PRIMEVIEW

COMMUNITY-ACQUIRED BACTERIAL MENINGITIS

nature REVIEWS DISEASE PRIMERS

For the Primer, visit doi:10.1038/nrdp.2016.74

Meningitis is an inflammation of the meninges lining the brain. Common bacterial infections that can lead to meningitis are caused by *Streptococcus pneumoniae* and *Neisseria meningitidis*. Meningitis is a medical emergency that requires immediate treatment.

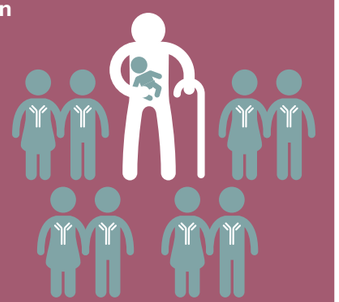
DIAGNOSIS

Classic symptoms of meningitis are neck stiffness, fever and altered mental status; however, not all patients show them. If bacterial meningitis cannot be excluded, a lumbar puncture should be performed, if safe. A positive cerebrospinal fluid (CSF) culture typically shows a high density of leukocytes — a sign that the host inflammatory and immune response has been triggered by bacterial invasion and proliferation in the CSF.

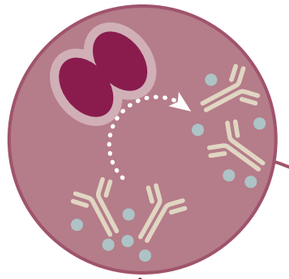
High leukocyte density in the CSF might not always be present, especially in patients with compromised immune systems or in those who received antibiotics before lumbar puncture; alternative diagnostic tests might be required.

PREVENTION

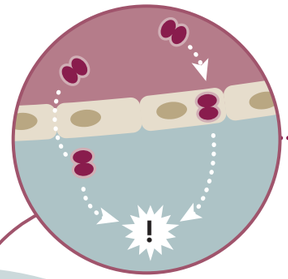
The introduction of vaccines covering several bacterial types that are implicated in meningitis has led to a reduction in the global incidence. Reduced transmission also protects individuals who have not received a vaccine or have a poor immunological response to it, in particular, infants and the elderly (herd protection).



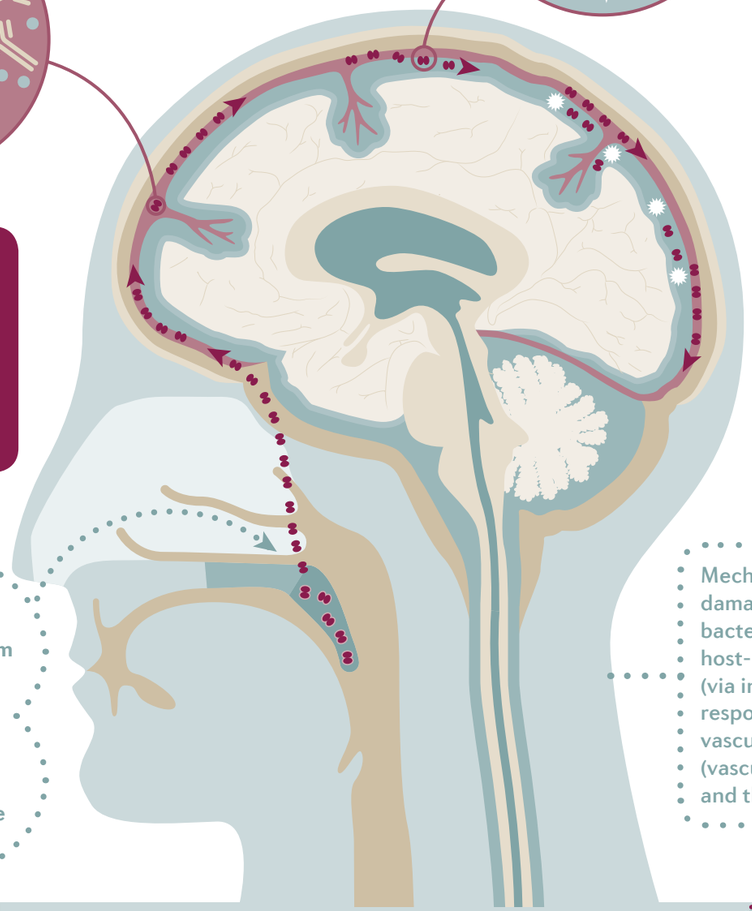
MECHANISMS



The bacterial polysaccharide capsule inhibits opsonization and enables immune evasion; bacteria survive in the bloodstream



Bacteria adhere to the vascular endothelium and enter the CSF. As their density increases, nutrient-deprived bacteria die, sparking an inflammatory response — meningitis.

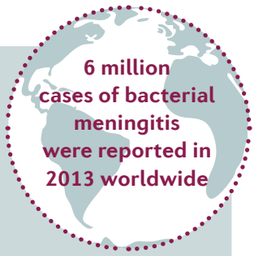


In susceptible individuals, bacteria move from their initial site of infection (typically the nasopharyngeal epithelium) to the bloodstream

Mechanisms of brain damage include direct bacterial cytotoxicity, host-mediated toxicity (via inflammatory response) and vascular damage (vasculitis, vasospasm and thrombosis)

OUTLOOK

Community-acquired bacterial meningitis remains a major infectious disease worldwide. Prevention and early treatment are essential to reduce morbidity and mortality. The emergence of antibiotic-resistant bacterial strains has urged the development of new and improved vaccine formulations. High case fatality and morbidity rates stress the need for new adjuvant anti-inflammatory therapies. Global surveillance systems are required to track the efficiency of vaccination programmes and the ever-changing molecular epidemiology of the bacterial strains and genotypes.



6 million cases of bacterial meningitis were reported in 2013 worldwide

MANAGEMENT

High rates of mortality and severe neurological complications mean that early treatment is vital; patients should be admitted to intensive care and empirical antibiotic therapy should start as soon as bacterial meningitis is suspected. The causative bacteria must then be identified to tailor antibiotic treatment. Adjuvant therapies (for example, dexamethasone) aim at dampening brain damage caused by the host inflammatory response to infection.

The most frequent neurological effects are cognitive impairment and hearing loss. Hearing loss can be attributed to bacteria spreading from the meninges to the cochlea. Otitis media (inner ear inflammation) is also a risk factor for meningitis.

EPIDEMIOLOGY

Meningitis has high morbidity and mortality worldwide. The incidence in high-income countries, where vaccination programmes and advanced health care are available, is far lower (typically 3 per 100,000 population per year) than in low-income countries. In the 'meningitis belt' in sub-Saharan Africa, incidence can reach almost 1% of the population during outbreaks. The various meningitis-associated pathogens frequently infect specific age groups: *S. pneumoniae* infects infants and the elderly and *N. meningitidis* infects older children, teenagers and young adults.

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Article number: 16075; doi:10.1038/nrdp.2016.75; published online 3 Nov 2016