

**Institute for Microbiology, Medical Faculty of Masaryk University
and St. Anna Faculty Hospital in Brno**

Miroslav Votava

Agents of sepsis

**The 12th lecture for 3rd-year students of dentistry
9th December, 2010**

Skin symptoms in viral diseases I

– revision

Macular (spotted) exanthem:

morbilli – morbilli virus (*Morbillivirus* genus)

rubella – rubella virus (*Rubivirus* genus)

erythema infectiosum (the fifth disease) –
parvovirus B19 (*Erythrovirus* genus)

exanthema subitum (roseola infantum, the
sixth disease) – human herpesvirus 6
(HHV 6, *Roseolovirus* genus)

some **echovirus infections** – >30 serotypes
(*Enterovirus* genus)

Skin symptoms in viral diseases II

– revision

Umbiliform papulae:

**molluscum contagiosum – molluscum
contagiosum virus (*Molluscipoxvirus*
genus)**

Skin symptoms in viral diseases III

– revision

Vesicles:

herpes simplex (cold sore) – herpes simplex virus type 1 (HSV 1, *Simplexvirus* genus)

herpes genitalis – HSV 2 (*Simplexvirus* genus)

varicella (chicken pox) – primary infection by varicella-zoster virus (VZV, *Varicellovirus* genus)

herpes zoster (shingles) – activation of latent infection by varicella-zoster virus

variola vera (smallpox, now eradicated) – variola virus (genus *Orthopoxvirus*)

(continued)

Skin symptoms in viral diseases IV

– revision

Vesicles – cont.:

vaccinia – vaccinia virus (for vaccination against variola, *Orthopoxvirus* genus)

cowpox, monkey pox – cowpox and monkey pox viruses (*Orthopoxvirus* genus)

tubera mulgentium (milkers' nodules) – milker's nodule virus (*Parapoxvirus* genus)

aphthae epizooticae (foot and mouth disease) – foot-and-mouth disease virus (FMDV, *Aphthovirus* genus)

hand, foot and mouth disease – coxsackievirus A16 (*Enterovirus* genus)

Skin symptoms in viral diseases V

– revision

Petechiae:

hemorrhagic fevers –

Ebola fever, Ebola virus (*Ebolavirus* genus)

Marburg disease, Marburg virus (genus *Marburgvirus*)

Lassa fever, Lassa virus (*Arenavirus* genus)

**generalized congenital cytomegalic disease –
cytomegalovirus (CMV, *Cytomegalovirus* genus)**

Skin symptoms in parasitoses I

– revision

Domestic (native) parasitoses:

scabies – itch mite (*Sarcoptes scabiei*)

demodicosis – human follicle mites (members of *Demodex* genus)

pediculosis capitis – head louse (*Pediculus capitis*)

pediculosis corporis – body louse (*Pediculus humanus*, syn. *Pediculus corporis*)

pediculosis pubis (phthiriasis) – pubic (crab) louse (*Phthirus pubis*)

dermatitis cercariosa – cercariae of avian and mammalian schistosomes non-pathogenic for man

Skin symptoms in parasitoses II

– revision

Infestation by native ectoparasites:

cimicosis, urticaria cimicosa – bites by bedbug
Cimex lectularius

pulicosis – bites by human flea *Pulex irritans*,
dog flea *Ctenocephalides canis*,
cat flea *Ctenocephalides felis*,
chicken flea *Ceratophyllus gallinae*

ixodosis – bite by hard tick *Ixodes ricinus*

culicosis – bites by common mosquitoes, e.g.
Culex pipiens

trombiculosis, trombidiosis – bites by
Neotrombicula autumnalis larvae

Skin symptoms in parasitoses III

– revision

Tropical parasitoses:

ulcus humidum (humid ulcer) – countryside in Near and Middle East, northern and western Africa; *Leishmania major*

ulcus siccum (dry ulcer, oriental sore) – cities in Near and Middle East, seats in northern and eastern Africa; *Leishmania tropica*

espundia (severe, even fatal disease) – South America; *Leishmania braziliensis*

tungosis (sore caused by skin-burrowed female of chigoe or sand flea) – subtropical and tropical America and Africa; *Tunga penetrans*

dracunculosis (Guinea worm disease, „the fiery serpent“) – now in Africa only; *Dracunculus medinensis*

Loa loa filariosis (loiasis, Calabar swellings) – West Africa (Cameroon); filariae *Loa loa*

onchocerciasis (river blindness; various skin signs, e.g. „leopard skin“) – Africa, Middle and South America; filariae *Onchocerca volvulus* and their endosymbiont *Wolbachia pipientis*

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Bacteremia versus sepsis – I

Bacteremia = mere presence of bacteria in blood

But: Bacteria = starting mechanism of sepsis

Interaction of microbial products with macrophages releases a lot of cytokines

→ systemic inflammatory response syndrome (SIRS) =

- elevated temperature
- accelerated pulse and breathing
- leukocytosis

Bacteremia versus sepsis – II

Sepsis = suspect or proved infection + systemic inflammatory response syndrome

Severe sepsis = sepsis + organ dysfunction (hypotension, hypoxemia, oliguria, metabolic acidosis, thrombocytopenia, confusion)

Septic shock = severe sepsis + hypotension despite adequate supply of fluids

Characterization of sepsis

Clinic:

fever or hypothermia

↑↓ T

tachycardia

↑ P

tachypnoe

↑ D

lowered blood pressure

↓ BP

confusion

Pathologic physiology:

higher heart output

lower peripheral vascular resistance

Laboratory:

leukocytes

↑↓ Leu

serum bicarbonate

↓ HCO₃⁻

bacteremia

may not be already demonstrable

Types of bacteremia – I

Intermittent bacteremia – in localized infections:

pneumonia (pneumococci)

meningitis (meningococci)

pyelonephritis (*Escherichia coli*)

osteomyelitis (*Staphylococcus aureus*)

septic arthritis (*S. aureus*, gonococci)

cholecystitis (enteric bacteria, enterococci)

peritonitis (mixed anaerobic and facultatively anaerobic flora)

wound infections (*Staph. aureus*, *Str. pyogenes*)

bedsores (mixed skin and intestinal flora)

Types of bacteremia – II

Continual bacteremia – in general infections:

typhoid fever (*Salmonella Typhi*)

brucellosis (*Brucella melitensis*)

plague (*Yersinia pestis*)

Types of bacteremia – III

Bacteremia in bloodstream infections:

thrombophlebitis (*Staph. aureus*, *Str. pyogenes*)

acute endocarditis (*S. aureus*, *S. pyogenes*, *Str. pneumoniae*, *Neisseria gonorrhoeae*)

subacute bacterial endocarditis = sepsis lenta
(α -hemolytic streptococci, enterococci,
HACEK group =

Haemophilus aphrophilus,
Actinobacillus actinomycetemcomitans,
Cardiobacterium hominis,
Eikenella corrodens,
Kingella kingae)

„culture-negative“ endocarditis (*bartonellae*,
coxiellae, *legionellae*)

Types of bacteremia – IV & V

Bacteremia in some malignities:

colonic carcinoma (*Streptococcus bovis*)

leukemia (*aeromonads, Bacillus cereus, Bacillus subtilis, Clostridium septicum*)

Bacteremia in intravenous drug users:

skin flora (staphylococci, corynebacteria)

mouth flora (neisseriae, eikenellae, even nasopharyngeal pathogens)

bacteria from the environment (clostridia, bacilli)

Types of bacteremia – VI

Bacteremia in iatrogenic infections:

tooth extraction (α -streptococci, prevotellae)

bronchoscopy (nasopharyngeal flora including pathogens)

bladder catheterization (*Escherichia coli*)

infusions (skin flora, G– non-fermenting rods)

vascular catheters (coagulase-negative staphylococci, yeasts)

invasive devices and implants (coagulase-negative staphylococci, micrococci, corynebacteria, nocardiae)

febrile neutropenia (antibiotic-resistant staphs, enterococci, G– rods, yeasts, moulds)

Clinical types of sepsis

- wound-originated sepsis
- urosepsis
- abdominal sepsis
- fulminant sepsis
- nosocomial (hospital-acquired) sepsis

Wound-originated sepsis

Staphylococcus aureus

Streptococcus pyogenes

beta-hemolytic streptococci groups G, F, C

Pseudomonas aeruginosa (burns)

Clostridium septicum

Urosepsis

Escherichia coli

Proteus mirabilis

other enteric bacteria

Abdominal sepsis

Polymicrobial etiology

anaerobes: *Bacteroides fragilis*

Peptostreptococcus micros

Peptostr. anaerobius

&

facultative anaerobes: *Escherichia coli*

Proteus mirabilis

Fulminant sepsis

Neisseria meningitidis

Streptococcus pyogenes

Yersinia pestis

Nosocomial sepsis

Staphylococci, coagulase-negative (intravenous catheter-associated sepsis, infections of plastic devices *in situ*, febrile neutropenia)

Staphylococcus aureus (infected surgical wounds)

***E. coli* & other enterobacteria** (catheter-associated infections of the urinary tract)

Gram-negative non-fermenting rods
(contaminated infusion fluids)

yeasts (catheter-associated sepsis, febrile neutropenia)

many other microbes (see above the agents of iatrogenic bacteremia)

Treatment of sepsis

At intensive care units (ICU) only

- **Control of infection**
 - antibiotics – initially broad spectrum ones, then oriented on the isolated microbe
 - removal of all infected tissues or devices)
- **Support of breathing and hemodynamics**
 - artificial ventilation
 - oxygen
 - fluids
 - vasopressors etc.

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Homework 12

Please give the
name of the author
and of the etching



Answer and questions

The solution of the homework and possible questions please mail (on 6.30 a.m. at the latest) to the address

mvotava@med.muni.cz

Thank you for your attention