Learning outcomes 5.1 Medical Microbiology
medis/medicin 2013/14

Week 1 - Medical Microbiology
Plenary sessions

➢ Bacterial structure and classification
  • Describe the structure and means of replication of bacteria.
  • Explain the meaning of the following terms used when describing bacteria: coccus, bacillus (rod).
  • Gram-negative, Gram-positive, acid-fast; aerobic, anaerobic; opportunistic, fastidious.
  • Outline the three main ways bacteria use to exchange genetic material.

➢ Bacterial pathogenicity
  • Explain the concepts of infectivity and virulence and define the term infective dose
  • Define the terms commensal and pathogen used in association with bacteria
  • List the potential sources and possible routes of infection by bacteria
  • Give examples of bacterial pathogens transmitted by different routes and outline the ways in which they cause disease
  • Give examples of bacteria whose pathogenicity results from toxins, and those which can live intracellularly in the host

➢ Lung infections
  • Explain the clinical classification of lung infections and describe which patient groups are most susceptible to such infections
  • Describe diagnostics methods for lung infections
  • List the potential sources and routes of infections
  • Describe the role of the innate immune system reaction to lung infections
  • Describe how the adaptive immune system reacts to lung infections and against which pathogens vaccination is possible
  • Describe the strategy for treatment of lung infections

➢ Meningitis
  • List the clinical manifestations of meningitis and list the most common microbial causes of meningitis
  • List the risk factors of importance for developing of meningitis
  • Describe diagnostics methods for meningitis
  • List the potential sources and routes of infections
  • Describe the age dependent immunity to meningitis
  • Describe vaccines against meningitis

➢ Introduction to protozoa
• Describe the life cycle of the malaria parasite
• Describe the manifestations of the disease
• Summarize immune response against malaria
• Explain the malaria diagnostics
• Summarize malaria prophylaxis and treatment
• Describe toxoplasma infections clinical signs
• Explain problems with toxoplasma infections during pregnancy, and how to prevent such an infection

➢ Introduction to helminthes
  • Describe the life cycle of Pinworm (Enterobius), symptoms of infection and treatment
  • Describe the life cycle of Tapeworms, symptoms of infection, complications and treatment

➢ Thermoregulation and pyrexia
  • Summarize the main processes responsible for heat production in the body.
  • Summarize the role of the skin and sweating in the mechanism of heat loss by the body.
  • Describe the control mechanisms regulating body temperature and the role of the hypothalamus in maintaining a set point.
  • Explain the meaning of core temperature, and how this varies in normal activities and in fever and hypothermia.
  • Describe the mechanism by which infections lead to fever, and indicate the step in the process affected by antipyretic drugs such as aspirin.

➢ Pathology of inflammatory responses
  • Describe the typical features of acute inflammation.
  • Describe the natural history of an acute inflammatory response and its effects on the affected tissue and the rest of the body.
  • Describe briefly how the microscopic features of acute inflammation differ from those of chronic inflammation.

➢ Virus properties
  • Describe the nature of viruses: their small size, unique mode of replication and diversity.
  • Define the following terms as used in the description and classification of viruses: DNA virus,
  • RNA virus, retrovirus, capsid, enveloped, non-enveloped, symmetry.
  • Give examples of different viruses associated with infectious disease in humans and describe the way in which they cause disease.

➢ Transmission and treatment of viral disease
  • Define the different routes and sites of infection associated with viral disease.
• Explain why it is difficult to develop drugs, which selectively act against viral infections.
• Give examples of classes of drugs, which have been used successfully in antiviral therapy.
• Describe the strategies underlying the search for novel antiviral agents.
• Describe the roles of the innate and adaptive immune responses in defense against viral infections, and explain how some viruses evade natural immune responses.
• Explain the meaning of latency in relation to viral infections.

Fungal infections
• Outline the main differences between fungi and bacteria.
• Summarize briefly the ecology and epidemiology of infectious fungi.
• List major groups of disease-causing fungi and specify their growth forms.
• Define the terms superficial and deep mycosis.
• Describe briefly the main classes of antifungal agents.

Cases

Rosemary Anderson (pneumonia) & Billy Rattle (meningitis)
• Describe the risk factors & pathophysiology of bacterial pneumonia
• Summarize the microbiology of common pneumonia causing microorganisms (pneumococcus, staphylococcus, others)
• Describe the pharmacology of the major penicillin & macrolide antibiotics
• Describe the phenomenon of antibiotic resistance from the points of view of microbiology & clinical practice
• Describe the pathophysiology of meningitis
• Outline the microbiology of meningitis
• Outline the preventive & public health issues of meningitis
• Describe the use and mechanism of action of the cephalosporin antibiotics
• Explain hypersensitivity to antibiotics and its mechanisms

Week 2 - Medical Microbiology
Plenary sessions

Bacterial genetics
• Describe the organization and replication of the bacterial genome and of extra chromosomal elements (Plasmids)
• Describe the organization and regulation of bacterial genes/operons
• Describe bacteriophages
• Explain restriction and modification systems
• Explain mechanisms of DNA transfereee between bacteria: Transformation, transduction, conjugation and mobile/transposable genetic elements
• Explain the importance of bacterial genetics in the development of resistance to antibiotics

➢ Antibacterial drugs
  • Describe the mode of action of the major groups of antibiotics and list the mechanisms of resistance to them.
  • Describe the mode of action, resistance mechanisms, pharmacokinetics, side effect and the use of specific antibiotics: Penicillins and beta-lactamase inhibitors, Ciprofloxacin, Azithromycin, Gentamicin, Metronidazol.
  • Give examples of antibiotic resistance and describe how this affects healthcare.
  Explain the principles of the rational use of antibiotics.

➢ Sexual transmitted diseases (STD)
  • List the bacterial and viral causes to sexual transmitted disease in Denmark
  • Explain sexual risk behavior and the impact on the different STD
  • Describe symptoms of the different STD
  • Describe diagnostic procedures for STD, discuss the prevention of STD in the community and surveillance of STD.
  • Describe the treatment of STD
  • Explain how papilloma virus can cause cellular changes, their complications and prevention

➢ HIV and international health politics
  • Describe the differences in HIV incidence between developed and developing countries (eg: give some country/region specific examples, including numbers affected/scale of the problem, differing modes of transmission, special problems, availability of treatment).
  • Summarize the current antiretroviral therapies for HIV and discuss the feasibility of using them in developing countries (eg: in terms of cost and the local healthcare infrastructure).

➢ Infections of skin and soft tissue
  o Name causes to primary skin infections (bacteria and virus infections)
  o Name causes to soft tissue infection
  o Explain roles of toxins in skin infection
  o Describe skin manifestations of systemic infections (bacteria and virus infections)
  o Explain the principles of diagnostics of skin infections
  o Discuss treatment and prevention of skin and soft tissue infections
Molecular mechanisms of antibiotic resistance
- Describe the molecular mechanism behind penicillin and methicillin resistance
- Describe methods for investigating spread of antibiotic resistant
- Describe the mechanism behind multi-drug resistance
- Outline methods for population genetics of bacterial strains

Hospital acquired infections
- Describe the dangers of acquiring infections in a healthcare (hospital)
- Outline the steps taken to prevent and manage hospital-acquired infections.

Control of communicable disease
- Describe the factors (eg: environment, lifestyle, level of immunity) which influence who gets infected, how, and why.
- Define an outbreak of infectious disease and explain how knowledge of routes of infections helps both identification and prevention of outbreaks.
- Summarize the importance of surveillance in communicable disease control.

Forsvaret mod infektion & Vaccination
- Forklar hvorledes det adaptive immunrespons medvirker i forsvar mod patogener.
- Giv eksempler på infektioner for hvilke vaccination er en succesfuld strategi
- Forklar forskellen mellem aktiv og passiv immunisering
- Benævn og beskriv virkningsmekanismerne for de forskellige typer af vacciner, der findes.
- Beskriv de forskellige administrationsveje for vacciner

Clinical skills – Modul 1 (Medicine + MedIS)
Simuleret konsultation (3.1)/Respiration & hjertekarsystemet (8.1)/Infektionssygedomme (4.1)

Resource session ”Antibacterial drugs”

Cases
- Margaret Thompson (varicella), Mark Johnson (mononucleosis) & Harry Flemming (HIV)
  - Outline epidemiology, microbiology & pathophysiology of varicella zoster virus
  - Discuss the scope & limitations of antiviral therapy
  - Summarize the pharmacology of aciclovir
  - Describe transmission, nature & course of infectious mononucleosis
  - Describe causes & control of fever
  - Describe in outline the particular features of retroviral infection & the effect of HIV on T-helper (CD4) cells
  - Describe the major routes by which HIV transmission takes place & how it may be reduced
• Summarize the pharmacology of the major components of HAART therapy, non-nucleotide reverse transcription inhibitors & protease inhibitors

Week 3 - Medical Microbiology
Cases

- Virtual Vaccination Clinic (vaccination) & Harry Flemming (candidiasis)
  • Identify recommendations on standard childhood vaccinations in the UK
  • Explain the use of certain vaccines (e.g. influenza) only for vulnerable groups
  • Identify sources of information for vaccinations and other health precautions advised for overseas travel
  • Name & describe the mechanisms of action of the different types of vaccine available
  • Summarize approaches to malaria prevention and prophylaxis
  • Outline significance of fungal infections in general, and in immunosuppressed patients in particular
  • Identify differences between HIV and AIDS
  • Describe the ways in which AIDS can present, and how this is related to immunodeficiency
  • Outline the available therapeutic strategies for HIV/AIDS
  • Summarize the mechanisms of action of antifungal drugs

Medical Biopрактиcals
Learning opportunities and their outcomes of Biopрактиcs

- Hygiene
  • Prevention of transmitting infectious agents by hygiene
  • Handling infectious material
- Laboratory skills
  • Isolation of bacteria from clinical samples
  • Characterization of bacteria, virus and pathogenesis factors
  • Determination of antibiotic resistance and mechanisms of resistance
  • Susceptibility of virus to antiviral treatment
- Theory
  • Principals for developing and transfer of resistance
  • Specific knowledge about resistance mechanisms, uptake, clearance, side effect and the use of the antibiotics:
    o Penicillins and beta-lactamase inhibitors
    o Ciprofloxacin
    o Azithromycin
Week 4 - Medical Microbiology
Plenary sessions

Clinical skills – Modul 1 (Medicine + MedIS)
Simuleret konsultation (3.1)/Respiration & hjertekarsystemet (8.1)/Infektionssygedomme (4.1)

Resource session ”Medical biopractical”

Clinical placement (Medicine + MedIS)

Infection

Relevant literature:

Microbiology
  o Schaechter’s Mechanisms of Microbial Disease 4th edition
    Chapter: 3, 5, 6, 7, 9, 10, 11, 13, 14, 27, 29, 31, 34, 36, 38, 41, 42, 44, 45, 52 (Malaria and Toxoplasma) 58-71 74, 75

Immunology
  o Børnevaccinationsprogrammet i Danmark
  o Immunology: Agger m.fl. Kapital 11 (Immunitet ved infektioner), Kapitel 15 (Vaccination)
    ▪ or
  o Mims’Medical Microbiology (Protecting the host: vaccination)

Antibiotics
  o Kampmann m.fl.: Basal og klinisk farmakologi. Antibiotika
    ▪ or
  o Schaechter’s Mechanisms of Microbial Disease 4th edition, Chapter: 16, 43, 60, 76
    ▪ or