



REVIEW ARTICLE



Clinical Pharmacist Role In Prevention and Management of Hospital Associated Microbial Infections In Health Care Practice

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Abstract

Hospital associated microbial infections occur when the patients receiving health care treatment in health care settings and the symptoms appear in 48 hours. Hospital associated microbial infections are caused by medical devices and other infectious species which include staphylococcus aureus, enterococci, klebsiella pneumonia, candida albicans, clostridium difficile, pseudomonas aeruginosa can cause more health care burden to the individual patients. The most commonly seen hospital associated microbial infections are septicaemia, catheter associated urinary tract infections, ventilator-associated pneumonia, sepsis, surgical site of infections are adversely affect the patients health. The prevention and management of hospital associated microbial infections by strict disinfection of medical devices, and hospital environments, detection and monitoring of infected patients, regular practice of hand hygiene, safe disposal of contaminants, and consumption of good nutrition food can prevent the complications of microbial infections in the health care. An early amalgamation of clinical pharmacist services with other health care team includes designing of new anti microbial treatment guidelines, initiation of awareness programmes on infection prevention and control, educating the health care professionals on antimicrobial resistance control, regular monitoring of treatment of the infected patients, and effective prescribing of antimicrobial drugs could drastically improve the health related outcomes of infected patients.

Keywords: Microbial infections, antibiotic resistance, antimicrobial drugs, clinical pharmacist services, infection control

1 | INTRODUCTION

Hospital is an integral part of a social and medical organization that provides treatment, and all health care benefits to disease patients.

Functions of hospital:

- Providing health care services to patients
- Monitoring financial operations of the hospital

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- Conducting research activities in the hospital
- Construction of hospital policies, administration laws and rules, and regulations of hospital
- Management of hospital pharmacy
- Hospital waste management
- Pathology Department
- Paramedical Department
- Pharmacy Department
- Dietary Department
- Operation Theatre Complex
- Radiology Department
- Medical Record Department

Hospital types:

- Acute care hospital
- Addiction abuse treatment hospital
- Community hospital
- Rural Hospital
- Urban Hospital
- Psychiatric Hospital
- Rehabilitation Hospital
- Teaching and charitable Hospital
- Multi specialty hospital
- Super specialty hospital

List of departments in Hospital:

- In patient department
- Outpatient department
- Administrative department
- Nursing Department

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Clinical pharmacy:

Pharmaceutical care is to improve the patient's health related quality of life by encouraging rational prescribing of drugs in the health care. Clinical pharmacist has good knowledge on therapeutics and regularly interacts with various health care professionals to enhance the effective drug prescribing pattern in the hospitals. Clinical pharmacist is placed in the various hospitals to improve the health care standards in the health care settings. Clinical pharmacy services are professional services provided by clinical pharmacist to improve the health care services to the individual patients and minimize the health care burden to the individual patients in health care settings. Clinical pharmacists are continuously work with physicians, and other health professionals, and patients to ensure effective medications to achieve best treatment outcome for the each patient¹⁻².

Clinical pharmacy services include:

- Adverse reactions reporting
- Drug interactions management
- Creating awareness on disease prevention and management
- Hospital policies designing
- Hospital treatment guidelines design
- Provision of drug and poison information
- Medication history interview
- Clinical history review

- Patient counseling
- Ward round participation
- Anti microbial stewardship

- Pseudomonas aeruginosa
- Candida albicans
- Stenotrophomonas maltophilia
- Enterococcus

Healthcare associated infections:

Healthcare associated infections are nosocomial infections which occur at the time of hospital admission. Infections are appears 48 hours after admission to the hospital.

Risk factors for healthcare associated infections include:

- Immuno suppression
- Older age
- Chronic length of stay in the hospital
- Multiple co-morbidities
- Regular hospital visit
- Admitted in intensive care unit

Types of healthcare associated infections:

- Surgical site Infections
- Clostridium difficile infections
- Catheter associated urinary tract infections
- Sepsis
- Methicillin resistant staphylococcus aureus
- Ventilator-associated pneumonia

Microbes associated with healthcare associated infections:

- Acinetobacter baumannii
- Clostridium difficile
- Staphylococcus aureus
- Escherichia coli

Surgical site infections:

It occurs when the incision is created by invasive surgical procedures.³⁻⁴

Risk factors:

- Old age
- Diabetes mellitus
- Malnutrition
- Obesity
- Abdominal surgery
- Prolong hospital stay
- Weak immune system
- Wound contamination
- Previous medical history of chronic diseases
- Having cancer
- Tobacco
- Steroid use
- Infections

Clinical features:

- Wound dehiscence
- Erythema
- Pus formation
- Pain

Prevent surgical site infections⁵:

- Regular hand washing practice

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- Maintaining clean skin
- Use of sterile clothing and drapes
- Maintaining controlled blood sugar levels
- Wound care
- Regular wound dressing

Antibiotics:

Sulfonamides:

- Sulfadiazine
- Sulfamethizole
- Sulfamethoxazole
- Sulfasalazine
- Sulfisoxazole

Fluoroquinolones:

- Ciprofloxacin
- Gemifloxacin
- Levofloxacin
- Moxifloxacin
- Norfloxacin
- Ofloxacin

***Clostridium difficile* infection :**

- It causes severe

Signs and symptoms⁶:

Mild to moderate infection:

- Diarrhea
- Abdominal cramping and
- Abdominal tenderness

Severe infection:

- Fever
- Loss of appetite
- Rapid heart rate
- Diarrhea
- Kidney failure
- Severe abdominal pain
- Blood in the stool
- Weight loss
- Abdominal swelling

Complications:

- Bowel perforation
- Toxic megacolon
- Coma

***Clostridium difficile* diagnosis:**

It is diagnosed through using below tests that include:

- Polymerase chain reaction
- Cell cytotoxicity assay
- Stool Test
- Blood Test
- Colonoscopy or sigmoidoscopy
- CT Scan

Prevention/infection control of *Clostridium difficile* infection⁷⁻⁸:

- Adhering to effective hygiene and cleansing procedures
- Following antimicrobial stewardship

- Providing education to all healthcare staff
- Approaching antimicrobial stewardship in hospitals
- Avoid use of unnecessary use of antibiotics
- Regular practice of hand-washing practices

Novel therapies for *clostridium difficile* infection:

- Metronidazole
- Fidaxomicin
- Nitazoxanide
- Rifaximin

Catheter associated urinary tract infection:

Catheters are commonly used medical devices in the hospital. However, prolong use of catheters are increase the risk of infection. Catheter-associated urinary tract infections are represented with CAUTIs. Improper control of catheter associated urinary tract infections causes several medical complications such as septicaemia, bladder stones, pyelonephritis and endotoxic shock. Catheter-associated urinary tract infections are caused by Gram-positive and Gram-negative bacteria.^{9–10}

Risk factors:

- Older age
- Previous medical history of urinary tract infection
- Renal problems
- Diabetes mellitus
- Poor immune function

Clinical symptoms:

- Hematuria

- Abnormal urine color
- Strong urine odor
- Fever
- Pelvic pain
- Pain around the testicles
- Blood in the urine
- Burning pain when passing urine

Laboratory tests:

- Urine analysis
- Urine culture
- Ultrasound of the abdomen
- CT scan of the abdomen

Prevention¹¹:

- Regular clean of catheter surroundings
- Maintaining the drainage bag below the urinary bladder
- Daily empty of drainage bag several times
- Hand hygiene before and after touching the catheter
- Washing of hands before and touching drainage bag

Treatment¹²:

- Trimethoprim
- Sulfamethoxazole
- Methenamine
- Ciprofloxacin
- Levofloxacin

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- Ceftriaxone
- Cefepime

Sepsis:

It is a life-threatening condition caused by body abnormal response to infectious condition. The human body responds to various inflammatory stimulations and releases chemicals into blood circulation and damages multiple organs. In this condition the microbial species enter into blood vessels causes inflammation and infection all parts of the body. The chronic condition of the sepsis causes septic shock to infected patients.¹³⁻¹⁶

Causes:

It includes:

- Bacterial infections
- Fungal infections
- Viral infections
- Pneumonia
- Infections in the digestive system
- Bloodstream infection

Risk factors¹⁷⁻¹⁸ :

- Older people
- Pregnant woman
- Cancer
- Liver disease
- Kidney disease
- Auto immune disease
- People with weakened immune systems
- People with chronic illnesses
- Have a compromised immune system
- Wound infections

- Previously medical treatment history of antibiotics
- Previously medical treatment history of corticosteroids

Diagnosis:

- Blood tests
- Urine examination
- Wound secretions
- Respiratory secretions
- X-ray test
- Computerized tomography (CT)
- Ultrasound scan
- Magnetic resonance imaging (MRI)

Complications:

It includes:

- Blood clot
- Heart failure
- kidney failure
- Loss of a portion of the bowel
- Stroke
- Liver failure Respiratory infections

Symptoms :

- Fever
- Chills
- Tachycardia
- Difficulty breathing
- Sweaty skin
- Extreme pain
- Redness
- Swelling around a wound

Clinical symptoms of severe sepsis:

- Low blood pressure
- Dizziness
- Low urine output
- Confusion
- Slurred speech
- Diarrhea
- Severe pain
- Shortness of breath
- Loss of consciousness
- Dementia

- Cefepime
- Piperacillin
- Tazobactam
- Ampicillin
- Sulbactam
- Levofloxacin
- Ceftriaxone
- Meropenem
- Ceftazidime
- Cefotaxime
- Clindamycin

Sepsis prevention¹⁹:

- Prevention of infection in the community
- Using proper hand hygiene practices
- Safe preparation of food
- Improving sanitation facilities
- Annual vaccination to children's and newborn babies
- Proper care of wounds

Treatment:**It includes:**

- Corticosteroids
- Insulin
- Kidney dialysis
- Oxygen therapy
- Hypertensive medications

Commonly prescribed antibiotics are²⁰:**Methicillin-resistant staphylococcus aureus (MRSA infection):**

Methicillin-resistant staphylococcus aureus infection is caused by bacteria. This bacteria shows more resistant to many antibiotics which are used in the treatment of staph infections²¹.

Clinical symptoms:

- Chest pain
- Shortness of breath
- Muscle pain
- Headache
- Cough
- Fever

Risk factors²²:

- Hospitalized patients
- Long-term treatment care facility
- Living in crowded conditions
- Sexual contacts

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- Consuming intravenous drugs

- Oxazolidinones

- Tigecycline

Complications:

It includes:

- Bloodstream
- Lungs
- Heart
- Bones
- Joints

Diagnosis:

- Wound cultures
- Sputum cultures
- Urine cultures
- Blood cultures

Preventing CA-MRSA²³⁻²⁴:

- Proper washing of hands.
- Proper care of wounds
- Sanitizing central lines
- Avoid of using injecting illicit drugs
- Avoiding contact with infected patients
- Avoid of using infected patients personal items such as razors, towels etc.

Treatment for HA-MRSA²⁵:

- Teicoplanin
- Telavancin
- Daptomycin
- Ceftaroline

Ventilator-associated pneumonia:

Ventilator-associated pneumonia is most commonly seen in patients who need treatment in intensive care units. Detection of ventilator-associated pneumonia requires thorough clinical examination of individual patients which includes radiographic examination, and microbiologic analysis of respiratory secretions could help for detection of ventilator-associated pneumonia in the hospitals.²⁶⁻²⁷

Pneumonia types:

Hospital-acquired pneumonia It occurs in 48 hours Ventilator-associated pneumonia: It is develops more than 48 hours. Healthcare-associated pneumonia: It occurs with infected patients

Microbiology:

It is caused by various pathogens include pseudomonas aeruginosa, staphylococcus aureus, klebsiella pneumoniae, enterobacter spp, Acinetobacter spp, streptococcus spp, Escherichia coli.

Risk factors:

It include:

Hospitalization more than 5 days Past medical history of antibiotic treatment Antibiotic resistance Immunosuppressive diseases

Diagnosis:

- Chest X rays
- Microbiologic Diagnosis
- Blood and pleural fluid culture
- Sputum culture
- Polymerase chain reaction

Prevention²⁸:

- Following good hand hygiene practice
- Maintaining individual patient's oral hygiene

- Maintaining the patient in a semi recumbent position

Treatment^{29–30}:

Commonly used empiric anti pseudomonal antibiotics includes:

- Imipenem
- Ciprofloxacin
- Cefepime
- Gentamicin
- Piperacillin
- Ceftazidime
- Tazobactam
- Meropenem
- Levofloxacin
- Amikacin
- Linezolid
- Vancomycin
- Imipenem
- Meropenem

Central Line-associated Bloodstream Infections:

Central line is a catheter tube which is placed in a large vein in the neck, chest to collect blood for various medical examinations. It is a serious infection that occurs when the contaminated blood enter into the central line and causes severe infection. Central lines are most commonly used in the intensive care units^{31–32}.

Causes:

- Catheter insertion areas contamination
- Contaminated infusion
- Individual patient's skin flora

Risk factors:

- Aging
- Immunosuppression
- Previous history of infections
- Poor food intake
- Pale skin
- Antibiotic therapy
- Diabetes mellitus
- Parenteral nutrition
- Lengthy hospitalization
- Poor hygiene
- Lack of non-adherence to aseptic technique
- Prolonged duration of the catheter

Clinical Symptoms:

- Symptom of breathlessness
- Diaphoresis
- Hypotension
- Fever
- Redness
- Swelling
- Tachycardia
- Pain
- Formation of pus

Prevention and management:

Prevention:

- Doing proper hand hygiene after touching the line

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- Applying effective antiseptic to the hand after touching the line

Management³³:

It includes:

Penicillin Cephalosporins Aminoglycosides Anti fungal drugs

Conclusion

Hospital associated infections are commonly caused by bacteria, fungal, viral species. It include acinetobacter, clostridium difficile, staphylococcus aureus, candida, enterococcus can increase the risk of hospital infections in the health care settings. Surgical site infection, bloodstream infection, urinary tract infection pneumonia, methicillin-resistant staphylococcus aureus infection and sepsis is most commonly observed in the hospitals. Intensive care treatment is more risk for development of antibiotic resistant bacteria. Gram-positive and gram-negative organisms cause nosocomial infections. In effective prescribing of antibiotic therapy is linked with bacterial resistance. Infection control practices are essential for prevention of new episodes of infections in the hospitals.^{34–38} Wearing face mask, hand gloves and regular hand washing, hand sanitization could lower the progression of infections. Designing of new antibiotic protocol, appropriate use of anti microbial drugs, conducting awareness programme on infection control, antibiotic stewardship practice, continuous medical education on infection control, and proper training of health care professionals could reduce the emergence of pathogenic infections in the hospitals. Clinical pharmacy is a branch of science which deals with pharmaceutical care activities in the health care. Clinical pharmacists are posted in the hospitals to improve the patient health care. Clinical pharmacist regularly interacts with many health care professionals to solve various patient related problems in the clinical practice. Clinical pharmacist has important role in designing of infection control guidelines, antibiotic therapy monitoring, hygiene protocols, drug problems management, detection of infectious species, infection sources and control, patient referral services can lower the infection incidences in the hospitals. Regular implementation of clinical pharmacist services in the hospitals can prevent the occurrence of hospital infections in

the health care.^{39–40} The prevention and control of health care associated infections include individual isolation, rapid detection and treatment of infectious species, practice of health safety protocol, avoiding unwanted use of catheters, tracing and treatment of infected person, developing new health care technology based infection detection devices can prevent the repeated episodes of health care infections and also reduces the health care economical cost to the infected patients.

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