Group B Strep
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**Group B strep (GBS)** is a bacterial infection that is most commonly associated with sepsis, pneumonia, and meningitis in newborns. Group B strep also infects select groups of adults, including diabetics, alcoholics, patients with cardiovascular disease, and cancer patients. In adults, Group B Strep causes infections septicemia, pneumonia, skin/soft tissue infections, and bone/joint infections. S. *agalactiae* also causes mastitis in cattle.

**Etiological Agent:**
*Streptococcus agalactiae*

**Transmission:**
Adult Transmission – Adults may carry GBS asymptptomatically in their throat, gastrointestinal tracts, and the rectum. However, the actual method of transmission of GBS in non-pregnant adults is not currently known.
Neonatal Transmission – GBS is transmitted to neonates vertically (transmitted from mother to child) during vaginal deliveries, but can also be transmitted via passage of bacteria into the amniotic fluid during pregnancy.

**Reservoirs:**
Humans and cattle are the primary reservoirs, but the bacteria has been found in a wide range of hosts including dogs, cats, goats, guinea pigs, and rabbits. As such, it is considered a zoonosis. Studies suggest that up to 30% of women are colonized with GBS.

**General characteristics:**
*Streptococcus agalactiae* is a gram-positive species of bacteria. They belong to the kingdom Bacteria, the phylum Firmicutes, and are in the class Bacilli. More specifically, GBS belongs to the order Lactobacillales and is within the family of Streptococcaceae. As a firmicute, GBS has low-GC content, and as a lactobacillale, it also produces lactic acid. *S. agalactiae* is a facultative anaerobe that often exists in pairs or chains of 50 cells or more. There are 9 different serotypes (variants), but serotypes Ia, III, and V are the most common serotypes found in human hosts.

**Key Tests for Identification**
In order to identify a bacterial infection as GBS, a swab of the infected area (or vagina in pregnant women, usually between 35-37 weeks) is taken and sent to the lab to be cultured. The primary test used to confirm GBS is the Lancefield Grouping Procedure, which is a rapid latex agglutination test that can be used to categorize strep in groups A-G. This test uses specific rabbit immunoglobulins that only react when the antigen (GBS) is present. S. *agalactiae* presents as a beta-hemolytic specimen when cultured on blood agar. GBS is also hippurate hydrolysis-positive and CAMP factor-positive, and both of these characteristics can be tested in the lab to confirm GBS. Additionally, when suspended in a starch-glucose solution, GBS cells
produce a pigment that is similar to a beta-carotenoic.\textsuperscript{10} In antibiotic disk susceptibility tests, GBS displays susceptibility to penicillin, ampicillin, and cephalothin.\textsuperscript{11}

![Figure 1. A Gram-stained sample of \textit{S. agalactiae}. The sample presents as gram positive.](image)

**Signs and Symptoms of Disease:**
Many people carry GBS or are infected without any symptoms. However, in certain groups of individuals, GBS can cause a very serious, even life-threatening progression of symptoms. The symptoms of GBS infection differ primarily by host.\textsuperscript{12}

**Infants:**
In infants, there are two progression paths for GBS Infection.
1. The first is Early-Onset Disease (EOD), which occurs in newborns within the first week of birth.\textsuperscript{12} Symptoms of EOD can include fever, rapid breathing (tachypnea), absence of breathing (apnea), cyanosis, temperature instability, and low blood pressure.\textsuperscript{5} It is important to note that symptoms of a GBS Infection can mimic pneumonia or Respiratory Distress Syndrome (RDS).\textsuperscript{5}
2. In Late-Onset Disease (LOD), GBS Infections in newborns occur sometime after the first week postpartum, and can occur up through 3 or 4 months of age. LOD occurs primarily as a sepsis (bacteremia), but can also present as meningitis.\textsuperscript{5} The earlier symptoms present after the first week, the greater the risk that meningitis will occur.\textsuperscript{5} Typical symptoms of LOD GBS Infection include fever, lethargy, difficulty feeding, seizures, difficulty feeding, and an abnormally low white blood cell count (neutropenia).\textsuperscript{5}

**Adults**
In adults, Group B strep is most often a harmless infection. However, alcoholics, diabetics, cancer patients and cardiovascular patients are at an increased risk of acquiring a serious GBS Infection. GBS can present as pneumonia or bacteremia (sepsis) in adults, and can also occasionally cause UTIs.\textsuperscript{12}

**Historical information:**
Group B strep became an emerging pathogen in the 1970s, when it became the leading cause of death in newborns in the US.\textsuperscript{13} In the 1970s, GBS caused fatality in 50% of known cases.\textsuperscript{13} In an effort to reduce the incidence of GBS Infection in neonates, clinical trials began in the 1980s. These trials involved administering IV antibiotics to mothers during delivery.\textsuperscript{13} This method of prophylaxis became the official protocol recommended by the American College of Obstetrics and Gynecology, as well as the CDC, in 1996. The American Academy of Pediatrics adopted the same standards in 1997.\textsuperscript{13} In 2002, new guidelines were put in place to screen all pregnant women between 35 and 37 weeks gestation to target prophylactic antibiotic use only towards at-
risk women/fetuses. Since the initial protocol requiring prophylactic intrapartum antibiotics began in the 1990s, the incidence of EOD GBS Infection in newborn has dropped 80%. However, it is still the leading infectious cause for illness and fatality in newborns.

**Virulence factors:**

Lactic Acid: Lactic Acid is produced by all Lactobacillales and contributes to cytotoxicity during a GBS Infection.

Adhesins/Biofilm Formation: GBS is capable of forming three-dimensional biofilms that enhance its ability to colonize and remain in the host. Adhesins greatly contribute to the formation of biofilms by GBS colonies.

Pore-forming Toxins: GBS’s genome encodes for the toxin Beta-hemolysin (cytolysin). This toxin allows GBS to pass many barriers in the human body, including the blood-brain barrier, making it particularly dangerous. It also impairs cardiac function and can contribute to liver failure.

CAMP Factor: Also known as “Protein B”, this is a protein secreted by *S. agalactiae* that has pore-forming properties, contributing to cytolysis.

Sialic acid-Rich Capsular Polysaccharide: *S. agalactiae* is encapsulated by this capsular polysaccharide, which allows it to evade the immune response.

Penicillin-Binding Proteins – These proteins are resistant to the anti-microbial proteins of the immune system.

**Control, Treatment, and Prevention:**

The primary method of control for Group B strep are preventative measures. Pregnant women are tested between 35 and 37 weeks gestation for the presence of GBS in their urogenital tract. If a woman is a carrier for GBS, IV penicillin or ampicillin is given during the intrapartum period. If preventative measures are not effective, a newborn may need additional procedures to address complications that arise as a result of the illness.

As of 2015, vaccines for Group B Strep have been created and tested on animals as well as humans. However, additional human testing is needed to have these approved by the FDA for Group B Strep prevention.

**Global and Local Outbreak Incidence:**

Local Incidence: 19,800 cases of GBS occur annually in the US. As of 2008, the incidence of EOD in newborns has dropped to .28 cases for every 1000 live births. Additionally, African Americans in all age groups are twice as likely to carry or be infected with GSB.

- It is important to note that these incidence rates are estimates as GSB is not currently a reportable disease in most states. However, there is a current survey population of approximately 33 million individuals across 10 states. This sample population includes 500,000 live annual births.
Global Incidence: While there is not a global method for reporting incidences of GSB Infection, global incidence rates range from .6 to 2.5 cases out of every 1000 live births.15

References

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