Infection Control for the Non-ICN
Workshop #1
Introduction to Infection Control

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Workshop #1

- The learner will be able to:
  - Define infection control.
  - Discuss the importance of infection control.
  - Describe chain of infection.
  - Identify agents responsible for human infections.
  - Identify host defense mechanisms.

Infection Control Defined

Policies, procedures, practices and/or techniques designed to prevent, investigate, and control the spread of infections and their causative microorganisms from one person to another.

Components of Infection Control

Infection control includes the following:

- ✓ Collection and analysis of infection-related data
- ✓ Investigation of suspected outbreaks of infection
- ✓ Infection risk assessment
- ✓ Planning, implementation and evaluation of infection control measures
- ✓ Education of individuals about infection risk, prevention, control activities and treatment of infections
- ✓ Development of IC policies and procedures
- ✓ Management of infection prevention and control activities

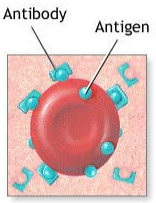
Goals of Infection Control

- Prevention of disease e.g.:
  - immunizing against vaccine-preventable diseases
  - defining precautions that can prevent exposure to infectious agents
- Prompt identification and treatment of disease
- Restriction of exposure of other individuals (including recipients of service, visitors, staff and other persons) to an infectious agent

Terms in Infection Control

Starting with “A”

Antigen



An antigen is a substance that induces the formation of antibodies because it is recognized by the immune system as a threat

Red blood cell

Starting with “A”

- **ANTISEPSIS**
  - The destruction or inhibition of micro-organisms on living tissues
  - limits or prevents the harmful results of infection
- **ANTISEPTIC**
  - A chemical applied topically to reduce the possibility of infection sepsis or putrefaction
  - Germicides
  - Bacteriocidal
  - Bacteriostatic
  - Microbicides
  - Viricides/antivirals

Lots of “C”

- **CARRIER**
  - A person who harbors a disease causing micro-organism in the absence of discernible clinical disease. May be one of the following:
    - latent infection carrier
    - incubatory carrier
    - convalescent carrier
  - May shed organisms into environment intermittently or continuously
  - Is a potential source of infection
- **CASE:** A person with symptoms.

More with "C"

- **CHEMOPROPHYLAXIS**
  - The administration of a medication for the purpose of preventing disease or infection.
  - Also referred to as "post-exposure prophylaxis" – PEP
- **COHORT** A group of individuals infected or colonized with the same micro-organism, grouped together in a designated room or area of a unit or residence.

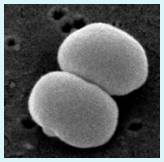
And more with "C"

- **COLONIZATION**
  - Presence of micro-organisms at a body site(s)without presence of symptoms or clinical signs of illness or infection
  - Many of the normal flora are either pathogens or opportunistic pathogens,
  - Most common sites:
    - Skin
    - Conjunctiva
    - Nose
    - Pharynx
    - Mouth
    - Lower GI
    - Urethra
    - vagina

Common colonization "bugs"

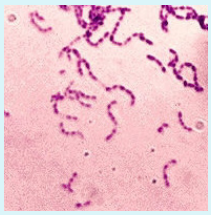
Staphylococcus epidermidis

- highly adapted to the diverse environments of its human host
- leading cause of bacterial disease in humans
- Transmission occurs from the nasal membranes of an asymptomatic carrier to a susceptible host.



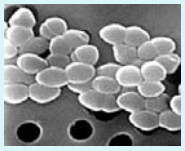
Streptococcus mutans

- primary bacterium involved in plaque formation and initiation of dental caries.
- an opportunistic infection,
- dental disease is one of the most prevalent and costly infectious diseases in the United States.



Enterococcus faecalis

- formerly classified as *Streptococcus faecalis*
- a regular component of the intestinal flora
- a significant nosocomial pathogen
- Almost always resistent to vancomycin

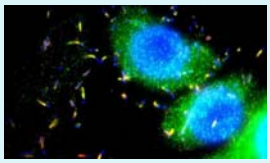


E. coli

- consistent resident of the small intestine
- So common used to measure fecal contamination of water
- Pathogen that causes
  - vaginal infections
  - urinary tract infections
  - intestinal infections
  - neonatal meningitis

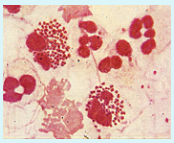
Streptococcus pneumoniae

- present in the upper respiratory tract of about half the population.
- In the lower respiratory tract it can cause pneumonia.
- causes 95 percent of all bacterial pneumonia.



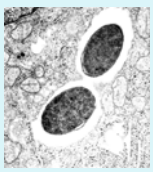
Neisseria

- frequent inhabitant of the upper respiratory tract, mainly the pharynx.
- 2 species that are pathogenic for humans:
  - *N. gonorrhoeae*.
    - Also referred to as the gonococcus,
  - *N. meningitidis*.
    - Also referred to as the meningococcus,



Clostridium

- numerous species colonize the bowel
- *Clostridium perfringens*
  - ubiquitous in nature
  - normal component of normal flora of intestinal tract in humans
  - the most common bacterial agent for gas gangrene
- *Clostridium difficile* may colonize the bowel
  - "antibiotic-induced diarrhea"
  - pseudomembranous colitis.



Back to the "C"

- **COMMUNICABLE DISEASE**
  - An illness or disease that can be transmitted to an individual by direct or indirect contact.
- **COMMUNICABLE PERIOD**
  - The time in the natural history of an infection during which transmission may take place.
- **CONTACT**
  - An exposed individual who might have been infected by another person or the environment.
- **CONTAMINATION**
  - The presence of micro-organisms on a surface or in a fluid or material.

And "C" goes on

Culture

- Diagnostic laboratory test in which microorganisms are grown in the laboratory for identification.
- Purpose is to isolate and identify micro-organisms causing infection

Kirby-Bauer

- Sensitivity testing
  - carried out to determine which antibiotic will be most successful in treating a bacterial infection *in vivo*.

E-Test

Just one "D"

Disinfectant

- antimicrobial agent
- applied to inanimate objects
- removes some or all pathogens

Examples:

- ✓ Aldehydes such as glutaraldehyde
- ✓ Oxidizing agents such as bleach and hydrogen peroxide
- ✓ Phenolics such as Chloroxylenol

On to “E” and “F”

ENDEMIC

- Prevalent in or peculiar to a particular locality, region, or people
- disease which is constantly present in a given area, though usually at low levels

FOMITE

- inanimate objects in the environment that may become contaminated with microorganisms
- most likely to find microbes in and on dark, moist objects that frequently come into contact with food, dirt or vegetation
- Can be items that have been sneezed or coughed on, like desk tops, telephones, pens, pads of paper etc.

Jumping to “I”

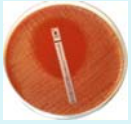
- **INCUBATION PERIOD**
  - The time interval between initial exposure to an infectious agent and the appearance of the first sign or symptom of the disease

INDEX CASE

The first case of a contagious disease to be identified

And then there was “M”

- Minimum inhibitory concentration (MIC)
  - the lowest concentration of antimicrobial that will inhibit the visible growth of a micro-organism
- Minimum bactericidal concentration (MBC)
  - lowest concentration of the antibiotic that kills 99.9% of the original inoculum in a given time



Going all the way to "O" and "P"

- **OUTBREAK**
  - Two or more epidemiologically linked cases of the same infection within one incubation period
- **PATHOGENICITY**
  - The ability of an infectious agent to cause disease in a susceptible host.
- **PREVALENCE RATE**
  - the total number of cases of a disease in the population at a given time

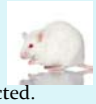
One more "P"

- Prevention-
  - actions that reduce occurrence of death/disease/injury.
  - Primary Prevention- interventions that promote health and prevent disease from developing
  - Secondary Prevention- interventions that detect disease in early stages for early diagnosis and treatment
  - Tertiary Prevention- interventions that change the course of disease, reduce disability and rehabilitate the consumer – e.g., PT or OT

Marching on with "R" and "S"

RESERVOIR

- Any person, animal, plant, soil or substance in which an infectious agent normally lives and multiplies.
- The reservoir typically harbors the infectious agent without injury to itself and serves as a source from which other individuals can be infected.



SEROCONVERSION

- The development of antibodies not previously present
- May result from
  - primary infection
  - Immunization

More "S"

- **SOCIAL DISTANCING-**
  - keeping one's distance away from another to prevent spread of a communicable disease
- **SURVEILLANCE**
  - A systematic collection, analysis and interpretation of data
  - Concerns incidences of diseases
  - Promotes the health of the public

One more "S"

- Spectrum
  - description of the GENERAL activity of an antimicrobial against micro-organisms
  - narrow spectrum
    - activity against a limited subset of bacteria.
  - broad spectrum
    - activity against a wide range of bacteria (perhaps even all genre)

Last but not least: "V"

- **VECTOR**
  - An organism that carries disease-causing microorganisms from one host to another.
- **VIRULENCE**
  - the relative ability of a pathogen to cause disease
  - a measure of the severity of the disease a pathogen is capable of causing
- **VIRULENCE FACTORS**
  - properties that enable a microorganism to establish itself on or within a host of a particular species and enhance its potential to cause disease
  - Virulence factors include
    - bacterial toxins
    - cell surface proteins
    - cell surface carbohydrates and proteins and
    - hydrolytic enzymes

QUESTIONS? ? ?

- What questions do you have for me?

Agents Responsible for Human Infections

Agents Responsible for Human Infections

- Biological Agents
  - Bacteria-
    - unicellular organism
    - aerobic or anaerobic

Virus- small organism that lacks individual metabolism; can not live w/o other living cells.

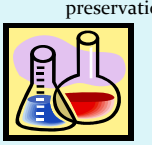
- Fungus-unicellular yeast or mold; few are pathogenic.

- Parasite-

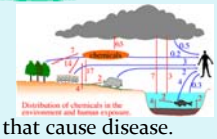
organism that lives on/in another.

Agents continued…

- Chemical Agents-various substances that can produce untoward reactions (Clark, 2008); man-made hazards (S&L, 2008).
  - Pesticides- agents added for plant protection from insects e.g., DDT.
  - Food Additives-substances added to food for preservation, taste or texture e.g., peanut oil.



Agents continued…



ENVIRONMENTAL AGENTS

Those things outside of the person that cause disease.

- Radiation
- Temperature
- Lighting

CONTRIBUTING SOCIAL FACTORS

-overcrowding

–stress

- lack of social support

- economic-

--access to care

The Bug (a.k.a. Infectious Agent

- any micro-organism that is capable of causing an infection.
  - bacteria
  - virus
  - fungus
  - parasite

Hiding place (a.k.a. reservoir)

- source of the infecting organism
- the environment, inanimate object, animal, insect or human that provides the requirements for a microorganism to survive at specific stages of in its life cycle.
- Can be
  - Food (e.g. Salmonella)
  - Water (e.g. Legionellious)
  - Human (either a case or a carrier)
  - Animal (e.g. lyme disease)
  - Insect (e.g. mosquito)

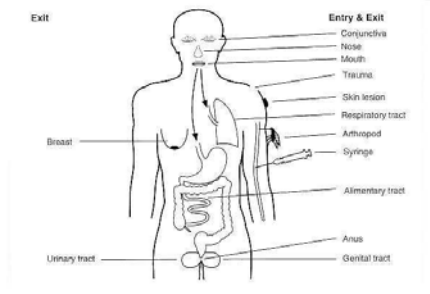
"The Way Out"a.k.a Portal of Exit

- the route a pathogen takes out of an infected host
- generally leave in body secretions
  - Sputum
  - Semen, vaginal secretions
  - Urine
  - Saliva
  - Feces
  - Drainage from wounds
  - Tears
  - Blood

Getting around a.k.a transmission

- The transfer of a disease-causing microorganism to a susceptible individual
- Categories of transmission:
  - contact
  - vehicle
  - vector

"A Way in" a.k.a. portal of entry



Portal of entry

Any body opening on an UNINFECTED individual that allows a pathogen to enter.

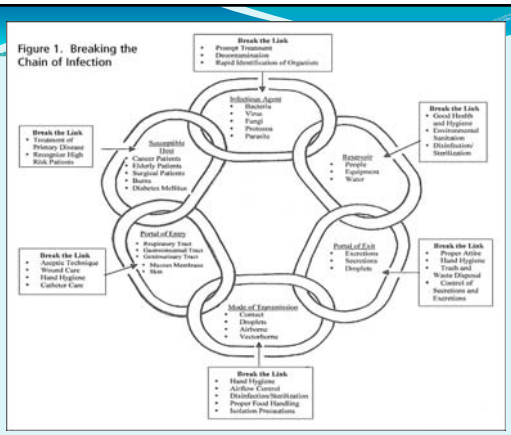
A pathogen can enter through any mucous membrane, cut in skin, mouth, eyes, or impaired skin.

Each invasive device, (e.g. catheter, gastrostomy tube, trach) creates an additional portal of entry into a body thus increasing the chance of developing an infection.

Another sick person – a.k.a. the Susceptible host

- Last and most important link in chain of infection
- Intrinsic risk factors
  - Age
  - Gender
  - Poor nutrition
  - Increased stress
  - Autoimmune disease
  - Concurrent disease
  - Pregnancy

- Extrinsic factors
  - Devices that are left in place most important factor
  - Cleanliness of environment

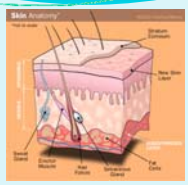


Host/Body's Natural Defense Mechanisms

Group of body protective systems that guard against infection.

- First line: physical barriers
  - Skin and normal floral
  - Mucus membranes
  - Coughing/sneezing
  - Tearing reflex
  - GI/GU tract environment
- Second line:
  - inflammation
  - WBC phagocytosis
- Third line:
  - Immune Response

Skin



- Skin – first line of defense
- Physical barrier
- Lysozone
  - secreted by sweat, lacrimal and salivary glands
  - breaks down cells walls of microbe
- Sebum
  - produced by sebaceous glands
  - protective film on skin
  - acidic and also contains fatty acids
  - kills some bacteria

Normal flora

- Regular inhabitants that rarely cause disease
- Competes with pathogenic flora
- Inhibits pathogens from multiplication
- often produce substances (toxins or acids) which are bactericidal.

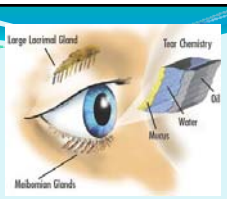
Mucus membranes

- Line many of the body's portals of entry
- Infectious agents become trapped in the thick mucus and in the cilia
- Secretions have antimicrobial properties
- Secretions contain IgG and IgA
  - Prevent microorganisms from attaching to host cells

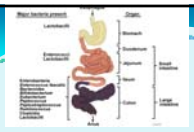
Coughing and Sneezing

- Cough
  - air exhaled under high pressure
  - spontaneous reflex reaction to remove foreign particles
- Sneeze
  - semi-autonomous, convulsive expulsion of air
  - airway defense mechanism that removes irritants from the nasal epithelial surface
  - occurs when a particle passes through the nasal hairs and reaches the nasal mucosa.
  - can reach speeds of 300 mph

Tearing reflex



- results from irritation of the eye by foreign particles
- attempt to wash out irritants
- contains lysomes that destroy bacteria



GI/GU Tract

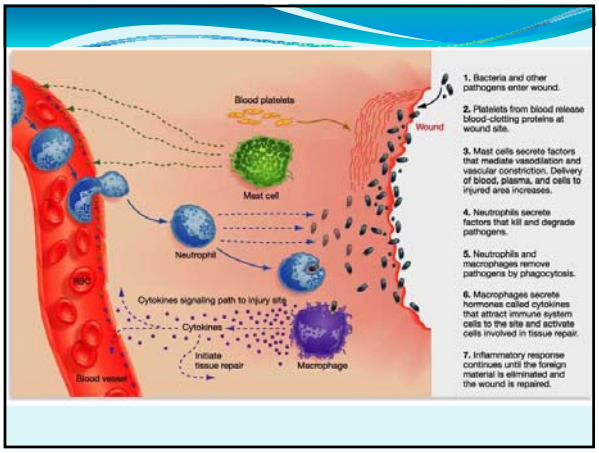
- **GI Tract**
  - **acid pH of the stomach**
  - **antibacterial activity of pancreatic enzymes, bile, and intestinal secretions**
  - **peristalsis and the normal loss of epithelial cells remove microorganisms**
  - **Normal bowel flora can inhibit pathogens**
- **GU tract barriers**
  - **length of the urethra (20 cm) in men**
  - **the acid pH of the vagina in women,**
  - **hypertonic state of the kidney medulla**
  - **kidney also produces and excretes large amounts of Tamm -Horsfall mucoprotein,**
    - **binds certain bacteria**
    - **facilitates their harmless excretion**

Non-specific responses -Second Line of Defense

- Generalized response
- Do not target a specific cell type

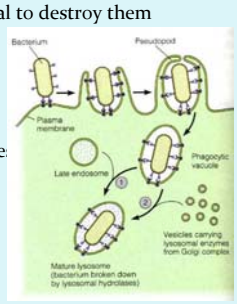
INFLAMMATION

- A complex biological response to harmful stimuli
- protective attempt by the body to remove the injurious stimuli as well as initiate the healing process
- directs immune system components to the site of infection
  - Causes localized redness, swelling, heat, and pain
  - Changes in capillary wall structure allow interstitial fluid and WBC's to leak out in tissue
  - Promotes macrophage (phagocytic WBC's) activity
  - Macrophages secrete **Interleukins** (communication proteins among WBC's)
  - **Interleukin-1**: increases body temperature
    - enhances the WBC's ability to protect the body
    - Causes drowsiness - reduces the body's energy usage and stress



Phagocytosis

- **Phagocytes** –
  - cells which "eat" foreign material to destroy them
  - formed from stem cells in bone marrow (stem cells are undifferentiated WBC's)
    - **Neutrophils** - phagocytize bacteria
    - **Eosinophils** - secrete enzyme to kill parasitic worms and other pathogens
- **Macrophage** - "big eaters" phagocytize just about anything



THIRD LINE OF DEFENSE – IMMUNE SYSTEM

- specific targets
- Two types of immunity:
  - Active Immunity
  - Passive immunity

- http://wps.prenhall.com/wps/media/objects/1551/1589206/web_tut/13_02/nav/13_02.html

Questions??

Preview of session #2