Chapter # 1

BASIC CONCEPTS OF INFECTION CONTROL

INFECTION

Definition

Invasion and multiplication of an infectious agent within the body. Multiplication of the bacteria that are part of the normal flora is not considered an infection. On the other hand multiplication of pathogenic organisms is deemed an infection even if the person is asymptomatic.

Types of Infection

Infections can be acquired in the community or during stay in the hospital.

Community Acquired Infections

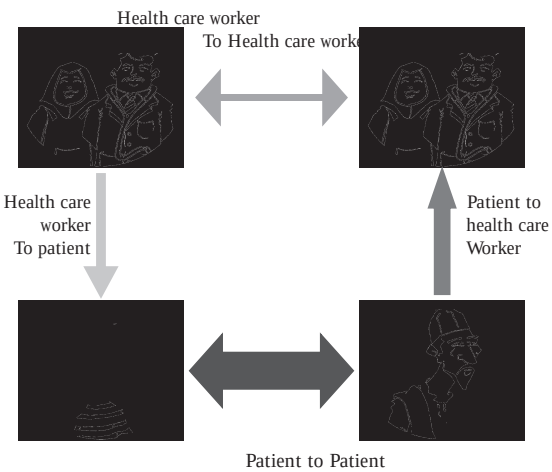
Community Acquired infections are those present and spread in the community. It also include infections in present or incubating at the time of hospital admission.
Respiratory tract infections, diarrhea, typhoid fever, skin infections etc are common examples.

Hospital Acquired Infections

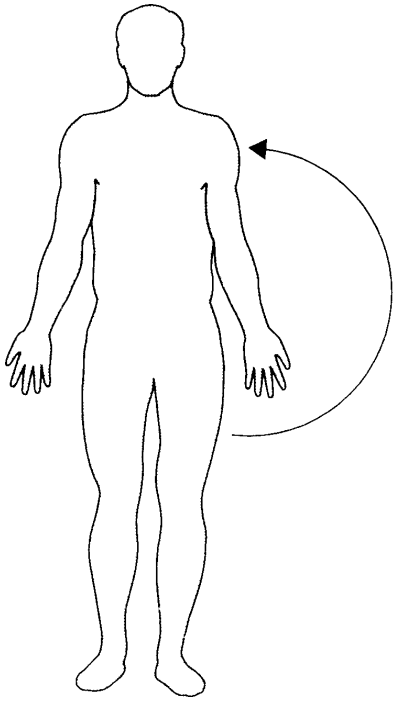
Hospital acquired infections (HAI) are also called nosocomial infections (NCI). These are infections that are acquired during stay in the hospital. Hospital environment poses greater risk of acquiring infections as most seriously infected and highly susceptible patients are present and often cared for by the same staff. Moreover, infectious agents present in the hospital environment and on the health care providers are generally resistant to antimicrobial agents. In developing countries about 25% of hospitalized patients acquire NCI. Treatment of such infections requires administration of costly antibiotics and compromise results of procedures / surgeries causing significant morbidity and mortality. In case of public hospitals this poses extra burden on the available limited resources. Approximately 25-28% of the budgetary allocation for medicines is spent on purchase of antimicrobial drugs. A large portion of thiscan be saved by proper infection control measures.

Risk groups for developing hospital–acquired infections

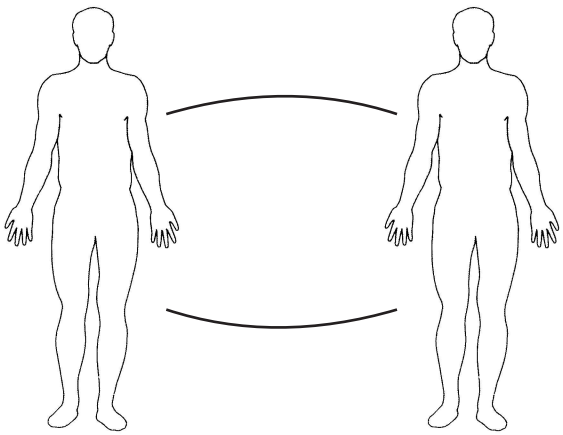
Healthy individuals have a normal general resistance to infection. Immuno-compromised patients, newborn babies, persons with chronic diseases like diabetes, and the elderly are more likely to develop an infection.
There are two sources of infection occurring in a hospital or health care setting:



Ways of Infections Transmission in Health Care Settings



Picture-1: Endogenous Infection



Picture-2: Exogenous Infection

Infectious Disease Transmission Cycle

1. Infectious agent

The infectious agent is the microorganism that can cause infection or disease. The infectious agents include bacteria, viruses, fungi, and parasites.

2. Reservoir

A reservoir is the place where the agent survives, grows, and/or multiplies. People, animals, plants, dust,soil, air, water and other solutions, and instruments and other items used in clinical procedures can serve as reservoirs for potentially infectious microorganisms.

3. Site of exit

The route by which the infectious agent leaves the reservoir is called the place of exit. The infectious agent can leave the reservoir through broken skin (e.g. puncture, cut, surgical site, or rash), mucous membranes (e.g., eyes, nose, and mouth), the respiratory tract (e.g., lungs), the genitourinary tract (e.g., vagina, penis), the gastrointestinal tract (e.g., mouth, anus), or the placenta by means of blood, excretions, secretions, or droplets that come from these sites.

4. Mode of transmission

The way in which the infectious agent moves from the reservoir to a susceptible host is called the mode of transmission. Transmission can occur by the following modes:

- Contact: The infectious agent can be transmitted directly from the reservoir to a susceptible host through touch (e.g., Staphylococcus) or sexual intercourse (e.g., Gonorrhea, HIV). Contact mode of transmission is the most important and frequent mode of transmission of Hospital acquired infections. It is divided into two subgroups:

a) Direct contact: Direct surface to surface body contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person.

b) Indirect contact: Contact of a susceptible host with a contaminated object, usually inanimate, such as medical instruments, bed sheets, needles, dressings or gloves.

- Droplet transmission: Transmission occurs via droplets containing microbes generated by the source person when they cough, sneeze, or talk or by procedures such as respiratory tract suctioning or bronchoscopy. These contaminated droplets are propelled through the air a short distance, usually not more than 1 meter, and are deposited on the susceptible host's conjunctivae, nasal mucosa, or mouth. These droplets are too heavy to become suspended in air. Agents transmitted by droplets are distinct from other agents that are transmitted via the air. Special air handling and ventilation are not necessary to interrupt transmission of microbes carried by this mode.

- Airborne transmission: The infectious agent can be transmitted via tiny droplet nuclei (< 5 microns) containing microorganisms that remain suspended in the air and that can be carried by air currents (e.g., Measles,M. tuberculosis) at greater distances than large droplets. The susceptible host inhales these droplets. The droplet nuclei may remain suspended in the air for varying periods of time and special air handling and ventilation is required in order to prevent transmission of these microorganisms.

- Common Vehicle transmission: The infectious agent can be transmitted indirectly from the reservoir to several susceptible host by material contaminated with the infectious agent. Examples of common vehicles include food (e.g.,Salmonella spp.), blood (e.g., hepatitis B virus, hepatitis C virus, and HIV), water (e.g., Cholera, Shigella), or contaminated instruments and other items (e.g., Hepatitis B virus, Hepatitis C virus, HIV, Crimean Congo Haemorrhagic Fever (CCHF) virus, Pseudomonas etc.).

- Vector transmission: The infectious agent can be transmitted to a susceptible host through insects and other invertebrate animals (e.g., mosquitoes can transmit malaria, dengue fever, and yellow fever; fleas can transmit plague, ticks transmit CCHF etc.

5. Route of Entry

The route of entry is the portal through which the infectious agent moves into the susceptible host. It includes: Bloodstream (site of invasive procedures such as injections or intravenous catheters), broken skin (e.g., puncture, cut, surgical site, rash), mucous membranes (e.g., eyes, nose, mouth), respiratory tract (e.g., lungs), genitourinary tract (e.g., vagina, penis), gastrointestinal tract (e.g., mouth, anus), placenta.

6. Susceptible host

Susceptible host is a person who can become infected by the infectious agent. Susceptible hosts in HCF include patients, health care personnel, ancillary staff, and visitors.

INFECTION CONTROL

Infection control strategies are aimed at breaking this chain of infection at all the possible sites.

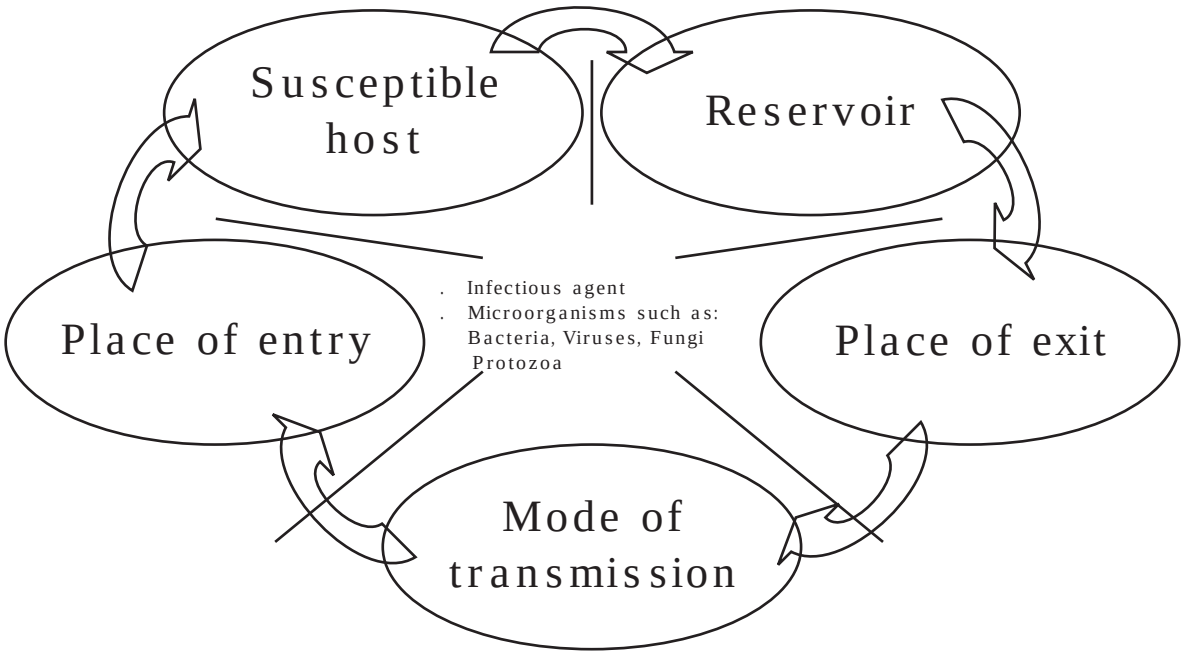
Rapid spread of HBV, HCV and HIV has attracted great attention during last couple of decades due to high morbidity and mortality associated with these conditions. These infections are transmitted in the community as well as in the health care facilities.

Mode of Transmission of HBV, HCV & HIV

Scientific studies have shown that HIV, HBV, and HCV are transmitted from direct contact with blood or body fluids that penetrate the skin or mucous membrane.Blood-borne pathogens are transmitted by:

- Direct contact with blood or fluids containing the blood-borne pathogen.
- Introduction of contaminated blood on to nonintact skin.
- Injuries from contaminated needles or other sharps instruments.

- Transfusion of contaminated blood or blood products.
- Infusion of intravenous fluids/medications or injection using contaminated needles (e.g., sharing re used injection solutions), syringes, or drugs.
- Splashes of contaminated body fluids into or on to the mucous membranes of a health care worker.
- Use of contaminated razors, toothbrushes, or tattooing needles.
- Sexual contact- through unprotected vaginal or anal intercourse. Transmission through oral sex has been reported but is much lower than through vaginal or anal intercourse.
- Perinatal transmission – virus may be passed from mother to infant during pregnancy, labor and delivery, or during breastfeeding. HCV is transmitted through blood and other body fluids. However, the risk of transmitting HCV through sexual contact or peri-natal transmission is considered to be low compared to direct transfusion or sharps injuries.



Picture-3: Chain of Infection