

Health Care-associated Infection (HCAI)

(Nosocomial” or “hospital” infection)

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Health Care-associated Infection (HCAI) (Nosocomial” or “hospital” infection)

An infection occurring in a patient during the process of care in a hospital or other health-care facility which was not present or incubating at the time of admission.

This includes infections acquired in the health-care facility but appearing after discharge.

Health care–associated infection

is a condition in which patients first manifest fever during active medical treatment for some other illness.

Surgical procedures

Urinary and respiratory tract instrumentation,

Intravascular devices....septic thrombophlebitis

Drug therapy..

Immobilization... , recurrent pulmonary emboli,

Clostridium difficile colitis.

Colonization

The presence of microorganisms on

Skin, on mucous membranes,

Open wounds, or

Excretions or secretions

BUT : are not causing adverse clinical signs or symptoms.

HEALTH CARE WORKERS.

Workers in the health care are at risk of occupational exposure to bloodborne:

Exposures can occur :

1) Via needle stick injury, exposure to mucous membranes, or non-intact skin:

HIV/AIDS , Hepatitis B and Hepatitis C..

2) Person's respiratory secretions, such as through coughing

Tuberculosis , MERS-COV, H1N1..

Estimated rates of HCAI worldwide

In modern health-care facilities in the:

Developed world:

5–10% of patients acquire one or more infections

Developing countries the risk of HCAI might **exceed 25%**.

In intensive care units, HCAI affects **about 30%** of patients and the attributable mortality **may reach 45%**

Source of infection

1) Endogenous

Body sites, such as the skin, nose, mouth, gastrointestinal (GI) tract, that are normally inhabited by microorganisms.

2) Exogenous :

Sources are those external to the patient, such as:

- A) Patient care personnel, visitors,
- B) Patient care equipment, medical devices, or
- C) The health care environment.

Source of infection

Four categories of infections account for approximately 75% of HAIs in the acute care

Hospital setting:

1. Surgical site infections
2. Central line-associated bloodstream infections
3. Ventilator-associated pneumonia
4. Catheter-associated urinary tract infections

HEALTH CARE ASSOCIATED INFECTION

infections associated with

Clostridium difficile,

Methicillin-resistant Staphylococcus aureus (MRSA)

Multi-drug resistant organisms (MDROs)

Contribute significantly to the overall problem.

Catheter-associated urinary tract infections .. 34%

UTI that is acquired in a hospital

The vast majority of nosocomial UTIs occur in patients whose urinary tracts are currently or recently catheterized.

Catheter-associated urinary tract infections..35-45%

Pathogenesis

Pathogen Spread up the periurethral space from the patient:

- 1) perineum
- 2) GI-Tract

OR

Via intraluminal contamination of the catheter

Catheter-associated urinary tract infections

Age	Male and female, female predominance
Sex	Urinary catheter
Main risk factor	Extraluminal: fecal organisms ascend catheter-urethra
Pathogenesis	Intraluminal: fecal or exogenous (cross-infection) organisms enter drainage system
	Less virulent than in uncomplicated UTI
Uropathogen virulence	Single (short-term catheter) multiple (long-term catheter): gram-negatives, gram-positives, <i>Candida</i> sp.
Microbiology	CA-bacteriuria in about 5% per day of catheter; >90% is CA-ASB, usually Persistent, most do not progress to CA-UTI.
Clinical	CA-UTI: fever, altered mental status, usually no lower tract symptoms
Diagnosis	CA-UTI: $\geq 10^3$ CFU/mL
	Multidrug resistance common
Resistance	5-14 day regimen, depending on severity
Treatment	Reduce urinary catheterization; condom, intermittent or suprapubic catheter vs. indwelling urethral catheter; strict closed system with indwelling urethral catheter

Catheter-associated urinary tract infections..35-45%

Urinary catheter
Urinary invasive procedures..

- ❖ **15-25% of hospitalized patients receive urinary catheters during their hospital stay ..**
- ❖ **3% of bacteriuric develop: bacteremia**
- ❖ **Important source of multi-drug resistant bacteria.**

Catheter-associated urinary tract infections..35-45%

The most important risk factor for developing a catheter-associated UTI (CAUTI) is:

prolonged use of the urinary catheter

Catheter-associated urinary tract infections..35-45%

Impact of CAUTI:

- ❖ **Increased morbidity, mortality**
- ❖ **Hospital cost, and length of stay.**
- ❖ **Bacteriuria can lead to :**
 - ❖ **unnecessary antimicrobial use, and**
 - ❖ **urinary drainage systems are often reservoirs for multidrug-resistant bacteria and a source of transmission to other patients.**

Catheter-associated urinary tract infections..35-45%

Diagnosis:

Symptomatic urinary tract infection:

Must meet at **least 1** of the following criteria

Fever (38.8C), urgency, frequency, dysuria, or suprapubic tenderness

and

A positive urine culture, that is, $>10^5$ microorganisms per 1 cc of urine with no more than 2 species of microorganisms.

Catheter-associated urinary tract infections..35-45%

Asymptomatic bacteriuria

Must meet **at least 1** of the following criteria:

an indwelling urinary catheter within 7 days

and

a **positive urine culture**, with no more than 2 species of microorganisms
and

NO fever (.388C), urgency, frequency, dysuria, or suprapubic tenderness.

A positive culture of a urinary catheter tip is not an acceptable laboratory test to diagnose a urinary tract infection.

Catheter-associated urinary tract infections..35-45%

Prevention:

- A] Catheters only when necessary and for the shortest time.
- B] Properly trained individuals are responsible for insertion
- C] Hand hygiene before and after insertion or manipulation of the catheter.
- D] Maintain unobstructed urine flow

The collection bag below the level of the bladder

Central Line-associated Bloodstream Infection (CLABSI)

14 %

At least one (1) of the following criteria:

- a.) acquired during hospitalisation and not present or incubating on admission;
- b.) is a complication of the presence of an indwelling medical device: (e.g., IV catheter, urinary catheter);

Vascular catheter

- ❖ Severe underlying disease
- ❖ Neutropenia
- ❖ Immunodeficiency
- ❖ New invasive technologies
- ❖ Lack of training and supervision

Central Line-associated Bloodstream Infection (CLABSI)

14 %

An important **cause of morbidity and mortality**

Most are associated with intravascular catheters, and central venous catheters in particular (90%).

Criterion 1 (recognized pathogens):

Isolation of one or more recognized bacterial or fungal pathogens from one or more blood cultures

Staphylococcus aureus,

Gram negative bacilli accounted for 19% and 21% of CLABSIs reported to CDC

Candida albicans.

Central Line-associated Bloodstream Infection (CLABSI)

14 %

Criterion 2 :

The patient has at **least one** of the following signs and symptoms within 24 hours of a positive blood culture being collected:

Fever ($>38^{\circ}\text{C}$);

Chills or rigors;

or HypotensionAND AT LEAST :

isolation of the same potential contaminant

from two (2) or more blood cultures drawn on separate occasions within a 48 hour period.

Catheter factors

Location of the catheter.

Duration of catheterization

Type of catheter material

Conditions of insertion

Catheter-site care

Skill of the catheter inserter



Femoral or internal jugular placement compared with subclavian

Use for hyperalimentation or hemodialysis compared with other indications

Submaximal compared with maximal (mask, cap, sterile gloves, gown) barrier precautions during insertion.

89-90% of these infection is caused by : central vascular catheter .

Pathogenesis:

Microflora at the insertion site migrate extraluminally to the catheter tip usually during the 1st wk after insertion.

Extrenisic contamination cause up to 50% of bacteremia with arterial line insertion for hemodynamic monitoring.

Laboratory-confirmed bloodstream infection

must meet at least 1 of the following criteria:

1. Patient has a recognized pathogen cultured from 1 or more blood cultures

and organism cultured from blood is not related to an infection at another site.

2. Patient has at least 1 of the following signs or symptoms: fever ($\geq 38.8^{\circ}\text{C}$), chills, or hypotension

Prevention

For clinician:

Follow proper insertion practices

Perform hand hygiene before insertion

Adhere to aseptic technique (Education)

Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile fullbody drape)

Perform skin antisepsis with >0.5% chlorhexidine with alcohol

Choose the best site to minimize infections and mechanical complications

- o Avoid femoral site in adult patients

Cover the site with sterile gauze or sterile, transparent, semipermeable dressings

Remove peripheral venous catheters if the patients develops signs of:
phlebitis (warmth, tenderness, erythema or palpable venous cord),
infection, or
a malfunctioning catheter

SURGICAL SITE INFECTION 17%

A surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place.

SURGICAL SITE INFECTIONS 17%

Inadequate antibiotic prophylaxis
Incorrect surgical skin preparation
Inappropriate wound care

Risk is high:

Surgical intervention duration
Type of wound
Poor surgical asepsis
Diabetes
Nutritional state
Immunodeficiency
Lack of training and supervision

SURGICAL SITE INFECTION

Occur in 2%–5% of patients undergoing inpatient surgery.

account for 17-20% of all HAIs in hospitalized patients

Each SSI is associated with approximately 7–11 additional postoperative hospital-days

Patients have a 2–11-times higher risk of death compared with operative patients without an SSI.

SURGICAL SITE INFECTION

Patient has at least 1 of the following:

- A)** Purulent drainage from the superficial incision
- b)** Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision
- C) at least 1** symptom or sign of infection:
 - 1) Pain or tenderness,
 - 2) Localized swelling, redness, or heat.

Diagnosis

Patient has at least 1 of the following:

a) Purulent drainage from the deep incision

b) a Deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured .

when the patient has at least 1 :

1) fever ($\geq 38.8^{\circ}\text{C}$), or

2) localized pain or tenderness.

Aculture-negative finding does not meet this criterion.

SURGICAL SITE INFECTION

The most common organisms:

Coagulase-negative staphylococci – 31 percent

Staphylococcus aureus – 20 percent

Enterococci – 9 percent

Candida species – 9 percent

Escherichia coli – 6 percent

Klebsiella species – 5 percent

Pseudomonas species – 4 percent

Enterobacter species – 4 percent

Serratia species – 2 percent

Acinetobacter baumannii – 1 percent

Prevention of SSIs

CDC infection prevention guidelines :

Clean hands and arms up to the elbows with an antiseptic agent just before the surgery.

Clean hands with soap and water or an alcohol-based hand rub before and after caring for each patient.

Wear special hair covers, masks, gowns, and gloves during surgery to keep the surgery area clean.

Use prophylactic antibiotics if indicated..

Clean the skin at the site of your surgery .

SURGICAL SITE INFECTION

Administer prophylactic antibiotics within 1 hour of before surgery and

Discontinue within 24 hours

Select appropriate agents on the basis of the surgical procedure, the most common pathogens causing SSIs for a specific procedure.

Redose prophylactic antimicrobial agents for long procedures

Pathogenesis

1) migration of skin organisms at the insertion site into the cutaneous catheter tract and along the surface of the catheter with colonization of the catheter tip.

this is the most common route of infection for short-term catheters

2) direct contamination of the catheter or catheter hub by contact with hands or contaminated fluids or devices

3) less commonly, catheters might become hematogenously seeded from another focus of infection [

4) rarely, infusate contamination might lead to CRBSI

LOWER RESPIRATORY TRACT INFECTIONS

LOWER RESPIRATORY TRACT INFECTIONS

Mechanical ventilation

Aspiration

Nasogastric tube

Central nervous system depressants

Antibiotics and anti-acids

Prolonged health-care facilities stay

Malnutrition

Advanced age

Surgery

Immunodeficiency

Health care associated pneumonia

Pneumonia that occurs 48 hours or more after admission and did not appear to be incubating at the time of admission.

Ventilator-associated pneumonia (VAP) is a type of HAP that develops more than 48 to 72 hours after endotracheal intubation

Health care associated pneumonia

Pneumonia has accounted for approximately 15% of all hospital-associated infections.

and 27% of all infections acquired in the medical intensive-care unit (ICU) and

and 24% coronary care unit.

the second most common hospital-associated infection after that of the urinary tract

Health care associated pneumonia.

Pneumonia: 15-20% but IT cause

40% extra cost in hospital.

Aetiology :

Aspiration of endogenous or hospital acquired oropharyngeal flora.

A leader cause of mortality among HCAI.

The most common and lethal is:

Ventilator-associated pneumonia: 5-15% death.

Health care associated pneumonia

Risk factors: (Events)

A} **Factors that increase colonization** by potential pathogens:

- 1) prior antimicrobial therapy.
- 2) contamination of ventilator circuits.
- 3) Decreased gastric acidity.

Health care associated pneumonia

B} factors facilitate aspiration of oropharyngeal contents:

- 1) Intubation
- 2) Decreased level of consciousness.
- 3) Presence of nasogastric tube.

C} factors that reduce the host defense:

- 1) Chronic lung disease
- 2) Old age
- 3) Upper abdominal surgery.

DIAGNOSIS

Fever, cough, and
development of purulent sputum.

Rdiologic evidence of a new or progressive pulmonary infiltrate,
leukocytosis,

Prevention of health care-associated infection

- ❖ Validated and standardized prevention strategies have been shown to reduce HCAI
- ❖ At least 50% of HCAI could be prevented
- ❖ Most solutions are simple and not resource-demanding and can be implemented in developed, as well as in transitional and developing countries
- ❖ Hands are the most common vehicle to transmit health care-associated pathogens .
- ❖ Transmission of health care-associated pathogens from one patient to another via health-care workers' hands .

Isolation

Standard precautions:

Gloving and hand cleansing for potential contact with :

- 1) blood
- 2) all other body fluid ,secretion or excretion
- 3)non-intact skin
- 4) mucus membrane

Patient with potentially contagious clinical syndrom:

Diagnosed to be colonized or infected with transmissible organism through:

airborne, droplet, and contact:

pulmonary tuberculosis

meningitis...etc

Tuberculosis

Tuberculosis (TB) is an airborne disease

Prompt recognition..Atypical presentation.

Isolation

Treatment

The room :

Negative pressure

100% exhaust

Private isolation with closed door.

Use of N95 respirators.

Follow the contact and test for infection.

SPECIAL INFECTION

- Transmission of multidrug-resistant/marker organisms
 - **MRSA**
 - **VRE**
 - **Carbapenem-resistant *Acinetobacter***
 - **ESBL-producing organisms → MDR *Enterobacteriaceae***
 - ***C. difficile***
 - ***Aspergillus* in burn and immunocompromised populations**
 - **Tuberculosis**
 - Human Immunodeficiency Virus (HIV)
 - Influenza
 - meningitis

SPECIAL INFECTION

Clostridium difficile

Clostridium difficile is a bacterium that causes colitis.

Diarrhea and fever are the most common symptoms of Clostridium difficile infection.

Overuse of antibiotics is the most important risk for getting Clostridium difficile infection.