Smoking, Meningitis and Sepsis

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Introduction

Meningococcal disease (MD) is a life-threatening infection caused by bacteria called Neisseria meningitidis, also known as meningococcus. It is a term used to describe two major illnesses: Meningitis and septicaemia.[1] These can occur on their own or both together. There are six main groups of Neisseria meningitidis distinguished by their polysaccharide capsule A, B, C, W, X and Y that cause disease around the world. In the UK, group B causes most of the disease.[2]

Meningitis refers to the swelling of the meninges, the protective membrane layers surrounding the brain and spinal cord.[2] Septicaemia, on the other hand, is a severe blood infection. Bacteria proliferate in the bloodstream, damaging the walls of the blood vessels and releasing endotoxins that harm the entire body. Septicaemia is usually more dangerous than meningitis. [1 2]

The disease can affect people of any age, but it is most common in babies, children, and young people.[1] This fact sheet provides information about meningococcal disease (MD), the relationship between MD and smoking and how a person's risk may be reduced by quitting.

TRANSMISSION AND SYMPTOMS

Neisseria meningitidis only infects humans – they are the only host. People spread meningococcal disease to others via direct contact with respiratory droplets from an infected person. Smoking, close contact – such as kissing, sneezing or coughing on someone, or living in close proximity to an infected person is usually required to facilitate the spread of the disease.[1]

The average incubation period is four days but can range between 2 and 10 days. After the incubation period, the onset of symptoms such as stiff neck, high fever, sensitivity to light, confusion, headaches and vomiting, loss of consciousness is sudden, and death can follow within hours.[1 2]

- In recent years there has been a steady decline in the incidence of meningococcal disease. In 2019-20 annual MD incidence across all age groups was approximately 1 per 100,000 population in the UK.[3]

- Around 8 – 15% of MD cases will result in death, even when the disease is diagnosed early and appropriate treatment is initiated.[1]

- Persistent neurological problems, such as loss of hearing and sight, brain damage or damage to vital organs, loss of fingers or limbs, and paralysis, occur in 10-20% of cases.[1]

WHO IS AT RISK OF MD AND WHY?

Meningococcal disease can affect any age group[1]. However, young children, particularly babies under the age of one, are most at risk. The risk is further increased if infants are exposed to tobacco smoke [4] – see the section on second-hand smoke below. Teenagers and young adults are the second most at risk group. Both adults and children with meningococcal disease and those who carry the bacteria asymptotically in the nasopharynx (upper part of the throat behind the nose) can spread the bacteria.[2 5] Around 10% of the general

population will be carriers at any given time. Once someone has carried these bacteria, they are more likely to develop immunity as a result.[2]

Babies and young children are more at risk because their immunological defences are not fully developed.[6] A risk factor for teenagers and young adults is increased social interaction; this increases the number of carriers to around 25%.[2 7]

Likewise, people who live in overcrowded premises are also at increased risk of MD.[8 9]

Several studies have also found that university students, particularly those living in dormitories, are also one of the populations most at risk due to the close quarters of students in university dorms which allows for rapid disease spread.[10 11]

As a result, socioeconomic status is a likely marker for differences in risk factors such as household crowding, exposure to tobacco smoke, and urban residence.

TOBACCO SMOKE AND MD

Research has established that there is a dose–response relationship between smoking and exposure to second-hand smoke and the risk of meningococcal disease in all age groups.[9 12 13 14]

According to the US Centres for Disease Control, *"antecedent viral infection, household crowding, chronic underlying illness and both passive and active smoking are associated with increased risk for meningococcal disease".*[5] It has been estimated that smoking is responsible for one-third to half of all cases of MD.[13 14 15]

Research carried out in Norway, Sweden, Denmark, and the Netherlands provides further evidence for the link between smoking and MD. In Norway, a positive association was observed between reduced incidence of MD and reduction in population smoking prevalence between 1975 and 2009 although evidence from the other countries was inconclusive due to limited data.[16]

In a more recent study, active smoking and second-hand smoke exposure were also revealed to be risk factors for an outbreak of meningococcal disease in adults in Italy.[12 17] Another study has indicated that exposure to second-hand smoke may also be linked to increased mortality among MD patients, with mortality among those patients exposed to second-hand smoke being over twice that of those who were not exposed.[18]

One explanation for the increased rates of meningococcal disease in smokers and passive smokers may lie in the increased ability of bacteria to adhere to and multiply on the mucosa cells of the nasopharynx.[19 20] Furthermore, smoking is also a known risk factor for infection in general, so it is likely that this is a contributing factor in the link between tobacco use and MD.[21 22]

SECOND HAND SMOKE, MD AND CHILDREN

There is strong evidence of an association between cigarette smoking in the home and increased rates of MD in children.[4 8 14 18 23 24] According to a case-control study, children under 18 had nearly four times the risk of contracting the disease if their mothers smoke. When compared to no exposure, active smoking or exposure to second-hand smoke more than doubles the risks in all age groups.[12]

A meta-analysis published in 2010 found a significant association between exposure to second-hand smoke and MD in children. The researchers analysed 42 studies and found that children exposed to second-hand smoke were twice as likely to get invasive meningococcal disease.[25]

A more recent meta-analysis of 18 studies found both second-hand smoke exposure and exposure to maternal smoking during pregnancy increased the risk of childhood invasive MD. Second-hand smoke exposure in the home doubled the risk of MD, with some evidence that this increased in line with increased exposure. The greatest risks were observed in children under five. Maternal smoking during pregnancy increased the risk of MD by three times. The authors concluded that exposure to second-hand smoke caused an additional 630 cases of invasive MD in children under 16 in the UK alone.[26]

A review of the evidence by the Royal College of Physicians concluded that 22% of cases of meningitis in children could be attributed to second-hand smoke exposure in the home.[4]

SMOKING CESSATION

The most effective way of reducing the risk of MD among smokers and children is by stopping smoking. Exposure to tobacco smoke causes direct damage to the nasal mucosa, which plays an important role in mediating immune responses to allergens and harmful microorganisms.[27]

Passive smoking is associated with an increased risk of respiratory disease, asthma and wheezing in young children.[28] [29] It is a cause of significant morbidity and mortality in babies and children, and cost to the NHS.[28]

Parents and careers should be informed about the harms of smoking and second-hand smoke exposure and the importance of maintaining a smokefree home. Emphasising that the only effective way of reducing exposure is to make homes and vehicles completely smokefree, as ventilation or limiting smoking to certain areas do not provide sufficient protection.

FURTHER INFORMATION

For further information on the signs and symptoms of meningitis and septicaemia contact the Meningitis Now helpline on 0808 80 10 388 or visit the website: https://www.meningitisnow.org/

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