CBC**

- **Red blood cells (RBC)**: Values for RBC range from 3.5-6.5 M/uL
- **Hemoglobin (Hgb)**: Hgb ranges from 13.5-21.5 g/dL. Hgb is manufactured to carry oxygen, but other substances may bind
- **Hematocrit (Hct)**: Hct is the percent of RBC when a sample is spun down
- **Platelets**: Platelets range from 130-400 K/uL. Low platelets may also be indicative of infection, as microorganisms lead to platelet destruction
- **White blood cells (WBC)**: WBC count can be falsely elevated by nucleated RBC, or if the baby was stressed during labor and delivery. Some laboratories may provide an “adjusted” WBC value. Normal WBC count varies in the neonate. Generally, in the first week of life, the values are 5,000-30,000 (or 5-30 K/uL). Leukopenia (<5000) is sign of infection in first week of life. Leukocytosis (>30000) is indicative after the first week.
- (Gardner et al., 2010; Goldman & Ausiello, 2007)

**White Blood Cells**

- **Monocytes**: These enter tissues and become macrophages to help destroy foreign bodies
- **Lymphocytes**: Functions in immune response, and antibody production; consists of B and T cells
• **Granulocytes**: Also phagocytosis functions; consists of eosinophils, basophils, and neutrophils
• **Neutrophils**: Fight infections
• **Eosinophils**: Less killing ability, release mediators to control inflammatory processes, increased in allergic disorders and parasitic infections
• **Basophils**: Granules contain histamine and heparin; inflammation mediators

## Neutrophils

Neutrophil counts are only seen as abnormal in 66% of infants. Neutropenia is seen with pregnancy induced hypertension (PIH), asphyxia, and intraventricular hemorrhage (IVH). The neutrophils, in their attempt to fight infection, release cells into the bloodstream, starting with mature cells.

From immature to mature forms of neutrophils:

myeloblast $\rightarrow$ promyelocyte $\rightarrow$ myelocyte $\rightarrow$ metamyelocyte $\rightarrow$ bands $\rightarrow$ segs

When the mature cells have been released to fight infection, the immature forms will then be released. This is the body’s attempt to fight infection, even though these cells are ineffective. This release of immature cells is seen as a “left shift” (Caple, 2011; Gardner et al., 2010).

## Nursing Management

Nurses and caregivers are essential in identifying symptoms of sepsis and in the treatment of the neonate with suspected or confirmed infection. Interventions include:

• **Assessment**: Continuous physical assessment is vital to identify subtle changes in the infant’s condition or behavior. Often times, the neonate may look “unwell” or a parent can voice concerns about behavioral changes. Inspect the infant for visible signs of distress, such as poor tone, lethargy, and pallor or a change in response to stimuli. Watch trends in the infant’s vital signs from baseline, including temperature and pulse pressure. Remember to include pain assessment. Intake and output should also be monitored.
• **Hand hygiene and aseptic technique**: Adherence to hand hygiene, use of personal protective equipment and aseptic technique is essential to prevent further infections or spread the organism to another. Depending on the organism, infection control practices may involve isolation.
• **Maintain neutral thermal environment**: Temperature instability is common with sepsis and diverts much needed energy away from growth and the body’s ability to fight the infection. The infant may need to be placed in a warmer or incubator, and temperature must be regularly monitored.
• **Maintain fluids and electrolytes**: A balance of fluid and nutrition is required for the septic
neonate. They should be placed NPO due to increased risk of aspiration, paralytic ileus, and necrotizing enterocolitis. An intravenous access is required.

- **Provide adequate oxygenation and ventilation:** Hypoxemia is a common problem with sepsis. Continuous pulse oximetry is required and supplemental oxygen may be needed to keep oxygen saturations within range. Severely septic, premature, or neonates with other complications may require continuous positive airway pressure (CPAP) or mechanical ventilation.

- **Maintain perfusion:** Hypovolemic and septic shock are complications of sepsis. Monitoring blood pressure is vital, and use of volume expanders or inotropes to maintain blood pressure may be required.

- **Monitoring and treatment of seizures:** Seizures are another potential complication of sepsis. Monitor the infant’s behavior for focal seizures (movement of one limb or “freezing” stare, for example). Medication and seizure precautions may be needed in severe cases.

- **Monitoring of lab results:** Lab results including CBC, blood cultures, electrolytes and arterial blood gases are important to determine progress of the infant’s condition. Hypoglycemia is another complication of sepsis and blood glucose monitoring is required.

- **Parental support:** Parents and caregivers require emotional support through this time of crisis, but each situation is unique. Assess the anxiety level and ability to cope for each family member anxiety level and coping ability. Appropriate education on neonatal sepsis pathophysiology, risk factors, treatments, prognosis, proper hand hygiene and any isolation precautions are needed. Encourage participation in care and bonding with the infant. (Caple, 2011; Gardner, 2009; Gardner et al., 2010).

### Fluid & Electrolyte Maintenance

Infants characteristically have 80% water make up in their bodies. Preterm neonates may have as high as 85-90% total body water. Therefore, fluid requirements are high, due to this high proportion of body water. When the infant is further compromised by sepsis, the balance of fluids and electrolytes is vital. Fluid requirements can vary between 80-120mL/kg/day in the first week of life (Gardner et al., 2010).

Electrolytes must also be monitored carefully. Here are some key points about the major electrolytes:

- **Sodium (Na+):** Major component of extracellular fluid (ECF). Normal values are 136-145 mmol/L; preterm infants may require higher levels due to immature renal system. Na+ is essential for retention of body water and takes part in regulation of acid-base balance, tissue osmolality and enzyme activity (Gardner et al., 2010)

- **Potassium (K+):** Major component of intracellular fluid (ICF). Normal values are 3.5-5 mmol/L. K+ is essential for cardiac function, participates in enzyme activity, CNS function, tissue osmolality and glycogen use (Gardner et al., 2010)

- **Chloride (Cl-):** Component of ECF. Normal values are 99-111 mmol/L. Cl- is necessary for K+
retention, transport of carbon dioxide, formation of hydrochloric acid in the gastrointestinal tract, and participates in tissue and cell osmolality (Gardner et al., 2010)

- Calcium (Ca²⁺): Component of ECF. Normal values are 7-12 mg/dL. Calcium is essential for blood coagulation and neuromuscular function (Gardner et al., 2010)

**Anti-infective: Bacterial**

**Anti-infective Therapy**

Antibiotic therapy is dependent on the type of organism that is causing the infection. After laboratory work up, broad spectrum antibiotics should be immediately started. The most common empiric antibiotics are ampicillin along with an aminoglycoside, usually gentamicin.

After identifying the causative organism (bacterial) then the antibiotic combinations with the most sensitivity and least toxicity should be started, and continued for the recommended course of treatment. Antivirals are required if sepsis is suspected or confirmed from a virus, and antifungals are used to treat fungal infections.

**Sources of sepsis: Bacterial**

**Group B Strep (GBS):** Ampicillin and gentamicin most common antibiotic therapy.

**Staphylococcus aureus:** Ampicillin, gentamicin, and clindamycin most common antibiotic therapy; if MRSA, vancomycin is used and then blood cultures are essential to identify sensitivity for antibiotic therapy.

**Escheria coli:** Treated with third-generation cephalosporins such as ceftriaxone.

**Coagulase-negative staphylococcus:** Vancomycin or flucloxacillin commonly used.

**Klebsiella:** Blood cultures essential to identify sensitivity; third-generation cephalosporins such as ceftriaxone.

**Hemophilus influenza:** Main treatment is third-generation cephalosporins.

**Streptococcus pneumonia:** Main treatment is third-generation cephalosporins.

**Pseudomonas:** Generally treated with aminoglycoside such as gentamicin and a quinolone.

**Anaerobic species, such as clostridium:** Vancomycin common treatment.

**Anti-infective: Viral and Fungal**

**Sources of sepsis: Viral**

**TORCH:**

**Toxoplasmosis:** Treated with pyrimethamine and sulfadiazine.
Rubella: Supportive care
Cytomegalovirus (CMV): Treated with ganciclovir.
Herpes: Treated with acyclovir.
HIV: Antiretroviral therapy such as zidovudine.
Syphilis: Main treatment is penicillin G.
Varicella: Zoster immune globulin used with supportive care.
Sources of sepsis: Fungal
Candida: Amphotericin B and flucytosine main therapies.
Malasezia furfur: Fluconazole, amphotericin B and flucytosine main therapies.
(Caple, 2011; Devlin, 2006; Gardner, 2009).

Considerations for Common Antibiotics

As discussed, there are common antibiotics used in the treatment of neonatal sepsis. Here are some considerations that nurses should be familiar with for a select number of therapies:

Ampicillin: Can be administered by slow IV push or intramuscular (IM). Dosing is usually done every 8-12 hours for neonates. Very large doses can cause CNS excitation or seizures. There may be moderately prolonged bleeding times with repeated doses. Clearance is mainly by the renal route. Reconstituted ampicillin must be used within an hour of mixing, and is not compatible with amino acid solutions/total parenteral nutrition (TPN) (Young & Mangum, 2010).

Gentamicin: Should be administered via a syringe pump for a minimum of 30 minutes. Dosing is based on serum concentration. Serum levels, including peak and trough levels, should be measured if therapy is more than 48 hours. Aminoglycosides are associated with neurotoxicity, ototoxicity, and nephrotoxicity. These risks increase with patients with poor renal function, high doses, or prolonged therapy. Gentamicin should not be administered with penicillins, and is incompatible with ampicillin, amphotericin B, furosemide, and heparin (Young & Mangum, 2010).

Ceftriaxone: Should be infused via pump over 30 minutes. Dosing is usually every 24 hours. Ceftriaxone should not be administered in neonates with hyperbilirubinemia as it displaces bilirubin from binding sites. Other side effects may include diarrhea, increased BUN and creatinine, skin rash, nausea and vomiting. It is incompatible with calcium (Young & Mangum, 2010).

Vancomycin: Should be infused via pump over a minimum of 60 minutes. Dosing is dependent on gestational age and serum concentration, including peak and trough levels. Aminoglycosides are associated with neurotoxicity, ototoxicity, and nephrotoxicity. These risks increase with patients with poor renal function, high doses, or prolonged therapy. Other side effects can include rash, hypotension, and phlebitis. Neutropenia can occur with prolonged therapy. Vancomycin is incompatible with cephalosporins, dexamethasone, and most penicillins (Young & Mangum, 2010).

Case Study

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Putting it Together: Case Study

Baby George was born at 31 weeks gestation. His birthweight was 1345g, and APGARS were 3 at one minute, and 7 at five minutes after resuscitation efforts. Maternal history includes a 22 year old mother, gravida 2, para 1 (now 2), with no prenatal care. Maternal temperature in labor, with periods of fetal tachycardia. Delivery was precipitous but one maternal dose of penicillin was given. Baby George is admitted to the NICU. A rapid GBS test was done with inconclusive results.

Upon admission to the NICU, Baby George is hypotonic, hypothermic, grunting, and not responding to stimuli as expected. He is on a warmer with a cardiorespiratory monitor. His oxygen saturations are 91%. An umbilical venous catheter (UVC) is successfully inserted and intravenous fluids started. George’s father is at the bedside.

Conclusion

In this course, you learned:

Neonatal sepsis has a high risk of morbidity and mortality, particularly with lower gestations and birthweights. It is vital to recognize risk factors and early signs and symptoms in order to initiate prompt diagnosis and treatment. Nurses and caregivers are integral in identifying behavioral changes that may eventually cascade into symptoms of severe sepsis. Assessment, hand hygiene and monitoring of the neonate’s condition are just as crucial as other medical therapies in prevention, detection, and treatment of neonatal sepsis.

References


