Course syllabus:

Medical Microbiology

Aim of the course:

The purpose of this course is to provide students with information regarding major infectious diseases factors, including bacteria, viruses, fungi and parasites. The student will learn about the pathological processes occurring in different organs following penetration of the pathogen and the causes that led to it, signs of the disease, treatment, prevention and laboratory diagnosis using innovative technologies (molecular biology) as well as traditional techniques (serology, culture). In addition, the course will deal with mechanism of action of antiviral and antibacterial preparations, aspects of infection control and dissemination of resistant bacteria in health institutions and in the community, as well as the importance of the human microbiome in light of current studies on the subject.

Duration of the course: 3 weekly hours

Prerequisites: General Microbiology course

Subjects:

Characteristics of the pathogen: Production of enzymes, toxins, body tissues adhesion mechanisms, capsule, host cell penetration. Opportunistic pathogens that may cause disease as a result of medical intervention, such as insertion of various catheters, administration of immunosuppressive agents, chemotherapy and treatments that require surgical intervention, zoonotic pathogens.

Laboratory diagnosis of infectious diseases: Traditional methods of infection diagnosis, such as bacterial culture, cell

culture, serology tests (also addressing the types of antibodies and their emergence in blood during an infection), as well as histology and innovative methods enabling the identification of pathogens using molecular biology. The importance of the communication between the clinician and the microbiology laboratory for identification of the pathogen and determining the required antibiotic treatment.

Gastrointestinal infections: *Salmonella*, *Shigella*, *Campylobacter* bacteria, pathogenic strains of *E. coli, Helicobacter pylori* and inflammation of gastric mucosa and duodenum that may lead to ulcers and cancer. Viral pathogens belonging to the group of jaundice and rotavirus and unicellular parasites, especially *Giardia lamblia*, *Cryptosporidium* and single-celled amoeba. Diarrheal disease following antibiotic therapy caused by the bacteria *Clostridium difficile****.***

Genital tract infections and sexually transmitted diseases: *Neisseria gonorrhoeae*, chlamydia and syphilis (*Treponema pallidum*), viral herpes, human papillomavirus (HPV), human immunodeficiency virus (HIV) and AIDS, as well as infection caused by the parasite *Trichomonas vaginalis*.

Urinary tract infections: The involvement of intestinal bacteria in urinary tract infections, urinary tract infections in pregnant women (emphasis on group B streptococcal infections) that may lead to premature birth and early infections in the newborn. Laboratory diagnosis using quantitative urine culture, urine biochemistry (urinalysis) and microscopic examination of urine sediment.

Respiratory tract infections: Pharyngeal infections caused by group A streptococcal infections, also addressing late complications arising from autoimmune reaction and damage to heart valves, joints and kidneys. Legionnaires' disease caused by *Legionella pneumophila*, influenza viruses, RSV virus. Acquired pneumonia versus community-acquired pneumonia caused by mould (aspergillus) in immunosuppressed patients.

Nervous system infections: Meningitis versus tncephalitis - common types of pathogens: *Neisseria meningitides*, *Haemophilus*, herpes and enterovirus. Laboratory diagnosis using cerebrospinal fluid analysis.

Skin and soft tissue infections: Streptococcal infections and infections caused by *Staphylococcus aureus*.

Viral and bacterial diseases in childhood and the importance of vaccines: rubella, measles, mumps, pertussis.

Action mechanisms of antibacterial agents: penicillins, cephalosporins, macrolides, tetracyclines, sulfonamides, carbapenems. Understanding the terms **"**minimum inhibitory concentration" (MIC)**,** "minimum bactericidal concentration" (MBC), bactericidal antibiotics and bacteriostatic antibiotics.

Controlling infectious diseases and bacterial resistance to antibiotics: Reaction mechanisms of bacteria to antibiotics using enzymes and pumps. Examples of beta-lactamase, ESBL, ampC, KPC enzymes. Prevention of the spread of infectious diseases in hospitals and community (e.g., MRSA bacteria).

Selected tropical infectious diseases: malaria and cutaneous leishmaniasis.

Human microbiome and selected diseases: Review of studies from current articles on involvement of bacteria in various diseases such as obesity, inflammatory bowel diseases and tumors.

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