Medical bacteriology syllabus for medicine students

Course syllabus for one semester

Course: Medical bacteriology

Addressed to: Students of medicine

Duration: 23 sessions that takes 90 minutes (two sessions per week)

Type of course: Theoretical

Overall objective

At the end of the course the students should be able to:

1. State the normal flora and infective microorganisms of the human body and describe the host-parasite relationship

2. List the pathogenic microorganisms, their general characteristics, classifications, nomenclature and methods for identification of bacteria

3. State the sources, modes of transmission and describe the pathogenesis of the diseases produced by the microorganisms.

4. Describe the mechanisms of immunity against infectious agents.

5. Help the laboratory for making a microbiological identification of pathogenic bacteria.

6. Apply the methods of sterilization and disinfection to prevent and control infections

7. State the suitable antimicrobial agents for treatment and vaccines available for prevention of communicable diseases

Part 1: Introduction to Bacteriology

Lecture I: History of microbiology, bacterial taxonomy

Discovery of microorganisms

Spontaneous generation and germ theory of disease

Taxonomy on of bacteria, classification, nomenclature, identification

Classification of bacteria, phenotypic classification and genotypic classification

Lecture II: Bacterial morphology and structure

Prokaryotic and eukaryotic cells - examples and differences

Cytoplasmic membrane

Basics of bacterial cell wall structures and properties associated with bacterial cell walls (gram positive/negative cell wall, staining, peptidoglycan, LPS, pathogenesis, and targets of antibiotics)

Lecture III: Bacterial appendages

Structure of flagellum and arrangement of flagella Fimbriae or pili, types of pili, functions of pili in bacteria Bacterial capsule & slime layer and function of capsule in bacteria, methods for demonstration of capsule Bacterial spores, morphology of spore, structure of bacterial spore

Lecture IV: Bacterial genetics

Genetic material of bacteria (chromosome, plasmid, transposable elements and integrons)

Bacterial phages, virulent phage and lysogenic phage

Mechanisms of transfer and recombination of bacterial genes (transformation, transduction, conjugation and lysogenic conversion)

Gene mutation

The significance of bacterial genetic variation (in drug resistance, pathogenesis or virulence and variation, diagnosis, and vaccination)

Lecture V: Bacterial growth & metabolism

Essentials of bacterial nutrition: macronutrients and micronutrients Energy source: phototroph, chemotroph Carbon source: autotroph, heterotroph Oxygen requirements for microbial growth: aerobes, microaerophilic, anaerobes, facultative anaerobes bacteria Physical environmental: temperature, CO2, pH, osmotic pressure, salt Batch cultures and continuous cultures Media for bacterial cultures Lecture VI: Sterilization and disinfection in microbiology Definition of terms, sterilization, disinfection, antisepsis, germicide Chemical germicide activity level: high-level disinfectant, intermediate level disinfectant, low-level disinfectant Chemical disinfectant groups: aldehydes: (formaldehyde, paraformaldehyde, glutaraldehyde) Halogen-based biocides: (chlorine compounds and iodophores) Quaternary ammonium compounds, phenolics, heavy metals, alcohols Physical methods of sterilization of microrganisms Heat, dry heat procedures, flaming, hot air oven moist heat sterilization procedure Pasteurization, boiling, tyndallisation, autoclave Filtration Radiation, Ionizing radiation, non-ionizing radiation Factors that alter the effectiveness of a disinfectant

Lecture VII: Antimicrobial chemotherapy

Mechanisms of antimicrobial action: inhibitors of cell wall synthesis, inhibitors of protein synthesis, inhibitors of nucleic acid synthesis, inhibitor of plasma membrane, inhibitor of synthesis of essential metabolites Antimicrobial drugs used in combination: antimicrobial synergism, antimicrobial antagonism Antibiotic resistance: mechanisms of antibiotic resistance, nongenetic origin of drug resistance, genetic origin of drug resistance Antibiotic susceptibility testing

Lecture VIII: Bacterial infection & pathogenesis and immune responses

Normal human microbiota (role of the resident microbiota, and locations in the human body)

Virulence of bacteria, bacterial virulence factors and their regulation (exotoxin, endotoxin, and their contribution to pathogenesis) Immunity and immune responses against bacterial infection Mechanisms of innate immunity (barriers, phagocytes, complement system etc.) Mechanisms of specific host defense (humoral immunity, cell-mediated immunity, their activities on exocellular or intracellular bacterial infection.

part 2: Second of the lesson plane is about pathogenic bacteria. For all bacteria listed below, the following topic will be discussed.

- 1- Morphology, classification, cultural and biological characteristics of each bacteria.
- 2- Bacterial antigenic determinants and virulence factors involved in pathogenicity

- 3- Immune response mechanisms in controlling bacterial infections
- 4- Infectious diseases caused by pathogenic bacteria and clinical findings
- 5- Route of transmission, Epidemiology and control of bacterial infections
- 6- Diagnostic laboratory tests for the diseases caused by bacteria
- 7- The suitable antimicrobial agents for treatment and vaccines available for prevention of diseases caused by bacteria

Lecture IX: The Staphylococci

Staphylococcus aureus

Coagulase negative staphylococci including, S. epidermidis, S. saprophyticus, S. haemolyticus, and S. lugdunensis

Lecture X: The Streptococci, Enterococci, and Related Genera

Streptococcus pyogenes (group A streptococci)

Streptococcus agalactiae (group B streptococci)

Streptococcus pneumoniae

Viridans streptococci

Group D Streptococci

Group C, G Streptococci

Enterococci

Lecture XI: Spore-Forming Gram-Positive Bacilli

Bacillus anthracis Bacillus cereus Clostridia , non-spore forming anaerobes Clostridium tetani Clostridium botulinum Clostridium difficile Clostridium perfringens

Lecture XII: Aerobic Non–Spore-Forming Gram-Positive Bacilli

Corynebacterium diphtheriae Other Coryneform bacteria Listeria monocytogenes Erysipelothrix rhusiopathiae Nocardia and related bacteria

Lecture XIII: Gram Negative Cocci and Moraxella Neisseria gonorrhoeae (meningococcus) Neisseria meningitides (gonococcus) Moraxella catarrhalis

Lecture XIV: Enterobacteriaceae: General Introduction, *Escherichia coli* & *Shigella* General characterization of Enterobacteriaceae *Escherichia coli Shigella*

Lecture XV: Enterobacteriacea: Samonella, Yersinia and other Enterobacteriaceae Salmonella Yersinia Klebsiella, Proteus, Enterobacter, Citrobacter, Morganella, and Serratia Lecture XVI: Vibrio, Campylobacter and Helicobacter Vibrio cholerae Vibrio parahaemolyticus & other Vibrios, Aeromonas and Plesiomonas Campylobacter Helicobacter pylori

Lecture XVII: Pseudomonas, Acintobacter and Related Bacteria

Pseudomonas aeruginosa Burkholderia pseudomallei and Burkholderia cepacia complex Stenotrophomonas maltophilia Acintobacter

Lecture XVIII: Haemophilus, Bordetella, Brucella, Francisella

Haemophilus influenzae Other strains of Haemophilus and Aggregatibacter aphrophilus Bordetella pertussis other Bordetella (B. parapertussis and B. bronchiseptica) Brucella Francisella tularensis

Lecture XIX: Legionella, Bartonella and unusual pathogenic bacteria

Legionella pneumophila and other Legionella Bartonellla Streptobacillus moniliformis Spirillum minus Cardiobacterium hominis

Lecture XX: anaerobic bacteria Anaerobic gram-positive cocci Anaerobic, non–spore-forming gram-positive rods Anaerobic gram-negative bacteria

Lecture XXI: Mycobacterium

Mycobacterium tuberculosis Mycobacterium leprae: Mycobacterium avium complex Rapidly growing mycobacteria Other Mycobacterium Species

Lecture XXII: spirochetes

Treponema pallidum and syphilis Diseases related to syphilis Borrelia recurrentis Borrelia burgdorferi Leptospira interrogans

Lecture XXIII: Mycoplasmas, Rickettsia, Chlamidia

Mycoplasma pneumoniae and other Mycoplasma Rickettsia rickettsii and Other Spotted Fever Group Rickettsiae Rickettsia prowazekii and Rickettsia typhi Ehrlichia and Anaplasma Coxiella burnetii Chlamydia trachomatis, Chlamydia pneumonia, Chlamydia psittaci