

## Learning Objectives (1 of 2)

- Explain mode of transmission and control of communicable disease
- Describe herpes infection
  - Symptoms in men and women
  - Effects on sexual partners, fetus, newborn infant
- Describe HIV
  - Pathogenesis, groups affected, effects on immune system
  - Clinical manifestations, test results, methods of prevention

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Learning Objectives (2 of 2)

- Describe sexually transmitted diseases
  - Major clinical manifestations
  - Complications
  - Methods of treatment

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Communicable Diseases

- Communicable disease: disease transmitted from person to person
- Endemic: communicable disease in which a small number of cases are continually present in the population
- Epidemic: communicable disease concurrently affecting large numbers of people in a population

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Methods of Transmission

- Communicable disease perpetuates with continuous transmission of infectious agent from person to person by either direct or indirect methods.
- Direct transmission
  - Direct physical contact (sex)
  - Droplet spread (coughing, sneezing)
- Indirect transmission through an intermediary mechanism
  - Contaminated food or water
  - Insects

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Methods of Control (1 of 3)

- Must break transmission to eradicate or control disease
- Immunization
  - To reduce number of susceptible persons in the population
    - Disease eventually dies out due to lack of susceptible hosts
    - Smallpox and poliomyelitis have been eliminated due to widespread immunization
  - To protect persons traveling to a geographic area where a disease is endemic

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Methods of Control (2 of 3)

- Identification, isolation, and treatment
  - Primary methods of control when immunization is not available
  - Promptly carried out to shorten time in which others may be infected (person-to-person transmission)
  - Isolation: prevents contact with susceptible persons and stops spread
  - If infection is not obvious, disease may not be recognized and treated, and will continue to spread and be difficult to control (TB, STDs, etc.)

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Methods of Control (3 of 3)

- Controlling indirect transmission
  - For contaminated food or water
    - Chlorination of water supplies
    - Effective sewage treatment facilities
    - Standards for handling, manufacturing, and distributing commercially prepared foods
    - Eradication and/or control of animal sources and vectors

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Requirements for Effective Control

- Requires knowing cause of disease and methods of transmission
- Otherwise, control measures will be ineffective
- During the bubonic plague or “black death”
  - People did not know that the disease was carried by rodents and the bacterium is transmitted to people by insects
  - May also be spread via droplets causing a pneumonic plague, fatal pulmonary infection

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Examples of Methods of Control

The diagram shows four scenarios labeled A, B, C, and D. In A, a person on the left has a straight arrow pointing to a person on the right. In B, a person on the left has a wavy arrow pointing to a person on the right who is inside a protective box. In C, a person on the left is inside a box, and a wavy arrow points to a person on the right who is also inside a box. In D, a person on the left has a wavy arrow pointing to a vertical barrier, which then points to a person on the right.

- A. **Unimpeded direct or indirect transmission** of a communicable disease from person to person.
- B. **Immunization** protects a susceptible person by conferring resistance to infection
- C. **Isolation and prompt treatment** of the infected person prevent the spread of disease to susceptible persons.
- D. **Control** of means of indirect transmission blocks spread of infectious agent.

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Sexually Transmitted Diseases

- Spread primarily by sexual contact
  - Between heterosexual partners
  - Through sexual acts with same sex partner
- Four major STDs
  - Syphilis (*Treponema pallidum*)
  - Gonorrhea (*Neisseria gonorrhoeae*)
  - Herpes (*Herpesvirus*)
  - Chlamydia (*Chlamydia trachomatis*)
- HIV/AIDS: separate class because of high mortality, devastating consequences
  - Spread through heterosexual and homosexual contact
  - Through blood and secretions

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Syphilis (1 of 4)

- *Treponema pallidum* infection
- Major clinical manifestations
- Primary syphilis: chancre
  - Penetrate mucous membranes of genital tract, oral cavity, rectal mucosa, or through break in skin; and multiply rapidly throughout body
  - Forms a chancre: small ulcer at site of inoculation
    - Location: penis, vulva, vagina, oral cavity, or rectum
    - Swarming with treponemas; highly infectious
    - Persists for 4-6 weeks; heals even without treatment
  - Even with healed chancres, treponemas are widely disseminated and continue to multiply

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Syphilis (2 of 4)

- Secondary syphilis: systemic infection with skin rash and enlarged lymph nodes
  - Begins several months after chancre has healed
  - Fever, lymphadenopathy, skin rash, shallow ulcers on mucous membranes of oral cavity and genital tract
  - Persists for several weeks then subsides even without treatment
  - Recurrences subside spontaneously

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Syphilis (3 of 4)

- Tertiary syphilis: late destructive lesions in internal organs
  - Late manifestations of the disease, may appear 20 years after initial infection; not generally communicable
  - Organisms remain active, causing irreparable organ damage (damage aortic wall causing aortic aneurysm; degeneration of fiber tracts in spinal cord; mental deterioration; paralysis)

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Syphilis (4 of 4)

- Diagnostic tests
  - Microscopic exam
    - Demonstration of treponema from fluid squeezed from chancre
    - Establishes diagnosis several weeks before a blood test becomes positive
  - Serologic tests (antigen-antibody reactions): turns positive soon after chancre appears and remains positive for years
    - Useful for diagnosing disease in asymptomatic individual and in cases where chancre is inaccessible or escapes detection

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Congenital Syphilis

- Transmission of disease from mother to child
- May cause death of fetus
- Treatment early in the pregnancy is important as treponemas are less likely to pass through placenta during first few weeks of pregnancy
- During early pregnancy: placental villi are covered by a double layer of epithelium and contain more connective tissue that is less permeable

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

Gram stain of pus from the urethra, illustrating many gram-negative intracellular diplococci characteristic of gonorrhoea.



© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Gonorrhoea (1 of 5)

- Gonorrhoea: *Neisseria gonorrhoeae* infection
  - Primarily infects mucosal surfaces: urethra, genital tract, pharynx, rectum
  - Symptoms appear about a week after exposure
  - Clinical manifestations differ between males and females
- Gonorrhoea in the female
  - Infects mucosa of uterine cervix and urethral mucosa
  - May spread into the Bartholin's glands, adjacent to the vaginal orifice
  - Cervical infection: profuse vaginal discharge
  - Urethral involvement: pain, burning on urination
  - Some may be asymptomatic

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Gonorrhea (2 of 5)

- Gonorrhea in the female
  - Infection may spread upward into fallopian tubes
  - Tubal infection: salpingitis
  - Abscess formation in tubes
  - Major complications: tubal scarring and sterility
- Manifestations
  - Abdominal pain and tenderness
  - Fever
  - Leukocytosis

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Gonorrhea (3 of 5)

- Gonorrhea in the male
  - Acute inflammation of mucosa of anterior urethra
  - Purulent urethral discharge
  - Pain on urination
  - Less likely to be asymptomatic in males than females
- Major complications
  - Spread of infection to posterior urethra, prostate, seminal vesicles, vasa deferentia, and epididymis
  - Sterility: infection in vasa deferentia and epididymis may lead to scarring, blocking the transport of sperm

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Gonorrhea (4 of 5)

- Extragenital gonorrhea
  - Rectum: pain and tenderness; purulent bloody mucoid discharge
  - From either anal intercourse or contamination of rectal mucosa from infected vaginal secretions
  - Pharynx and tonsils: oral-genital sex acts
- Disseminated gonococcal infection
  - Organisms gain access into bloodstream and spread throughout body
  - Fever; joint pain; multiple small skin abscesses; infections of the joints, tendons, heart valves; meningitis

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Gonorrhea (5 of 5)

- Diagnosis and treatment
  - Culture
    - Suspected sites: urethra, cervix, rectum, pharynx
    - Blood in disseminated infections
  - Nucleic acid amplification test: based on identification of nucleic acids in organism
- Treatment: antibiotics
  - Penicillin-resistant strains due to penicillinase enzyme

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Herpes (1 of 3)

- Herpes: Herpes simplex virus infection
- Two types are not restricted in distribution
- Type 1: infects oral mucous membrane
  - Causes fever blisters, usually infected in childhood, most adults have antibodies to virus
  - May cause genital infections
- Type 2: infects genital tract
  - Infections usually occur after puberty
  - Causes 80% of infections
  - 20% from type 1 due to oral-genital sexual practices
  - May infect oropharyngeal mucous membranes

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Herpes (2 of 3)

- Vesicles and shallow ulcers following sexual exposure
- Men: glans or shaft of penis
- Women: extensive involvement
  - Vulva: usually painful
  - Vagina, cervix: little discomfort
- Vesicles: small, painful blisters on external genitalia and genital tract; rupture and form shallow ulcers that coalesce
- Contain large quantities of virus and are infectious to sexual contacts
- Regional lymph nodes are enlarged and tender
- Virus persists in infected tissues causing recurrent infections

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Herpes (3 of 3)

- **Diagnosis**
  - Intranuclear inclusions in infected cells
  - Viral cultures from vesicles or ulcers most reliable diagnostic test
  - Serologic tests in some cases
- **Treatment**
  - Antiviral drug shortens course and reduces severity, but does not eradicate virus (orally, per IV, or topically)
  - Cold compress and pain relievers
- **Major complication:** spread from infected mother to infant through active herpetic lesions in mother's genital tract
- **Delivery should be by cesarean section**

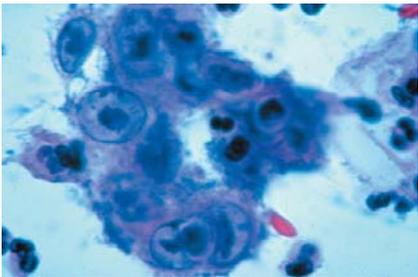
© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Several small superficial herpetic ulcers on shaft of penis behind glans.



© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Vaginal smear illustrating clusters of herpes-infected epithelial cells containing intranuclear inclusions (original magnification 1,000).



© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Chlamydia (1 of 2)

- *Chlamydia trachomatis* infection; most common STD
- **Rise in cases:**
  - 3-4 million cases/year
  - From increased recognition due to availability of new diagnostic tests
- **Clinical manifestations:** similar to gonorrhea
- **Women:** cervicitis and urethritis
  - Involves uterine cervix, urethra; moderate vaginal discharge
- **Men:** Non-gonococcal urethritis: an acute urethral inflammation with frequency and burning on urination
- **Major complications:** sterility in women; epididymitis in men

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Chlamydia (2 of 2)

- **Tests for diagnosis**
  - Detection of Chlamydial antigens in cervical/urethral secretions
  - Fluorescence microscopy
  - Cultures
  - Nucleic acid amplification tests: based on Chlamydial nucleic acids
- **Cases**
  - 10% to 20%: among young sexually active females attending family planning clinics
  - 17% to 46% among clients in STD clinics
- **Treatment:** antibiotics

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Comparison of four major sexually transmitted diseases

Organism	Neisseria gonorrhoeae	Chlamydia trachomatis	Herpes virus	Chlamydia trachomatis
Major clinical manifestations	Primary: chancres Secondary: systemic infection with skin rash and enlarged lymph nodes Tertiary: late, destructive lesions in various organs	Urethritis Cervicitis Proctitis Infection of ocular mucous (conjunctivitis)	Superficial vesicles and ulcers on external genitalia and in genital tract Regional lymph nodes often enlarged and tender	Cervicitis Urethritis
Tests used to establish diagnosis	Demonstration of intracytoplasmic inclusions in urethra Serologic tests	Culture of organisms from sites of infection Nucleic acid tests also available	Demonstration of intranuclear inclusions in infected cells Virus cultures Serologic tests in some cases	Detection of chlamydial antigens in cervical/urethral secretions Fluorescence microscopy Cultures Nucleic acid tests also available
Major complications	Damage to cardiovascular system and nervous system in tertiary syphilis; may be fatal	Disseminated bloodstream infection Total infection with impaired fertility Spread of infection to prostate and epididymides	Spread from infected mother to infant	Total infection with impaired fertility Epididymitis
Treatment	Antibiotics	Antibiotics	Antiviral drug shortens infection but not curative	Antibiotics

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Sexually Transmitted Diseases

- Other common but less serious STDs
  - Condylomas: anal and genital warts
  - Vaginitis: *Gardnerella*
  - Trichomonal vaginitis: *Trichomonas vaginalis* infection
  - Scabies and crabs
  - Hepatitis

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### HIV/AIDS

- Cripples body's immune system
- Attacks and destroys T lymphocytes increasing susceptibility to infections and malignant tumors
- AIDS: end stage and most serious manifestation
- Causes
  - HIV-1: causes AIDS in most parts of the world
  - HIV-2: causes AIDS in Western Africa
- 1981: First AIDS case identified in a small group of homosexual men with an unusual opportunistic lung infection
- 1983: HIV case identified
- 1985: Blood test to detect HIV infection

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Groups at high risk of immunodeficiency virus infection

1. Homosexual or bisexual men
2. Present or past intravenous drug abusers
3. Persons with clinical or laboratory evidence of HIV infection
4. Persons born in countries where heterosexual transmission plays the major role in spreading the infection.
5. Male or female prostitutes and their sexual partners
6. Sexual partners of infected persons
7. Persons with hemophilia who have received blood products
8. Newborn infants of infected or high-risk mothers

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### HIV and Its Target

- Target: CD4 protein on cell membranes of helper T lymphocytes, monocytes, macrophages, macrophage-like cells in skin, lymph nodes, and CNS
- CD4 functions as a receptor for virus
  - HIV: an RNA-containing retrovirus
  - Core contains RNA and enzyme reverse transcriptase contained within a protein coat or capsid
  - Core surrounded by a double-layered lipid envelope acquired from the cell membrane of infected cell when virus buds out from cell

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Viral Replication

- Virus binds to cell, viral envelope fuses with cell membrane and virus enters cell
- Once inside cell, virus makes a DNA copy of its RNA genetic material (reverse transcriptase enzyme)
- DNA copy inserted into cell's genetic material (HIV integrase enzyme)
- Viral genes direct synthesis and assembly of more virus particles
- Viral protein assembled into small segments around viral RNA and bud out of cells coated with the cell membrane of infected cells (HIV protease enzyme)

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Sequence of events in HIV infections and their significance

EVENT	SIGNIFICANCE
HIV invades CD4+ cells and becomes part of cell DNA	Individual is infected for life
Virus proliferates in infected cells and sheds virus particles	Virus present in blood and body fluids
Body forms anti-HIV antibody	Antibody is a marker of infection but is not protective
Progressive destruction of helper T cells	Compromised cell-mediated immunity
Immune defenses collapse	Opportunistic infections Neoplasms

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Clinical Manifestations (1 of 2)

- Virus attacks and kills helper T cells and monocytes
- Monocytes survive but virus continues to replicate in monocytes and transports virus throughout body and brain
- Patient susceptible to opportunistic infections and cancer due to resulting immunodeficiency
- Early stage
  - Large amount of virus detected in blood and body fluids
  - Large numbers of infected lymphocytes in lymph nodes
  - Mild febrile illness
  - Body responds by forming anti-HIV antibodies (in 1 to 6 months after initial infection) and cytotoxic T cells
  - Amount of virus declines but body's defenses cannot eliminate virus

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Clinical Manifestations (2 of 2)

- NO latent or dormant phase where virus remains inactive
- Large numbers of virus produced continuously that infect and destroy CD4 cells and circulate in bloodstream
- Amount of virus correlates with magnitude of infection
- Chronic stage
  - Eventually rate at which CD4 cells are replaced cannot keep up with rate of destruction
  - Some strains of HIV may be aggressive, others benign
  - Current anti-viral drugs can suppress proliferation and damage but CANNOT completely eliminate the virus, which persists indefinitely in infected tissues of host

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Antibody Response to HIV

- Antibody response to HIV
  - Antibodies are formed within 1-6 months
  - Detection of antibodies provides evidence of HIV infection
  - Antibodies do not eradicate virus
  - Virus is detectable only by laboratory tests
- Signs and symptoms of AIDS
  - After a high-risk exposure and inoculation, infected person usually experiences a mononucleosis-like syndrome that may be attributed to flu or another virus
  - Infected person may remain asymptomatic for years
  - At early stage, only sign of HIV infection is laboratory evidence of sero-conversion

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Early and Late Manifestations of HIV Infection

- Early
  - Asymptomatic
  - Mild febrile illness
- Late
  - Generalized lymph node enlargement
  - Non-specific symptoms
  - Fever, weakness, chronic fatigue, weight loss, thrombocytopenia
  - AIDS

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Index of Disease

- Measurement of viral RNA and CD4 lymphocytes
- Viral replication: measure amount of viral RNA in blood
  - Virus replicates in lymph nodes but amount of viral RNA in blood reflects extent of viral replication in lymphoid tissue
- Damage to immune system: measure number of CD4 lymphocytes in blood
  - Normal level: 800-1200
  - Number declines progressively as disease advances
  - Below 500: risk of opportunistic infections
  - Below 200: risk of major HIV complication

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

## Complications of AIDS

- Opportunistic infections from organisms not normally pathogenic or of limited pathogenicity
  - *Pneumocystis carinii* pneumonia
  - *Mycobacterium avium-intracellulare*
  - Parasitic infections: toxoplasmosis; cryptosporidiosis
  - Rapidly progressive tuberculosis or histoplasmosis
- Malignant tumors in AIDS patients
  - Kaposi's sarcoma: human herpes virus 8
  - Malignant tumors of B lymphocytes
  - Cancers of oral cavity, rectum, uterine cervix

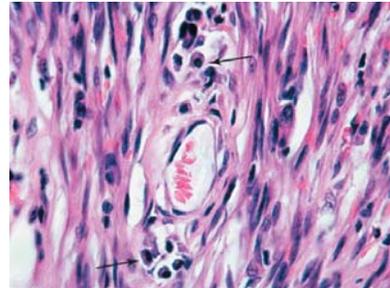
© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Common infections in AIDS patients

- Viruses
  - Herpes, cytomegalovirus, Epstein-Barr virus (infectious mononucleosis)
- Fungi
  - Histoplasmosis, coccidioidomycosis, aspergillosis, *Candida* infections
- Protozoa
  - *Pneumocystis carinii* pneumonia, amebiasis, cryptosporidiosis, toxoplasmosis
- Mycobacteria
  - Tuberculosis, *Mycobacterium avium-intracellulare* infections

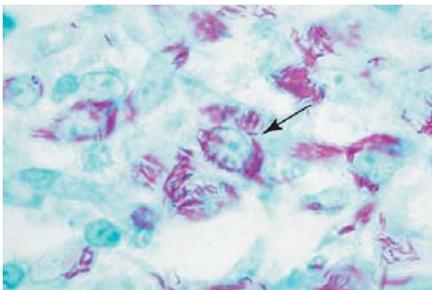
© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

Kaposi's sarcoma, showing proliferating spindle-shaped connective tissue cells surrounding a small blood vessel in the center of the field.



© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

High magnification view of the mycobacteria.



© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### HIV Transmission

- HIV virus may enter body by any of several routes
  - Sexual contact
  - Blood and body fluids
  - Mother to infant
- Transmission by blood and blood products
  - Direct inoculation: intimate sexual contact, linked to mucosal trauma from rectal intercourse
  - Transfusion: contaminated blood or blood products, lessened by routine testing of all blood products
  - Sharing of contaminated injection needles
  - Transplacental or postpartum transmission via cervical or blood contact at delivery and in breast milk
- Not transmitted by casual household or social contacts

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Treatment of HIV Infections/AIDS

- No cure for AIDS
- Primary therapy includes use of various combinations of three different types of antiretroviral agents to maximally inhibit HIV viral replication with fewer adverse reactions
- Treatment schedules revised as new drugs are developed and as advantages and side effects of various drug combinations are recognized

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)

### Discussion

- How is syphilis transmitted? What are its clinical manifestations?
- What are the manifestations of herpes infection of the genital tract?
- What is the significance of a positive test for HIV antibody?

© 2011 Jones and Bartlett Publishers, LLC (www.jbpub.com)