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**COURSE AND FORMS
OF INFECTION – II**

**The 11th lecture for the 2nd-year students,
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Infection – revision

Definition:

Infection = a relation between the pathogenic microbe and the macroorganism (= ecological point of view)

Infection colonization:

Infection = situation when an **etiological agent**

- 1) **penetrates into an organism and multiplies in it, or**
- 2) **it settles on bodily surfaces (skin or mucosae) and unfavourably affects them**

Colonization = situation when

- 1) **a non-pathogenic microbe settles on a bodily surface, or**
- 2) **a pathogen located there does not cause pathological symptoms**

Course of infection I – revision

Four components can be distinguished during the course of infection:

- **Incubation time**
- **Prodromes**
- **Typical syndrome (= complex of symptoms) of the infectious disease**
- **Convalescence**

Course of infection II – revision

Incubation time

salmonellosis $\frac{1}{2}$ –1 day, influenza 1–2 days, tbc 2–8 weeks, hepatitis B 90–100 days

Prodromes

not always; nonspecific (\uparrow T, headache, feeling ill etc.), several hours to days

Typical syndrome of infectious disease

as described in textbooks

Convalescence

from subsiding troubles till normalization of laboratory results (except antibodies!)

Course of infection III – revision

Relapse

the **same agent**, infection comes on again during the convalescence

Recurrence

the **agent remains** in the body, infection comes on again only after recovery (Brill-Zinsser disease = recurrence of epidemic typhus)

Reinfection

new infection by the **same agent** from outside

Superinfection

infection by **another agent** before recovery from the first infection

Forms of infection – revision

Inapparent infection (without symptoms)

sole consequence: development of immunity (usually by means of antibodies)

Manifest infection (with symptoms)

subclinical: non-characteristic signs only

abortive: only some symptoms or slightly manifested ones

clinical: typical signs as in textbooks

foudroyant, fulminant: very abrupt, with dramatic symptoms

Duration of infection – revision

Acute: days (common cold, salmonellosis)
to weeks (majority of infections)

Subacute: months – either as a complication of any infection, or as the rule (some kinds of hepatitis, warts, sepsis lenta)

Chronic: years (tbc, lepra, dermatomycoses, parasitic infections)

Fulminant, foudroyant: very rapid course –
hours (meningococcal sepsis)

Extent of infection – revision

Local: portal of entry & regional nodes, or a specific organ (common cold, ringworm, warts, uncomplicated gonorrhoea, abscessus in an organ)

Systemic: whole organ system (influenza, lung tbc, meningitis, extensive pyoderma, pyelonephritis, pelvic inflammatory disease)

Generalized: **regularly** (exanthematic viroses, typhoid fever, exanthematic typhus), **or as a complication** (sepsis after injury, during cystitis or cholecystitis, salmonellosis in a newborn)

Focal infection I – revision

Focal infection theory:

chronic infection limited to a certain focus can result in a systemic illness with symptoms in quite a different site

Concept of focal infection used to be very fashionable formerly in diverse medical branches

In the name of so-called sanation of focuses thousands of patients were bona fide subjected to tooth extractions, tonsillectomies, cholecystectomies and other surgical interventions without proving the usefulness of these procedures by controlled studies

Focal infection II – revision

The connection between systemic disease and a local infection has been proved only in

- rheumatic fever – inflammation of heart, kidneys and joints after tonsillar infection by *Streptococcus pyogenes*
- Reiter's syndrome = reactive arthritis after
 1. sexually transmitted urogenital infection by *Chlamydia trachomatis* serotypes D-K,
 2. intestinal infection caused by pathogens from genus *Salmonella*, *Shigella*, *Yersinia* or *Campylobacter*
- hemolytic-uremic syndrome after intestinal infection by *Escherichia coli* serotype e.g. O157:H7
- sterile mykids e.g. on palms during tinea pedis

Special types of chronic infections – revision

Inapparent chronic infections can be classified as

1. latent: agent hides in a non-infectious form, or it escapes from the infected cell after an activation of infection only

HSV and VZV: nerve ganglia cells, CMV: kidney and salivary glands cells, EBV: lymphocytes

2. persistent: agent can be detected by routine methods, because it is present mostly in an infectious form

Both types are markers of failing immunity

Both types can be activated

Examples of persistent infections

– revision

Bacterial: *Rickettsia prowazekii* (activation of exanthematic typhus = m. Brill-Zinsser), *Salmonella Typhi* (carriers), *Mycob. tbc* (lymphatic nodes)

Viral: HBV (hepatocytes), adenoviruses (adenoids), JCV and BKV (kidneys), congenital infections by CMV and rubella virus

Parasitary: hypnozoites of *Plasmodium ovale* and *P. vivax* (liver), *Toxoplasma gondii* bradyzoites (nodes, muscles, brain)

...

Primary infections

primary secondary infection: before the first (primary) infection is over the secondary infection (superinfection) supersedes caused by another microbe

primary postprimary infection: in tbc only; in postprimary infection the late hypersensitivity has developed

primary recurrent infection: during latent infections, e.g. HSV: primary infection = gingivostomatitis aphthosa; recurrent one = herpes labialis

Other types of infection – I

Opportunist infection: infection on a weakened terrain, often secondary one

During **AIDS**: CMV retinitis, CMV or candidal esophagitis, herpes zoster, cryptococcal meningitis, toxoplasmatic encephalitis, cryptosporidial or microsporidial enteritis, colibacillary and other types of sepsis

Nosocomial (hospital-acquired) infection: in connection with the stay in hospital, often opportunist one

Iatrogenic infection: caused by a medical intervention

Community-acquired infection: infection obtained in common population

Other types of infection – II

Pyogenic infection: is manifested by suppuration

Specific infection: usually with typical pathology and histology, therefore syphilis or tuberculosis

Exogenous infection: agent enters the body from the outside

Endogenous infection: agent = member of normal microflora (the disease is not contagious, it is not possible to determine the incubation time)

Other types of infection – III

Anthroponoses = infections transmissible **among human beings only** (typhoid fever, shigelloses, exanthematic viroses, venereal infections etc.)

Zoonoses = infections transmissible **from animals to man** and vice versa (salmonelloses, tularemia, lyme borreliosis, tick-borne encephalitis, some types of ringworm etc.)

Sapronoses = infections acquired **from the environment** in which the agent actively multiplies (tetanus, gas gangraene, legionellosis, histoplasmosis, amoebic meningoencephalitis etc.)

Other types of infection – IV

Active infection: still proceeding, possibly even without apparent signs

Subsided infection: without signs of activity, but sequelae or at least antibodies remain

Recent infection: occurred at best several weeks ago

These attributes are typically used in the interpretation of serologic results

Outcome of infection – I

It depends on both participants:

Microorganism:

its pathogenicity

virulence

dosis

portal of entry

Macroorganism: species resistance

individual's immunity

non-specific (innate)

specific (acquired)

intensity of reaction

Outcome of infection – II

Complete recovery (restitutio ad integrum):
banal respiratory, urogenital, intestinal
and infant generalized infections

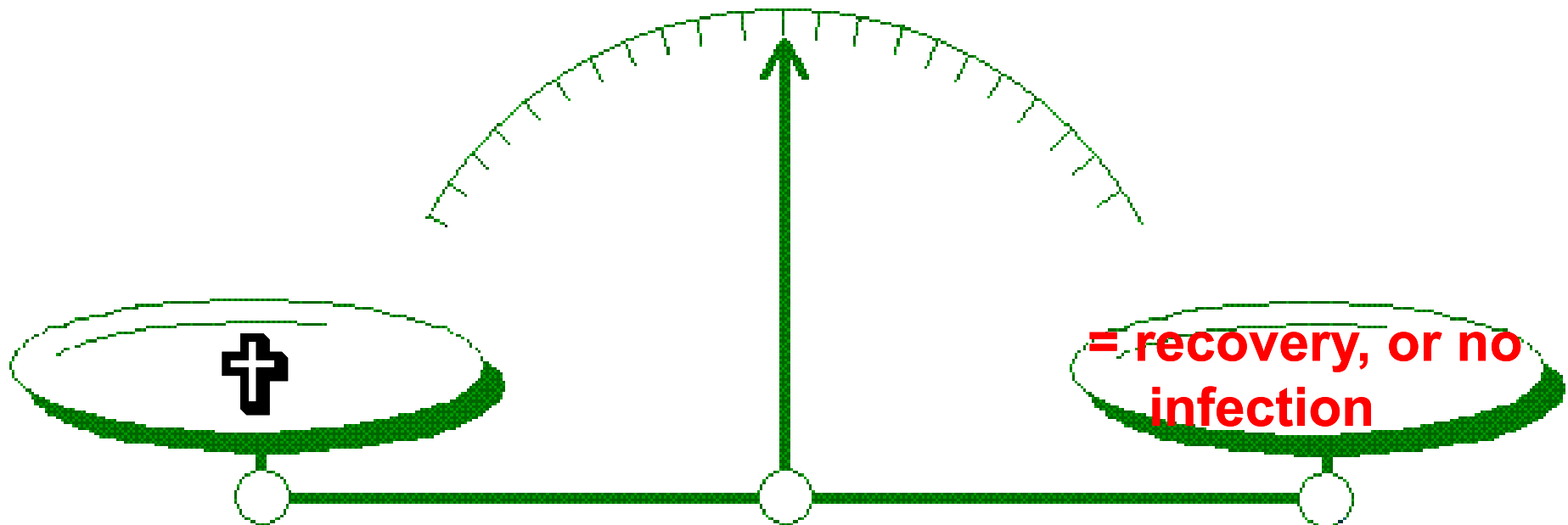
Recovery with sequelae:
paralysis after encephalitis, deafness after
otitis, scar after abscess, cavern after
lung tuberculosis

Persistent infection:
if the immune system is not able to
eliminate the agent

Death (exitus letalis)

Outcome of infection – III

- Species pathogenicity
- Strain virulence
- High dosis
- Uncommon portal of entry
- Exaggerated reaction
- High species resistance of the host
- High non-specific resistance of the individual
 - no risk factors
 - no functional or anatomical defects
- Specific immunity and its quality



Recommended reading material

Paul de Kruif: Microbe Hunters

Paul de Kruif: Men against Death

Axel Munthe: The Story of San Michele

Sinclair Lewis: Arrowsmith

André Maurois: La vie de Sir Alexander Fleming

Hans Zinsser: Rats, Lice, and History

Michael Crichton: Andromeda Strain

Albert Camus: Peste

Victor Heisser: An American Doctor Odyssey

Richard Preston: The Hot Zone

Mika Waltari: The Egyptian

Please mail me other suggestions at:

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Thank you for your attention