HEALTH CARE FACILITIES: OCCURRENCE, PREVENTION AND CONTROL OF INFECTIONS: A REVIEW

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Abstract: Healthcare facilities include hospitals, healthcare centers, medical nursing homes, and medical laboratories etc, where people receive medical services and treatment. A variety of healthcare-associated infections (HAIs) like bloodstream infections, urinary tract infections, pneumonia, surgical site infections, gastrointestinal infections etc, are likely found to occur in healthcare facilities. Various modes of transmission such as contact transmission, droplet transmission, airborne and vector borne transmissions are the major routes for these HAIs. All of them are showing their impact leading to increased mortality and morbidity rate and many incidents have occurred in the past because of them. In order to control these HAIs an "Infection Prevention & Control Program" (IPCP) must be adequately adopted by healthcare facilities. As a part of this program a special committee named "Hospital Infection Control Committee" (HICC) must be established within the facilities by allocating required members to look after various aspects. All necessary resources must be arranged for its effective functioning. Infection Prevention & Control (IPC) practices to be followed in special units like- Surgical units, Out-patient department, Emergency care unit, Dialysis unit, Maternal & Neonatal units, Clinical laboratories are outlined and explained in this article. Follow these IPC practices and precautions in all special units with proper surveillance.

***Index Terms*— Infection prevention and control (IPC), Healthcare facilities (HCFs), Healthcare Associated Infections (HAIs), Surveillance, Surgical site infections (SSIs)**

I. INTRODUCTION [1-3]

Infections that occur in healthcare facilities are termed as Healthcare Associated Infections (HAIs). There is a need for controlling these infections within healthcare facilities (HCFs) as they pose a major risk to patients as well as to healthcare workers. They occur after being admitted to healthcare showing an impact on the occurrence of disease, prevalence & increased death rate. A count of at least 5 to 10% of patients who came to acute care hospitals, 7% of patients in developed countries, and 10% in developing countries are at a risk to receive HAIs leading to an economic burden on the society. With an initiative to achieve control for it, cost-effective Infection prevention and control (IPC) practices are framed out and they must be sure shot implemented.

II. BACKGROUND [1], [3]

If we travel back to the past, many incidents outline the importance of infection prevention which were initially rejected but accepted later. Some of them are - In 1846 Semmelweis, a Hungarian physician, identified a high mortality rate in the maternal ward due to childbed fever in mothers delivering babies. After adequate research, he found that poor hand washing of doctors and medical students during their visit to the maternal ward from the autopsy chamber is the reason. Hence, he suggested using hand wash with a chlorinated lime solution but no one has followed. British physician John Snow used various statistical approaches and spotted that the Cholera outbreaks crop up and proliferate due to filthy hands & orofecal transmissionwhich is also refused. As time passed, medical practitioners realized their significance and began implementing them. Outbreaks of the Nipah virus, severe acute respiratory syndrome (SARS), Influenza, Ebola, a nurse dead while treating an infected patient, etc also illustrated IPC's importance. Hence IPC practices and their implementation at both National and HCF levels are necessary.

III. HEALTH CARE ASSOCIATED INFECTIONS (HAIS) [1], [3]

Based on susceptibility, microbes enter the host, start invading, and may cause colonization or infection. Various types of HAIs associated with HCFs are as below

1. Bloodstream infections
2. Urinary tract infections
3. Pneumonia
4. Surgical site infections
5. Gastrointestinal infections

Bloodstream infections [1], [4]

These are serious infections that can have a high fatality rate, up to 50% in some cases. The infectious pathogen directly conquers blood vessels through lymphatic vessels or vascular devices and enters the bloodstream. In most cases, intramuscular catheters are the source of infection. Tunnel infection occurs when an infection develops at the catheter's entry site or along its

subcutaneous path. Infections can be spread by both central and peripheral lines. Pathogen analysis, clinical syndrome, number of positive cultures, and catheter tip & lumen semi-quantitative cultures are used to make the diagnosis.

Urinary-tract infections [1], [5]

The most frequent HAIs are urinary tract infections (UTIs), which account for 35–45% of all HAIs. Catheter-associated UTIs (CAUTIs) are found to be the major cause of secondary bloodstream infections resulting in increased death & morbidity rate. The majority of these infections are due to indwelling urinary catheters. Discomfort in the suprapubic area, fever, urination frequency, and dysuria, large quantities of germs in the urine, are used to diagnose the condition.UTI can also be caused by drainage bag contamination and infected urine flow into the bladder.

Healthcare-associated pneumonia [1], [6]

One of the most dangerous HAIs leading to death is pneumonia. The reason may be inhaled of aerosol /inspiration of respiratory droplets or aspiration of colonized oropharyngeal and stomach fluids with reduced gastric acidity. Patients in intensive care units lying under ventilators are prone to ventilator-associated pneumonia (VAP) with high morbidity & mortality rate. The infection can spread during suction treatments through the oropharynx due to insufficient hand washing and improper cleaning of breathing devices.

Surgical site infections (SSIs) [1], [7]

It is often known as wound infection, occurs in the part where surgery is done& mainly involves superficial infections. It can occur anywhere, based on the patient's health and the operation done on them. The main reason is contamination during the process and can be determined from the site of surgery, operation time, and the patient's overall health.SSI commonly develops within 30 days of surgery. Infection might develop even 30 days following surgery in some cases.

Gastrointestinal infections (GIT) [1], [8]

Bacteria, protozoa, and viral pathogens are responsible for GIT infections. In pediatric wards and the community, these are prevalent infections. The infection spreads quickly in the pediatric unit due to a filthy atmosphere, toilets, and poor hand washing. The infection spreads via fecal-oral contact and can be contracted through harmed food or drink, diseased persons or personnel, exposure to an infectious habitat, or equipment that enters the gastrointestinal system, such as endoscopes.

What are the transmission routes of HAIs? [1], [9]

They play a major role in the spread of infections. There are various routes through which infection transmission occurs in HCFs.

1. Contact transmission: Occurs through touch, fluids of the body, blood, or secretions and it can be direct or indirect
2. Droplet transmission: Infected person coughs, sneezes, talks, etc.., making way for this type of transmission
3. Airborne transmission: Infection spreads by infectious organisms suspended in the air. In certain conditions coughing may also promote infection
4. Vector-borne transmission: Microorganisms with the help of vectors like mosquitoes, houseflies, etc leads to this type of transmission

Preventive measures [1]

HAIs can be prevented by adopting below cost-effective measures

a. Following Hand hygiene
b. Use of personal protective equipment
c. Utilizing Aseptic techniques
d. Sterilization
e. Dispose of biomedical wastes properly
f. Environment maintenance
g. Maintain a safe working environment & work practice

IV. Infection Prevention And Control Program (IPCP) [1-3], [10]

In order to control HAIs within healthcare facilities, a program named Infection Prevention and Control Program (IPCP) must be started in HCFs. With its implementation, the safety and well-being of workers in healthcare, patients & their families, and the community is protected and was started with the initiative to minimize the risk of HAIs by

a. Following IPC steps at all HCF levels
b. Providing safe & quality health care
c. Decreasing the rate of mortality& morbidity

IPCP structure [1]

The director / healthcare head should establish the “Hospital Infection Control Committee” (HICC) by appointing members and arranging necessary resources for its functioning which is responsible for monitoring, surveillance, reporting, research & education. The members include

1. Chairperson
2. Infection control officer / Member secretary
3. Members representing from Administration or Management, Medical and surgical disciplines, Support services, Infection control nurse
4.

IPC procedures & practices [1]

As per IPCP, a two-level approach is used to prevent the spread of infectious pathogens. They are Standard and Transmission based precautions

Standard precautions [1], [3], [10-12]

These are the primary steps followed for controlling the transmission of microbes, done by all patients irrespective of their infection status.

1. Proper Hand hygiene –hand wash, hand rub
2. Use Personal protective equipment like Aprons, gowns, gloves, face masks, footwear, hair covers, etc
3. Take necessary measures during Respiratory infections by using tissues, covering mouth & nose, and proper hand wash
4. Prevent injuries from sharp items like needles, scalpels, etc
5. Handle patient care equipment safely by following sterilization or disinfection techniques
6. Follow asepsis principles
7. Control infection in the environment by placing patients properly, cleaning the environment & disposing of waste

Transmission based precautions [1], [3], [10-12]

Follow them based on epidemiology and transmission routes in addition to the standard or normal precautions. They are applicable for high-risk procedures (Surgery) and special units (ex- ICU), and mainly include Droplet, Airborne, and Contact precautions

V. IPC In Special Units

IPC in some of the special units are below

1. Surgical units [1], [13]

A. Aseptic protocols: Before surgical hand preparation, the personnel's nails should be short, not polished. Clean hands under running water and it should be free from debris. Use appropriate antiseptic and preoperative surgery hand scrubs for at least 5 minutes. Following it, place hands in an upward position away from the body, which makes water rush away from the fingertips to the elbow

B. Scrub: Use sanitary clothes, consisting of a V-neck shirt with short sleeves, drawstring pants, and loose-fitting. If contamination takes place, clean them using a laundering facility

C. Surgical attire: It comprises gloves, gowns, caps, face shields, goggles, masks, eye protectors, footwear, and waterproof aprons that prevents the surgical team from infections

D. Sterile field: Sterile objects, surgical personnel, and the scrubbed crew are permitted to enter. In a sterile field, the scrubbed team's non-sterile areas are the chest above and waist below

E. Cleaning & Disinfection: Clean and disinfect OT daily to prevent microbial contamination. A Wet vacuum is the best choice for cleaning floors. Adopt wet mopping if it is not available

F. Infrastructure of Operation Theatre(OT):The Location of OT should be on the top floor and kept out of patient care areas and traffic

G. Components of Operation Theatre: A multifunctional area where surgical operations and surgical procedures were performed. Equipment cleaning, processing, and sterilization areas are present here and divided into zones according to an appropriate level of sterility and cleanliness

2. Out-patient department [1], [14]

The registration desk of the out-patient department (OPD) is the interaction point for patients who need treatment. IPC practices includes- Following standard precautions; recognizing patients with symptoms & indications of infectious diseases at the registration desk; collecting information by asking short and easy questions during registration which helps in identification and isolation; recruiting individuals trained in infection prevention; setting up infection prevention policies and procedures based on guidelines & standards.

3. Emergency care unit [1], [15]

It is a busy facility with a high flow of patients accounting for 50% of admissions in hospitals &also the first line of defense in public health emergencies and disasters. There are two features of IPC in emergency care

a. Control spreading of infections to healthcare workers from sick patients
b. Reduce the chance of infection during emergency medical treatment

IPC practices here includes- Adopting standard measures like hand hygiene, use of personal protective equipment (PPE); avoiding overcrowding; maintenance of inpatient beds and isolation rooms in required number with effective environment & room cleaning.

4. Dialysis unit [1], [16]

The Doctor or experienced nurse must take responsibility for monitoring IPC practices, providing training, performing surveillance, and maintaining communication. Here blood-borne pathogens are spread and infection occurs by contact transmission via hands, contaminated surfaces, and infected blood. IPC practices include- Following standard precautions mainly Hand hygiene; observing respiratory etiquette; Identification of patients with airborne illness, mask and separating them from others; providing treatment as per their infection status.

For Dialysis water:

Purify and filter it; use techniques like reverse osmosis & deionization techniques to remove contaminants; follow standards during the conduct of endotoxin testing & bacterial culture& perform reprocessing and ensure dialyzer suitability for reuse.

5. Maternal and Neonatal units [1], [17], [18]

1 in 10 deaths associated with pregnancy and childbirth is due to sepsis. 95% of deaths are due to maternal sepsis & 4 to 56% of deaths in hospital-borne babies are due to infections. Maternal "peripartum" infections linked with childbirth are "Intrapartum" and "Postpartum" bacterial infections. In order to prevent maternal& newborn infections while delivery- Maintaining cleanliness is essential, especially keep your hands, perineal area and umbilicus clean; Digital vaginal examination is indicated for routine checkup of the first stage of labor at four-hour intervals in low-risk women; don't shave perineal/pubic hair, if necessary, use a hair clipper; The WHO does not advocate shaving regularly- shaving after delivery increases risk of infection; adopt hand hygiene in neonatal wards.

6. Clinical laboratory [1], [19]

The IPC practices are- avoid overcrowding and too much equipment; control the entry of rodents and arthropods; separate the work area from the patient waiting area& offer adequate space for staff to perform their activities with the required facilities for storage of chemicals, reagents, and specimens; Safety arrangements must be there; Follow the dress code - worn by everyone& washed regularly; Good habits should be adopted by staff like washing hands, protective clothing, preventing smoking, eating, mouth pipetting, etc; Perform risk assessment for all activities done in the laboratory and identify hazards; Install an emergency escape route; Follow Good housekeeping practices & Good laboratory practices (GLP); A Biomedical waste management system must be there to handle laboratory waste and its disposal.

7. Epidemics / Pandemics [1], [20]

IPC practices to be followed are- Set surveillance techniques for rapid identification and analysis of cases; explain roles & tasks for staff members during an epidemic situation; improve staff training; check the number of cases and outcomes received per day; follow standard & transmission precautions; find out ideas for transport of patients, samples, ambulance services, etc; monitor IPC practices applied and check for modifications based on situation and needs; make sure that there is proper communication between staff, patients, visitors, community and submit reports to local public health authorities with proper communication.

VI. Process Of Surveillance [1], [10], [12]

It is a continuous process of collecting, analyzing, and interpreting data for the effective functioning of IPCP& outbreak identification to decrease morbidity & mortality rates. If any deficiencies or problems are associated with the program they can be identified by surveillance check and controlled. An Infection control officer / Infection control nurse plays a key role in collecting data from patients and helps

a. To find out the disease rate approximately concerning reported cases, occurred deaths
b. To discover outbreaks, pathogens, and steps for resistance
c. Keeps an eye on IPC practices

Types of Surveillance

1. Active surveillance:
   Here designated hospital infection control professional / nurse collect the data using various sources in and away from the wards
2. Process & Outcome surveillance:
   IPC processes are evaluated (ex-hand hygiene) and HAI events are detected (ex-UTI)
3. Clinical / Patient-based surveillance:
   HAIs are counted, risk factors are estimated and patient care procedures are checked for similarity with IPC principles
4. Laboratory-based surveillance:
   It includes findings from laboratory studies of specimens and reporting to HICC and various HCF units
5. Priority-directed & comprehensive surveillance:
   Specific events, processes, organisms, and patients are focused and patients are continuously monitored for HAI events

VII. Conclusion

Healthcare facilities should be a place where treatment is provided but not where new diseases occurs. If any disease/pandemic occurs because of these Healthcare-Associated Infections, it will be difficult to handle the situation as there is a lot of traffic in the patients moving to and fro from healthcare facilities. So we conclude it by saying "Prevention is better than Cure". Implement all the above said IPC practices with proper monitoring and make a step for better health of the Nation.

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