

A Comprehensive Study of Bacterial Meningitis and its Effects on the Human Brain

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ABSTRACT

Meningitis is a serious infection that affects the protective layer surrounding the brain and spinal cord. This disease can be caused by bacteria, viruses and fungi. Meningococcal meningitis, caused by the bacteria Neisseria meningitidis, can cause large epidemics. Meningococcal disease can infect a person of any age, but it is most often seen in children under the age of five, immunocompromised individuals, adolescents and young adults. Vaccination is a preventive measure against this deadly disease which can save lives and reduce complications. In view of the alarming situation of the current pandemic, the role of vaccination has become more important than ever. It strengthens your immune system. Like pneumococcal pneumonia, many other diseases caused by viruses and bacteria can be prevented with vaccines. One such disease is meningococcal, the rate of death due to it is very high.

Keywords: Bacterial meningitis, gram positive, gram negative

INTRODUCTION

Meningitis is a serious infection that affects the protective layer around the brain and spinal cord. This disease can be caused by bacteria, viruses and fungi. Meningococcal meningitis is caused by the bacteria Neisseria meningitidis. Due to this, a big epidemic can arise. It can spread from person-to-person through breath (droplet).

Often, symptoms begin 24 to 48 hours after the onset. Patients die within Even those who survive.1 in 5 patients may experience lifelong complications, such as hearing loss, brain damage.

Although meningococcal disease can infect a person of any age, it is most often seen in children under the age of five, immunocompromised individuals, adolescents, and young adults. Meningitis or meningitis is an inflammation of the

protective membranes (meninges) that cover the brain and spinal cord. This inflammation can be caused by infection with viruses, bacteria, and other microorganisms, as well as in less common cases by certain medications.

Due to the proximity of this inflammation to the brain and spinal cord, meningitis can be life-threatening and is therefore classified as a medical emergency. The most common symptoms of meningitis are headache and neck stiffness, as well as fever, confusion or altered consciousness, vomiting, intolerance to light (photophobia) or intolerance to loud sounds (phonophobia).

Children often only display non-specific symptoms, such as irritability and drowsiness. If a rash is also observed, this may indicate a specific cause of meningitis; For example, meningitis

caused by meningococcal bacteria can cause a characteristic rash. Lumbar puncture may be required to diagnose or identify meningitis.

A sample of cerebrospinal fluid (CSF), which envelops the brain and spinal cord, is removed by inserting a needle into the spinal canal. CSF is tested in a medical laboratory. The first treatment for acute meningitis consists of antibiotics given promptly and, in some cases, antiviral medication. Corticosteroids can also be used to avoid complications from excessive inflammation.

Meningitis can have serious long-term consequences such as hearing loss, epilepsy, hydrocephalus and cognitive impairment, especially if not treated promptly. Some forms of meningitis (such as those associated with meningococci, *Haemophilus influenzae* type b, pneumococci or mumps virus infections) can be prevented by immunization.[1-6]

SIGNS AND SYMPTOMS

Clinical Signs

In adults, the most common symptom of meningitis is severe headache, which appears in about 90% of cases of bacterial meningitis, followed by neck stiffness (difficulty flexing the neck forward due to tension in the neck muscles). Due to the growth of the muscles and due to the stiffness, that occurs in them).

The three traditional symptoms of diagnosis include stiffness in the back of the neck, sudden high fever, and a change in mental status; however, all three symptoms are present in only 44–46% of bacterial meningitis cases. If none of these three signs are present, then meningitis is very unlikely. Photophobia, or intolerance to bright light, and phonophobia, or

intolerance to loud sounds, are two additional symptoms that are frequently associated with meningitis.

Young children often do not show the above symptoms, they just become irritable and look unwell. New-borns up to 6 months of age may have a bulging fontanel (the soft spot on the top of the baby's head). Other symptoms that distinguish meningitis from other less serious illnesses are leg pain, extreme cold, and abnormal skin colour.

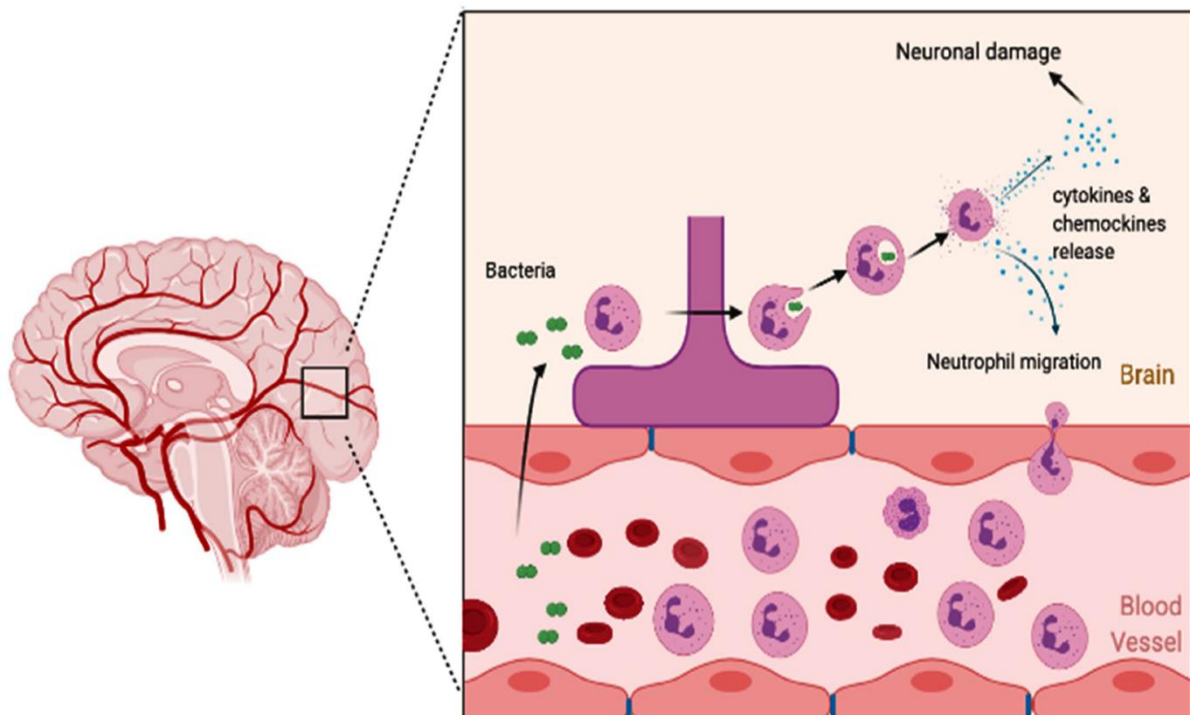
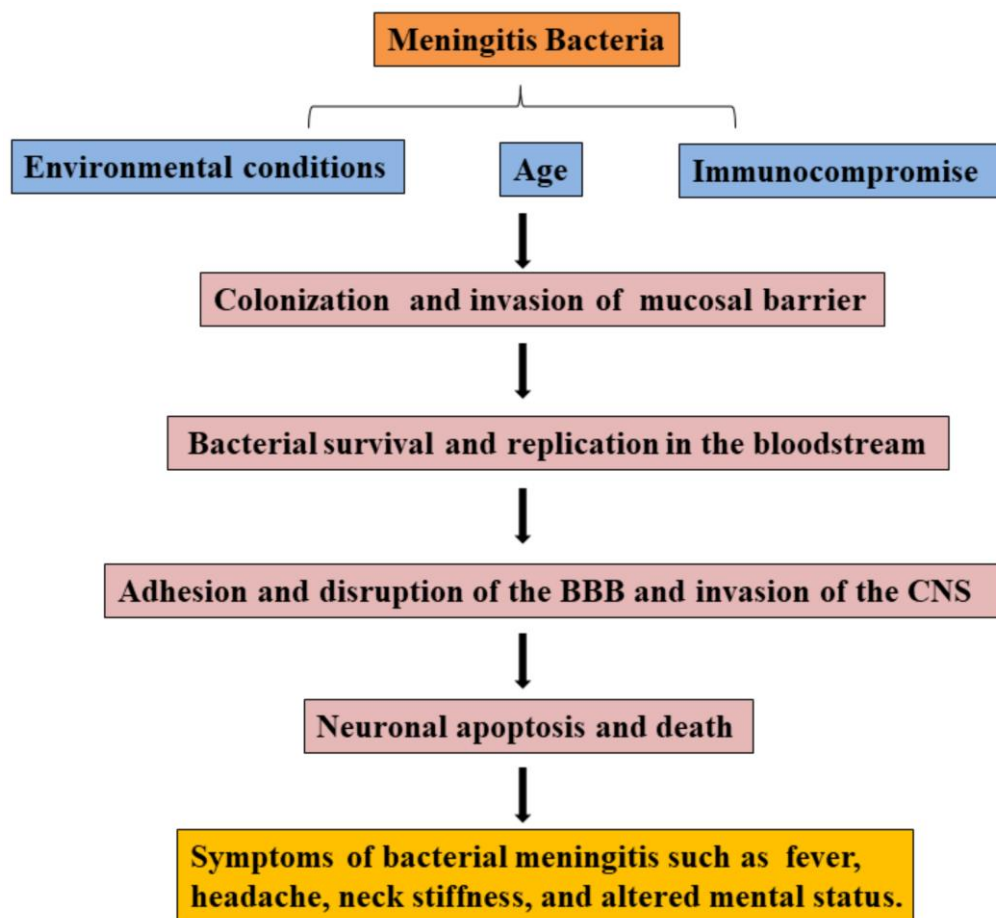
Stiffness in the back of the neck is present in 70% of cases of bacterial meningitis in adults. Other signs of meningism include a positive Kernig sign or Bruzinski sign. To detect Kernig's sign, the person is made to lie supine (lying face up) and his hips and knees are brought to an angle of 90 degrees. In someone who is Kernig's sign positive, knee pain prevents passive extension of the knee.

The Bruzinski sign is found to be positive when flexion of the person's neck causes involuntary flexion of the knee and hip. Although Kernig's sign and Bruzinski's sign are common tests to diagnose meningitis, the sensitivity of these tests is limited. However, their sensitivity to meningitis is very good: these symptoms are very rare in any other disease.

The "Zolt accentuation maneuver," a different test, can be used to check for meningitis in people who are complaining of fever and headache. The individual is instructed to quickly turn their head horizontally; it is unlikely that he has meningitis if his headache does not get worse as a result.

Common Bacterial Pathogens Based on Age and Predisposing Factor in Patients with Meningitis

Predisposing factor	Common bacterial pathogens
1 month	<i>Streptococcus agalactiae</i> , <i>Escherichia coli</i> , <i>Listeria monocytogenes</i> , <i>Klebsiella</i> species
1-23 month	<i>Streptococcus pneumoniae</i> , <i>Neisseria meningitides</i> , <i>Streptococcus agalactiae</i> , <i>Haemophilus influenzae</i> , <i>Escherichia coli</i> .
2-50 years	<i>Neisseria meningitides</i> , <i>Streptococcus pneumoniae</i>
>50 years	<i>Streptococcus pneumoniae</i> , <i>Neisseria meningitides</i> , <i>Listeria monocytogenes</i> , Aerobic Gram-negative bacilli
Nosocomial acquisition	Aerobic Gram-negative bacilli (including <i>Pseudomonas aeruginosa</i>), <i>Staphylococci</i> (<i>Staphylococcus aureus</i> and coagulase-negative <i>Staphylococci</i>)
Head trauma basilar skull fracture penetrating trauma	<i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i> , group A-hemolytic <i>Streptococci</i>)
Post neurosurgery	<i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , aerobic Gram negative bacilli (including <i>Pseudomonas aeruginosa</i>), <i>Propionibacterium acnes</i>
Cerebrospinal fluid shunt	<i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , aerobic Gram negative bacilli (including <i>Pseudomonas aeruginosa</i>), <i>Propionibacterium acnes</i>
Immunocompromised state cellular immunodeficiency Humoral immunodeficiency	<i>Listeria monocytogenes</i> , <i>Nocardia</i> species <i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i> , <i>Neisseria meningitides</i> , <i>Staphylococcus aureus</i> , other <i>Streptococci</i>
Neutropenia	Aerobic Gram-negative bacilli (including <i>Pseudomonas aeruginosa</i>), <i>Staphylococcus aureus</i>



MATERIAL, METHOD & SHORT RESULTS

Meningitis is usually an infection caused by microorganisms. Most infections are caused by viruses, with bacteria, fungi and protozoa being the other most common causes. [It can also be caused by a number of non-infectious causes. The term aseptic meningitis refers to cases in which no bacterial infection is demonstrated. This type of meningitis is usually caused by a virus, but it can also be caused by bacterial infections that have previously been partially treated, when the bacteria from the meningitis are eliminated, or the pathogen enters the area adjacent to the meningitis infect (eg sinusitis). Aseptic meningitis can also result from endocarditis, an infection of the heart

valves that spreads through the bloodstream in small clumps of bacteria. Aseptic meningitis can also be caused by infection with a spirochete, a type of insect that includes *Treponema pallidum* (the cause of syphilis) and *Borrelia burgdorferi* (known to cause Lyme disease). Meningitis can result from cerebral malaria (malaria affecting the brain) or from encephalitis caused by infection with amoebic meningitis, an amoeba such as *Naegleria fowleri* that is spread by contact with clean air sources.

SIGNIFICANT & MANUAL METHOD

Antimicrobial susceptibility pattern of the Gram-Negative bacilli isolated from pyogenic Meningitis

Organisms		Tetracycline	Ampicillin	Gentamicin	Amoxicillin	Amikacin	Chloramphenicol	Cefotaxime	Ceftazidime	Ceftriaxone
<i>H. Influenzae</i> (51)	R	34 (66.7)	42 (82.3)	34 (66.7)	43 (84.6)	08 (15.4)	17 (33.3)	--	--	--
	S	17 (33.3)	09 (17.7)	17 (33.3)	08 (15.4)	43 (84.6)	34 (66.7)	51 (100)	51 (100)	51 (100)
<i>Klebsiella</i> sps (08)	R	07 (87.5)	06 (75.0)	05 (62.5)	05 (62.5)	04 (50.0)	05 (62.5)	02 (25.0)	07 (87.5)	07 (87.5)
	S	01 (12.5)	02 (25.0)	03 (37.5)	03 (37.5)	04 (50.0)	03 (37.5)	06 (75.0)	01 (12.5)	01 (12.5)
<i>E. coli</i> (06)	R	03 (60.0)	04 (80.0)	03 (60.0)	03 (60.0)	02 (40.0)	05 (100)	04 (80.0)	03 (60.0)	03 (60.0)
	S	02 (40.0)	01 (20.0)	02 (40.0)	02 (40.0)	03 (60.0)	--	01 (20.0)	02 (40.0)	02 (40.0)
<i>Pseudomonas</i> sps (03)	R	02 (66.7)	03 (100)	03 (100)	03 (100)	02 (66.7)	03 (100)	02 (66.7)	03 (100)	03 (100)
	S	01 (33.3)	-	--	--	01 (33.3)	--	01 (33.3)	--	--

AmpC Production by three-dimensional diffusion method for *klebsiella pneumonias*

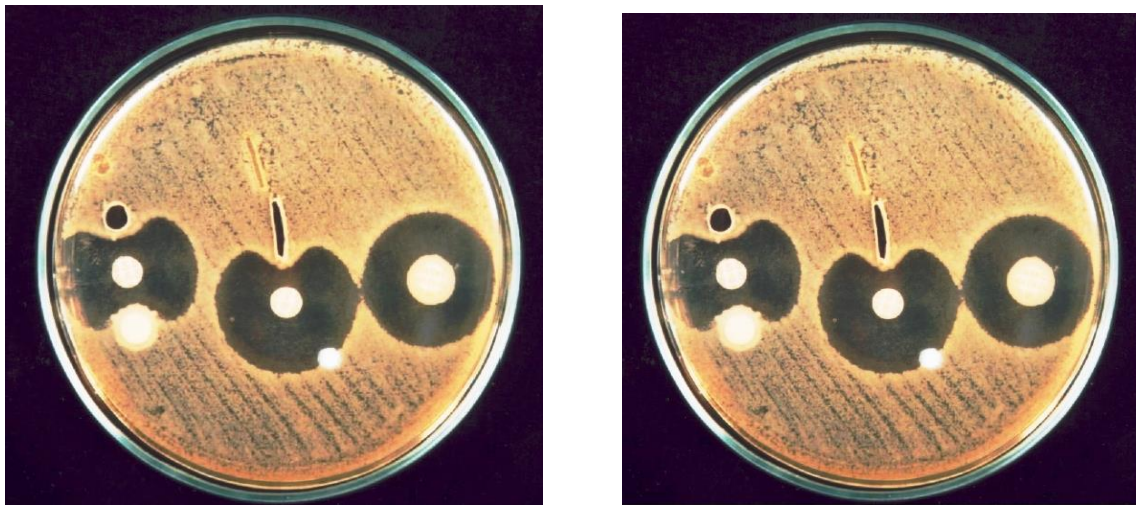
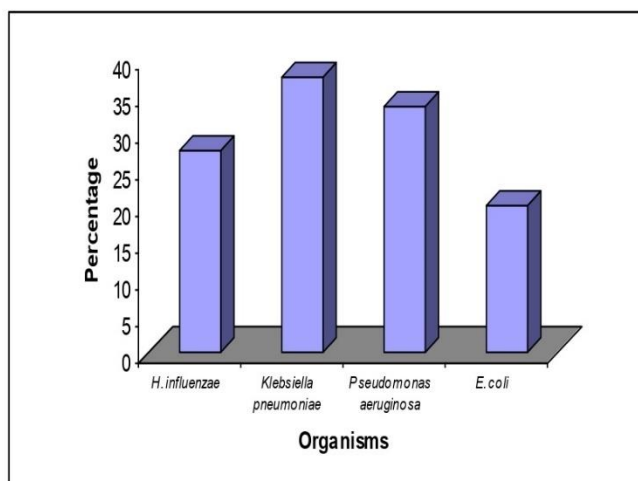


Fig. 1: Antibiotic susceptibility testing by kirby-Bauer's disc diffusion method for *Pseudomonas aeruginosa*.

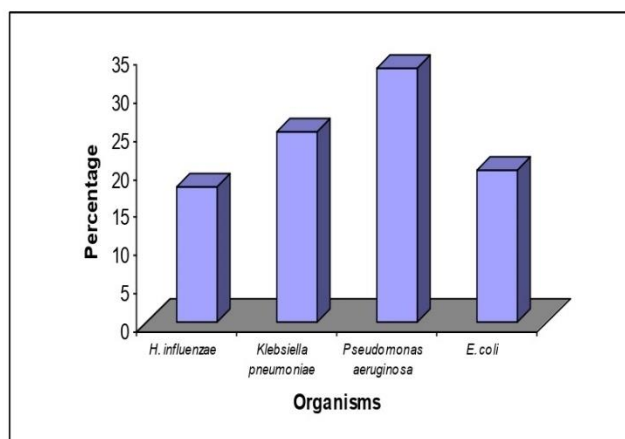


Fig. 2: Antimicrobial susceptibility pattern of the Gram-Positive Cocci isolated from pyogenic Meningitis.

Organisms		Penicillin	Tetracycline	Ampicillin	Gentamicin	Cephoxitin	Amikacin	Chloramphenicol	Cefotaxime	Ceftazidime	Ceftriaxone
<i>Streptococcus Pneumoniae</i> (89)	R	21 (23.6)	NT	--	NT		NT	NT	NT	NT	NT
	S	68 (76.4)	--	89 (100)	--	89 (100)	--	--	--	--	--
Gp B Streptococci (19)	R	NT	-	NT	NT	00	NT	NT	NT	NT	NT
	S		19 (100)	--	--	19 (100)	--	--	--	--	--
<i>Staphylococcus aureus</i> (11)	R	11 (100)	07 (63.6)	06 (>50.0)	02 (33.3)	06 (54.5)	04 (66.7)	06 (54.5)	03 (27.3)	05 (45.5)	06 (54.5)
	S		04 (36.4)	05 (45.5)	08 (72.7)	05 (45.5)	03 (27.3)	05 (45.5)	08 (72.7)	06 (54.5)	05 (45.5)



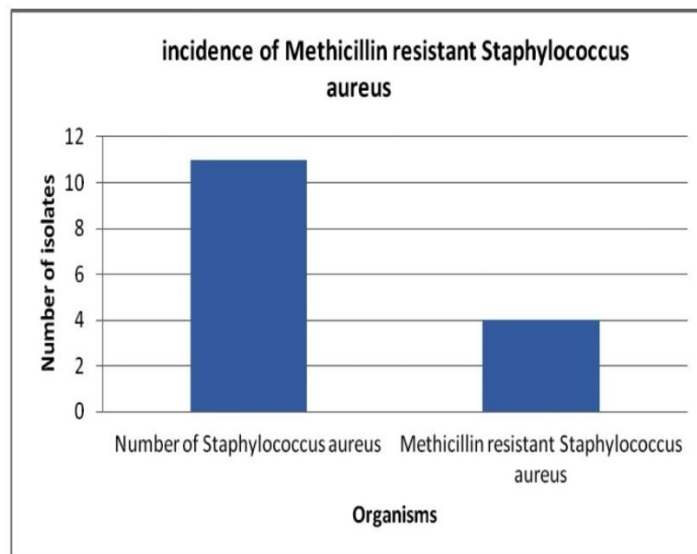
Incidence of Amp C production among Gram negative bacilli



Percentage of metallo beta lactamase among Gram negative bacilli

Antimicrobial susceptibility pattern of N-Meningitidis isolated from pyogenic Meningitis

Organisms		Penicillin	Tetracycline	Ampicillin	Gentamicin	Amoxicillin	Amikacin	Chloramphenicol	Cefotaxime	Ceftazidime	Ceftriaxone
N. meningitidis (13)	R		13 (100)	-	--	13 (100)	--	--	--	--	--
	S		--	13 (100)	13 (100)	--	13 (100)	13 (100)	13 (100)	13 (100)	13 (100)



Organisms	No. of organisms isolated	ESβL producing isolates
<i>H. influenzae</i>	51	24 (41.2%)
<i>Klebsiella</i> sps	08	06 (80.0%)
<i>E. coli</i>	05	03 (60.0%)
<i>Pseudomonas</i> sps	03	02 (66.7%)
Total	67	35 (52.2%)

CONCLUSION

Meningococcal disease is extremely serious and poses many risks, but with timely vaccination in children, it is possible to protect them. For additional information, consult your doctor if your child has never been vaccinated. The fight against meningitis can be won by all of us working together. Acute bacterial meningitis can be treated with intravenous antibiotics and sometimes corticosteroids. This treatment helps to reduce its symptoms and prevent the risk of further complications. An antibiotic or a combination of antibiotics depends on the type of bacteria and the cause of the infection. Viral meningitis treatment – Viral meningitis cannot be treated with

antibiotics, and in most cases the condition of meningitis improves on its own within a few weeks. For mild cases of viral meningitis, a doctor may usually recommend bed rest, increased fluid intake, over-the-counter medications to reduce fever, and relieve body aches. Antifungal agents can be used to treat fungal meningitis.

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