Objectives

To be able to

• define hospital acquired infections

• discuss the sources and routes of transmission of infections in a hospital

• describe methods of prevention and control of hospital acquired infections
Hospitals are complex institutions where patients go to have their health problem diagnosed and treated.

But, hospitals and medical/surgical interventions introduce risks that may harm a patient’s health.
Definition: Hospital infection

Any infection that is not present or incubating at the time the patient is admitted to the hospital.

Clinically recognizable microbiologic disease developing in a patient after 48 hours of admission to the hospital which was not incubating at the time.
Consequences of Nosocomial Infections

- Additional morbidity
- Prolonged hospitalization
- Long-term physical, developmental and neurological sequelae
- Increased cost of hospitalization
- Death
- Legal implications – CONSUMER COURT
- Bad publicity
Frequency of Nosocomial Infection

- Nosocomial infections occur worldwide.

- The incidence is about 5-8% of hospitalized patients, 1/3 of which is preventable.

- The highest frequencies are in East Mediterranean and South-East Asia.
Nosocomial Infections Cost

- The cost varies according to the type and severity of these infections.

- The CDC has recently reported that US$5 billion are added to US health costs every year as a result of NI.
Prolongation of Hospital Stay due to Nosocomial Infections in the USA

<table>
<thead>
<tr>
<th>Infection Site</th>
<th>Excess Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Wound</td>
<td>6.0</td>
</tr>
<tr>
<td>Urinary tract</td>
<td>1.2</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>4.0</td>
</tr>
<tr>
<td>Bacteremia</td>
<td>7.0</td>
</tr>
<tr>
<td>Other sites</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Adapted from Dixon, Ann Int Med 89:749, 1978
TRANSMISSION

- Where do nosocomial infection come from?

✓ **Endogenous infection:** About 50% of N.I. Are caused by this way.

✓ **Exogenous cross-infection:** Mainly through hands of healthcare workers, visitors, patients, Hospital environment
NOSOCOMIAL INFECTION SITES

- **Urinary tract infection:** most common type of N I (30-40% of reported cases)

- **Lower respiratory and surgical wound infections** are the next (each about 15%).

- **Less frequent include bacteraemia (5%), intravenous site infection, gastrointestinal tract and skin infections.**
# Commonly Occurring Hospital Infections

<table>
<thead>
<tr>
<th>Infection Type</th>
<th>Common Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound Infections</td>
<td>Staph. aureus, E. coli, Anaerobes</td>
</tr>
<tr>
<td>Respiratory infections</td>
<td>Gram Negative bacilli, Staph. Aureus, Acinetobactor</td>
</tr>
<tr>
<td>Urinary Tract infections</td>
<td>E. coli, Klebsiella, Psuedomonas</td>
</tr>
<tr>
<td>Gastrointestinal infections</td>
<td>Enteroviruses, Salmonella</td>
</tr>
<tr>
<td>Spesis</td>
<td>Gram Positive cocci, Gram Negative bacilli</td>
</tr>
</tbody>
</table>
Hospital Associated Risk Factors

- Low resistance of patients to infections
- Contact with infected person
- Contaminated environmental sites
- Drug resistance of endemic microbes
- Interventional diagnostic and therapeutic techniques
<table>
<thead>
<tr>
<th>Route</th>
<th>Source</th>
<th>Examples of disease</th>
</tr>
</thead>
</table>
| 1. Aerial (from persons) | Droplets  
Mouth  
Nose  
Skin scales  
Skin exudate, infected lesion | Measles, tuberculosis, pneumonia  
Staphylococcal sepsis  
Staphylococcal and streptococcal sepsis |
| 2. Aerial (from inanimate sources) | Particles  
Respiratory equipment  
Air-conditioning plant | Gram-negative respiratory infection  
Legionnaires’ disease, fungal infections |
| 3. Contact (from persons) | Direct spread  
Respiratory secretions | Staphylococcal and streptococcal sepsis |
| | Indirect via equipment  
Faeces, urine, skin and wound exudate | Enterobacterial diarrhoea, *Pseudomonas aeruginosa* sepsis |
| 4. Contact (environmental source) | Equipment, food, medicaments, fluids | Enterobacterial sepsis (*Klebsiella/Serratia/Enterobacter* spp.)  
*Ps. aeruginosa* and other pseudomonads |
| 5. Inoculation | Sharp injury, blood products | Hepatitis B, HIV |
Other sources of air contamination in a hospital

Dust from Handkerchief

Hands

clothing

Handkerchief

Dust from clothes

Dust from floor
Spread of Resp. infections by droplets and droplet nuclei

> 5µ size

< 5µ size

SMALL DROPLETS evaporate to droplet-nuclei in this zone

DROPLET-NUCLEI carried in air currents for minutes or hours

LARGE DROPLETS settle to ground in a few seconds
Sepsis – How can the patient get the infection?
Causative Agents

- “Conventional” pathogens-
  *Staph.aureus, M. tuberculosis, HBV HAV*
- “Conditional” pathogens-
  *P.aeruginosa, Klebsiella etc. Acinetobactor*
- “Opportunistic” pathogens- Acinetobactor  
  *Candida, Aspergillus, Pneumocystis caranii etc.*
Resistant Organisms

• Gram Positive – VRE, MRSA (super bug)
  Coagulase negative staphylococci (Staph. epidermidis)

• Multi drug resistant gram negative organisms – Pseudomonas aeruginosa, Klebsiella spp, Esch. coli (ESBL producers), acinetobactor

• Candida
Viruses

- Respiratory viruses - Influenza, Parainfluenza, RSV, varicella zoster
- Viruses causing diarrhea – Rota, Norwalk
- Blood borne viruses – HBV, HIV, HCV
Concepts of Infection Control
Goals for infection control

1. Protect the patients

2. Protect the health care workers, visitors, and others in the healthcare environment.

3. Become cost effective and cost efficient
MANAGEMENT OF HOSPITAL INFECTION

- REGULATORY BODIES
- INFECTION CONTROL COMMITTEE
- INFECTION CONTROL TEAM
INFECTION CONTROL PROGRAM

A comprehensive, effective and supported program is essential for reducing NCI

• surveillance,
• preventive activities,
• control measures
• staff training.
Authority of Infection Control Program (Regulatory Bodies)

- Hospital Accreditation Boards
- Local Regulatory Boards
- CAP: College of American Pathologists: Lab regulation
- CDC: Centre for Disease Control and Prevention
- APIC: Assoc. for Professionals in Infection Control and Epidemiology
Infection Control Committee
Infection Control Committee

Purpose

• **Advisory**
  – Review ideas from infection control team
  – Review surveillance data

• **Expert resource**
  – Help understand hospital systems and policies

• **Decision making**
  – Review and approve policies and surveillance plans
  – Policies binding throughout hospital

• **Education**
  – Help disseminate information and influence others
INFECTION CONTROL TEAM

- HOSPITAL EPIDEMIOLOGIST
- INFECTION CONTROL PRACTITIONER/S
- MICROBIOLOGIST
- HOSPITAL PHYSICIAN/SURGEON
- ICU STAFF NURSE
INFECTION CONTROL MANUAL

- Recommended instructions and practices for patient care.

- This manual should be developed and updated in a timely manner by the infection control team.

- It is to be reviewed and accepted by infection control committee.
SURVEILLANCE
SURVEILLANCE DEFINITION

A dynamic process of gathering, managing, analyzing and reporting data on events that occur in a specific population.
OBJECTIVES OF THE SURVEILLANCE

1. Reducing the infection rate within a hospital.
2. Establishing baseline rates.
3. Identifying outbreaks.

Specimens can be from different sources
A. Patients
B. Health service providers
C. Outbreaks

Specimen: Collection of specimens, laboratory identification
SURVEILLANCE

- Hospital wide
- Periodic
- Targeted
- Defining the threshold limit
- Post discharge
Organization for surveillance

Feedback & dissemination

- prompt, relevant to target group
- Meetings & discussions
- Dissemination by committee
CONTROL PROGRAM
Investigation of an outbreak

- Has an Epidemiological element and Microbiological element
- Causative organism has to be isolated in all patients
- Tracing the source and at the same time steps to contain the outbreak
- Epidemiological typing – phenotypic, genotypic methods
Typing Methods

- Antibiotic susceptibility and biotyping
- Serotyping
- Phage typing
- Molecular typing – DNA finger printing, plasmid profile, Restriction enzyme analysis
- PFGE, PCR
Standard precautions

Includes both the features of

- **Universal precautions** (to reduce risk of transmission of blood borne pathogens)

- **Body substance isolation** (to reduce risk of transmission of pathogens from moist body substances)
Universal Precautions

Blood and fluids visibly contaminated with blood. Also semen and vaginal secretions, tissues and body fluids (mainly to prevent blood borne infections)

Body Substance Isolation
Faces, urine, sputum, saliva, wound drainage etc.
Isolation Precautions

Determined by the types of transmission
Contact, Airborne, Droplet

Fundamentals are:
• Hand washing
• Ventilation
• Appropriate barriers
• Patient –care equipment and articles
• Linen and Laundry
PROTECTIVE GEARS

- Mask
- Long-sleeve shirt
- Plastic apron
- Trousers
- Boots
- Thick gloves
Educational material that can be put in the wards

GLOVES
Before touching blood, body fluids, mucous membranes, non-intact skin or performing venipuncture CHANGE gloves after contact with each patient.

WASH
Wash hands immediately after gloves are removed. Wash hands and other skin surfaces immediately if contaminated with blood or other body fluids.

GOWN / APRON
For procedures likely to generate splashes of blood or other body fluids.

MASK
EYE PROTECTION
Masks and protective eyewear or face shields for procedures likely to generate splashes of blood or other body fluids.

SHARPS
Dispose of needles with syringes and other sharp items in puncture-resistant container near point-of-use.

DO NOT RECAP BY HAND
Do not recap needles or otherwise manipulate by hand before disposal.

RESUSCITATION
Mouthpieces of resuscitator bags should be available to minimize need for emergency mouth to mouth resuscitation.

WASTE / LINEN
Waste and soiled linen should be handled in accordance with disposal policy and local law.
Hand hygiene is the single most important measure to reduce risk of transmitting organisms from one person to another or one site to another in a same patient.
Bacteriologically effective hand washing

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Hands That Heal

Hands That Kill

Which hands are yours?
Hospital Waste Management

Not all waste is infectious

Segregation of infectious waste is required

Standard precautions

Proper disposal of waste

Biohazard label
Environmental control:
1. Cleaning of hospital environment and dis-infection.
2. Proper air ventilation.
3. Water pipes examination, check its quality.
4. Proper waste collection and disposal.
5. Cleaning and dis-infection of equipment.
6. Proper linen collection, cleaning, distribution.
Central Sterile Supply department (CSSD) serving all hospital departments compiling with infection control precautions.
Cultures of Walls, Floors and Other Smooth Surfaces

• All hospitals have some bacterial colonization of environment

• Floors, Walls, Tables, Beds etc. should be cleaned properly but not cultured
Patient protection:

* corrective measures before major procedure, vaccination, proper use of antibiotics.

* Isolation precautions.

* Limiting endogenous risk
Staff health promotion and education:

1. Continuous education
2. Employee health history - immunizations
3. Occupation injury must be notified.
Sweet Home

Thank You