
UNIT 1 OVERVIEW OF INFECTIOUS HAZARDS IN HEALTH CARE SETTINGS

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Common Infections Acquired by Hospital Staff
- 1.3 Exposure to Infectious Agents
- 1.4 The Routes of Transmission
 - 1.4.1 Air Borne Infections
 - 1.4.2 Blood Borne Infections
 - 1.4.3 Infections Acquired through Fomites
- 1.5 Health Care Waste
 - 1.5.1 Types of Hospital Waste
 - 1.5.2 Latex Allergy
- 1.6 Prevention of Infections in Hospitals
- 1.7 Infections Acquired in Hospital Laboratories
- 1.8 Infections Acquired in Operation Theatres
- 1.9 Infections Acquired in Intensive Care Units
- 1.10 Key Words
- 1.11 Let Us Sum Up
- 1.12 Answers to Check Your Progress
- 1.13 References and Suggested Further Readings

1.0 INTRODUCTION

Hospitals are breeding ground for harmful microorganisms. You probably will not be in a place which is so filled with microorganisms if you are not visiting a hospital. These pathogenic organisms may be hiding anywhere in the hospital. They may be floating in air like tuberculosis bacteria or circulating in blood of the admitted patients like hepatitis B virus which may be transmitted to a health care worker through needle prick. Almost all persons involved in patient care either directly or indirectly are at risk of acquiring these infections. In hospitals one may be directly involved with patient care when s/he regularly interacts with the patients. Other category of staff in hospitals like laundry workers deal with clothes used by patients. Doctors and nurses come in former category and they are more at risk of acquiring infections from the infected patients by virtue of their nature of work. Pharmacists or those working in kitchen or for that matter anyone who does not come directly in contact with the infected patients in wards or OPDs still can be infected by handling the stuff used by the infected patients.

While performing their duties, healthcare workers are frequently exposed to dangerous infectious agents. The risk of transmission of infectious agents is substantial. The mortality and morbidity associated with these infections can be significant. At the same time health care workers are at a high risk of exposure to blood and body fluids. Needle stick injuries, cuts and splashes are common occupational accidents exposing health care providers to different blood borne pathogens. Transmission of hepatitis B virus, Human Immune Deficiency Virus (HIV), and Hepatitis C Virus (HCV) has been related to injuries and frequency of exposure. WHO reports in the World Health Report 2002, that of the 35 million health-care workers, 2 million experience percutaneous exposure to infectious diseases each year. It further notes that 37.6% of Hepatitis B, 39% of Hepatitis C and 4.4% of HIV/AIDS in Health-Care Workers around the world are due to needlestick injuries¹. Studies have shown that adherence to standard precautions and awareness about post exposure prophylaxis (PEP) is poor in developing countries among health care workers.

Health care associated infections (HCAI) or nosocomial or hospital acquired infections are the new infections acquired by patients while they are being taken care of in the hospitals. These infections were not present in the patients at the time of admission to the health care setting. It also includes the infections acquired by the health care staff while taking care of the admitted patients. No health care setting is free from HCAI. It is more prevalent in countries where standard precautions are not followed regularly. Some steps as simple as proper hand washing can bring a huge difference in the burden of HCAI in a hospital. According to a meta-analysis published in *The Lancet* in 2011 the pooled prevalence of health-care-associated infection was 15.5 per 100 patients. Pooled overall health-care-associated infection density in adult intensive-care units was 47.9 per 1000 patient-days. HCAI results in prolonged hospital stay, long-term disability, increased antibiotic resistance, increased costs for health systems, patients and their families, and excess deaths.

Detection, treatment and prevention of hospital acquired infections in health care workers is important because such infections may be life threatening as the causative organisms are mostly resistant to antimicrobial agents. He may act as reservoir of infection and act as continued source of infection to patients and other staff in his contact.

In this unit, you will learn about the various pathogens which are found in a health care setting, modes of transmission of these organisms and their harmful effects on health care workers. You will also learn about the precautionary measures to be taken by hospital staff and management to protect themselves and the patients.

1.1 OBJECTIVES

At the end of the unit you will be able to:

- list the common infectious agents which are present in a health care setting;
- differentiate the modes of transmission of different microorganisms;
- outline the ill effects of these organisms on the health care workers;
- discuss the prevention of infections in hospital setting; and,
- explain the importance of standard precaution

1.2 COMMON INFECTIONS ACQUIRED BY HOSPITAL STAFF

Almost all infections which can be transmitted from human to human is possible in health care workers. The major ones are:

- Diarrheas caused by enterococci
- Tuberculosis
- Hepatitis B virus
- Hepatitis C virus
- Staphylococcus
- Pneumonia
- Human immunodeficiency virus / AIDS

1.3 EXPOSURE TO INFECTIOUS AGENTS

Healthy people are naturally contaminated. Our tissues and organ systems are full of microorganism.. There exists a symbiotic relationship between these organisms and human body. These are known as commensals. Whether a tissue will develop an infection after contamination depends upon the interaction between the contaminating organisms and the host. Healthy individuals have a normal general resistance to infection. Persons with underlying disease, newborn babies, and the elderly have less resistance and will probably develop an infection after contamination. Local resistance of the tissue to infection also plays an important role: the skin and the mucous membranes act as barriers for pathogenic organisms. Infection may follow when these barriers are breached. The most important determinants of infection, however, are the nature and number of the contaminating organisms. When only a few organisms are present on or in a tissue, an infection will not necessarily develop. However, when a critical number is exceeded, it is very likely that the tissue will become infected. For every type of microorganism, the minimal infective dose can be determined; this is the lowest number of bacteria, viruses, or fungi that cause the first clinical signs of infection in a healthy individual.

Check Your Progress 1

1. What is Health Care Associated Infection?

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2. What are the factors responsible for a healthy person infected with a germ becoming sick?

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3. What mode of transmission you think is the most important in a hospital and why?

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1.4 THE ROUTES OF TRANSMISSION

Microorganisms can be transmitted from their source to a new host through direct or indirect contact, in the air, or by vectors. Health care setting is the main site of transmission of blood borne infections. We keep on hearing the dreaded stories of transmission of HIV or HBV by needle prick injuries. Earlier through blood transfusion many infectious agents were used to be transferred from infected person to a patient. Vector-borne transmission is typically by insects, arthropods, and other parasites. These become contaminated by contact with excreta or secretions from an infected patient and transmit the infective organisms mechanically to other patients. Some vectors like mosquitoes bite individuals and transmit the pathogens, Airborne transmission occurs with microorganisms that are dispersed into the air. These are dispersed in large numbers because of sneezing or coughing. Direct contact with patients when health-care worker touches a patient can result in transmission of a large number of microorganisms to the staff. Indirect contact through fomites is very common in health care settings.

Table 1.1: Common infections and routes of transmission

Route of infection	Causative organism	Disease
Skin	Methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant enterococci (VRE)	Severe skin infection (Cellulitis)
Inhalation	Mycobacterium tuberculosis, Avian flu, Chlamydia psittaci, Klebsiella pneumonia , Varicella zoster	Various acute and chronic infections of respiratory tract
Ingestion	E. coli, Salmonella typhi, Clostridium difficile, Campylobacter jejuni, Hepatitis A	Severe diarrhoeas, typhoid, jaundice etc.
Parenteral (needle prick injury, contact with infected body fluids)	HIV, HTLV, Hepatitis B, Hepatitis C	AIDS, T cell lymphoma, Hepatitis.

1.4.1 Air Borne Infections

When an infected person coughs or sneezes the organisms come out of his mouth or nose. These organism mixed with water droplets evaporates and

becomes droplet nuclei whose usual size is from 1 to 5 micron. These nuclei may be suspended in the air for a long long time. Airborne transmission occurs when droplet nuclei (evaporated droplets) <5 micron in size are disseminated in the air. Droplets can also be generated during medical procedures like tracheal suctioning. Diseases which spread by this mode include pulmonary tuberculosis (TB), measles, chicken pox, Severe acute respiratory syndrome (SARS), bird flu, pneumonia etc.

Tuberculosis (TB)

Tuberculosis (TB) is a serious public health problem in many developing countries. India accounts for nearly a fourth of all new TB cases detected worldwide. Mode of transmission of the bacteria is through droplet nuclei. The bacteria exit through nose when TB patient coughs, sneezes or shout. Health care workers working in chest OPD and indoor are at highest risk of getting TB infection. Ideally active pulmonary tuberculosis cases should be kept in isolation. The room should be well ventilated. But in overcrowded public health facilities these are not possible all the time. As a result, health care workers readily get TB infection. With the rising of number of multi drug resistant TB (MDR – TB) cases, the situation is more complex nowadays. The care of primary MDR – TB is complex and outcome not very good.

Meningococcal meningitis

Meningococcal meningitis is due to a bacteria. Once admitted the patient of meningitis due to meningococcus is infectious to others until antibiotic is started. So the patient should be put promptly on an effective antibiotic drug otherwise health care workers in close respiratory contact with such cases should receive chemoprophylaxis with ciprofloxacin or an effective alternative agent. Health care workers should avoid close respiratory contact with the patient.

Severe acute respiratory syndrome (SARS)

SARS first appeared in 2002 in China. It spread rapidly worldwide within a few months. SARS is a viral respiratory disease of zoonotic origin caused by the SARS coronavirus (SARS-CoV). It is transmitted through droplets that enter the air when someone with the disease coughs, sneezes or talks. Fever, dry cough, headache, muscle aches and difficulty breathing are common symptoms. Treatment is supportive care.

Bird flu (Avian flu, Avian influenza, H5N1, H7N9)

Bird flu viruses infect birds, including chickens, other poultry, and wild birds such as ducks. Usually bird flu viruses only infect other birds. Rarely humans are affected. Two types, H5N1 and H7N9, have infected some people during outbreaks in Asia, Africa, the Pacific, the Middle East, and parts of Europe. Most of the people who get bird flu have had close contact with infected birds or with surfaces that have been contaminated by the birds' saliva, mucous, or droppings. It is also possible to get it by breathing in droplets or dust that contain the virus. Rarely, the virus has spread from one person to another. It may also be possible to catch bird flu by eating poultry or eggs that are not

well cooked. The symptoms can range from mild to severe. Often, the symptoms are similar to the seasonal flu, such as, fever, cough, sore throat, runny or stuffy nose, muscle or body aches, fatigue, headaches, conjunctivitis and dyspnea. In some cases, bird flu can cause serious complications and death. Some people are at higher risk for serious illness. They include pregnant women, people with weakened immune systems, and senior citizens. Treatment with antiviral medicines may make the illness less severe. They may also help prevent the flu in people who were exposed to it. There is currently no vaccine available.

1.4.2 Blood Borne Infections

Blood borne infections like HIV, HBV and HCV has the potential of transmission related to type of injuries and frequency of exposure. There is one case of seroconversion of HIV/AIDS in over 650 accidents as opposed to 20 - 30% in the case of hepatitis B. This may be due to low concentration of HIV in the blood.

Human Immunodeficiency Virus (HIV)

The HIV epidemic has forced us to recognize the potential dangers facing health care workers on the job and has forced all health care workers to reassess the type of procedures undertaken by them. It has highlighted the basic lack of precautions taken in the past regarding personal safety and to halting the transmission of many potential pathogens. This dreaded modern-day pandemic caused by HIV can be transmitted in health care settings through inoculation injuries from contaminated needles or exposure of abraded skin or mucous membrane to blood or body fluids infected by the HIV. It has been estimated that the risk of seroconversion following parenteral exposure is from 1.3 per 1000 to 3.9 per 1000.

Post-exposure prophylaxis

Post-exposure prophylaxis (PEP) is short-term antiretroviral treatment to reduce the likelihood of HIV infection after potential exposure. Within the health sector, PEP should be provided as part of a comprehensive universal precautions package that reduces staff exposure to infectious hazards at work. PEP must be started within 72 hours after a possible exposure. The recommended PEP regimen is Tenofovir combined with either lamivudine (3TC) or emtricitabine (FTC) for 28 days.

Hepatitis virus

Hepatitis is an inflammation of the liver that can lead to liver damage and death. It can be caused by a virus which is transmitted through needle prick. Hepatitis B is a recognized occupational hazard among hospital personnel. According to the World Health Organization, the prevalence rate of HBV is three to six times higher in hospital staff than those of the general population. The most common mode of transmission of HBV is blood. With the advent of effective and safe hepatitis B vaccines, the occupational risk of acquiring this infection is now greatly diminished in health facilities where health care personnel like nurses and doctors are given the complete course of vaccination. However, the risk will not be completely eradicated. There are concerns of vaccine failures and lack of knowledge about the duration of immunity in those who have seroconverted.

Hepatitis is much more transmissible than HIV. Risk of infection from a single needle prick is 6% - 30%. Since almost half of the infected patients are asymptomatic and disease develops later in life, the hepatitis caused by HBV is almost always fatal.

Another hepatitis virus (HCV) is now a major cause blood borne hepatitis. Hepatitis C infection is caused most commonly by needle stick injuries. Risk of HCV infection after needle stick injury is 1.8%. HCV infection often occurs with no symptoms, however chronic infection can develop which may lead to active liver disease. Currently there is no vaccine available against hepatitis C.

1.4.3 Infections Acquired through Fomites

A single incidence of hand contact with a contaminated surface results in a variable degree of pathogen transfer. Studies has shown that contaminated hands can transfer viruses to five more surfaces or 14 other subjects. Microorganisms such as Methicillin-Resistant Staphylococcus Aureus (MRSA) and Vancomycin-Resistant Enterococci (VRE) are frequently found to contaminate environmental surfaces in the hospitals because the routine cleaning of equipment items and other high-touch surfaces does not always remove pathogens. These microorganisms are capable of surviving for days to weeks. The contaminated surfaces are frequently touched by the health care staff. Contamination of hands or gloves by touching such contaminated environmental surfaces is well documented resulting into severe skin infections (cellulitis) not responding to the treatment. Pathogens may also be transmitted to susceptible patients. Contamination of environmental surfaces may be an important source of infection through ingestion. This includes hepatitis A virus, E.coli, Salmonella typhi, Clostridium difficile etc. The most important thing a health care staff can do to reduce fomite transmission is to wash his hands. If you have done anything that might have put you in contact with bodily secretions, wash your hands. Washing your hands after touching dirty objects, like cutting boards, is also a good idea.

1.5 HEALTH CARE WASTE

The waste generated at a health-care setting is a reservoir of pathogenic microorganisms, which gives rise to infection. If waste is inadequately managed, these microorganisms can be transmitted by direct contact, in the air, or by a variety of vectors. Infectious waste contributes in this way to the risk of nosocomial infections, putting the health of hospital personnel, and patients, at risk.

1.5.1 Types of Hospital Waste

Hospital or any health care setting generates a whole lot of waste. Nearly 85% of them are non-infectious. All the waste generated in a health care setting can divided into these categories:

- **Infectious waste:** waste contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples), cultures and stocks of infectious agents from laboratory work (e.g. waste from autopsies and infected animals from laboratories), or waste from patients in isolation wards and equipment (e.g. swabs, bandages and disposable medical devices)

- **Pathological waste:** human tissues, organs or fluids, body parts
- **Sharps:** syringes, needles, disposable scalpels and blades, etc.
- **Chemicals:** for example, solvents used for laboratory preparations, disinfectants, and heavy metals contained in medical devices (e.g. mercury in broken thermometers) and batteries~
- **Pharmaceuticals:** expired, unused and contaminated drugs and vaccines
- **Radioactive waste:** such as products contaminated by radionuclides including radioactive diagnostic material or radiotherapeutic materials
- **Non-Hazardous or general waste:** waste that does not pose any particular biological, chemical, radioactive or physical hazard

1.5.2 Latex Allergy

Rubber latex can either be natural or synthetic. Natural rubber latex comes from the sap of the rubber tree, found in Africa and Southeast Asia. Allergic reactions to products made with latex develop in persons who become allergic to proteins contained in natural rubber latex. Whereas, synthetic latex rubber is made from chemicals. Synthetic rubber products do not trigger allergic reactions in people who are allergic to products made with natural rubber latex. Latex is a common component of many medical and dental supplies. These include disposable gloves, dental dams, airway and intravenous tubing, syringes, stethoscopes, catheters, dressings and bandages. When people with latex allergy come into direct contact with latex, an allergic reaction may follow like a medical or dental procedure conducted by health care workers wearing natural rubber latex gloves can develop allergic reactions which may be life threatening. In most cases, latex allergy develops after many previous exposures to latex. Latex allergy symptoms may include hives, itching, stuffy or runny nose. It can cause asthma symptoms of wheezing, chest tightness and difficulty breathing. Symptoms begin within minutes after exposure to latex containing products. The most severe latex allergy can result in anaphylaxis. Allergic skin problems can occur following direct contact with allergic latex proteins in latex glove products. Symptoms may include immediate itching, redness and swelling of skin that touched the item containing latex.

1.6 PREVENTION OF INFECTIONS IN HOSPITALS

We can prevent the healthy staff of the hospital being infected with a pathogenic organism either by separating the infectious source from him or cutting off any route of transmission. Usually in a hospital, a highly infectious patient is kept in an isolation ward. Great care should be taken in protecting the health care workers from the bloodborne infections like HIV/AIDS and viral hepatitis B and C. All objects that come in contact with patients should be considered as potentially contaminated. If an object is disposable, it should be discarded. If it is reusable, transmission of infective agents may be prevented by cleaning, disinfection, or sterilization. The box below shows the standard precautions to be taken by a health care staff handling potential hazardous substances in hospitals. You will read in more details about some of the commonly used

techniques to prevent infection in health care workers as well as patients in hospitals in coming units.

Box: Essentials of the standard precautions to be used by anyone taking care of patients in a health care setting

A. Hand washing:

Wash hands after touching blood, secretions, excretions and contaminated items, whether or not gloves are worn

Wash hands immediately after gloves are removed, between patient contacts

Use a plain soap for routine hand washing

Use an antimicrobial agent for specific circumstances

B. Gloves

Wear gloves when touching blood, body fluids, secretions, excretions, and contaminated items

Put on clean gloves just before touching mucous membranes and non-intact skin

C. Mask, eye protection, face shield

Mask, eye protection or face shield should be worn whenever there are chances of contamination of face with the secretions of patient's

D. Gown

Always wear a gown or apron when going near a patient

E. Environmental control

Ensure that the hospital has adequate procedures for the routine care, cleaning, and disinfection of environmental surfaces

F. Linen

Linen mixed with pathogens should be handled carefully; otherwise the pathogen may spread in air and infect others

G. Others

Be extra cautious while handling sharp instruments

Use ventilation devices as an alternative to mouth-to-mouth resuscitation methods

Place a patient who contaminates the environment or who does not assist in maintaining appropriate hygiene in an isolated (or separate) room

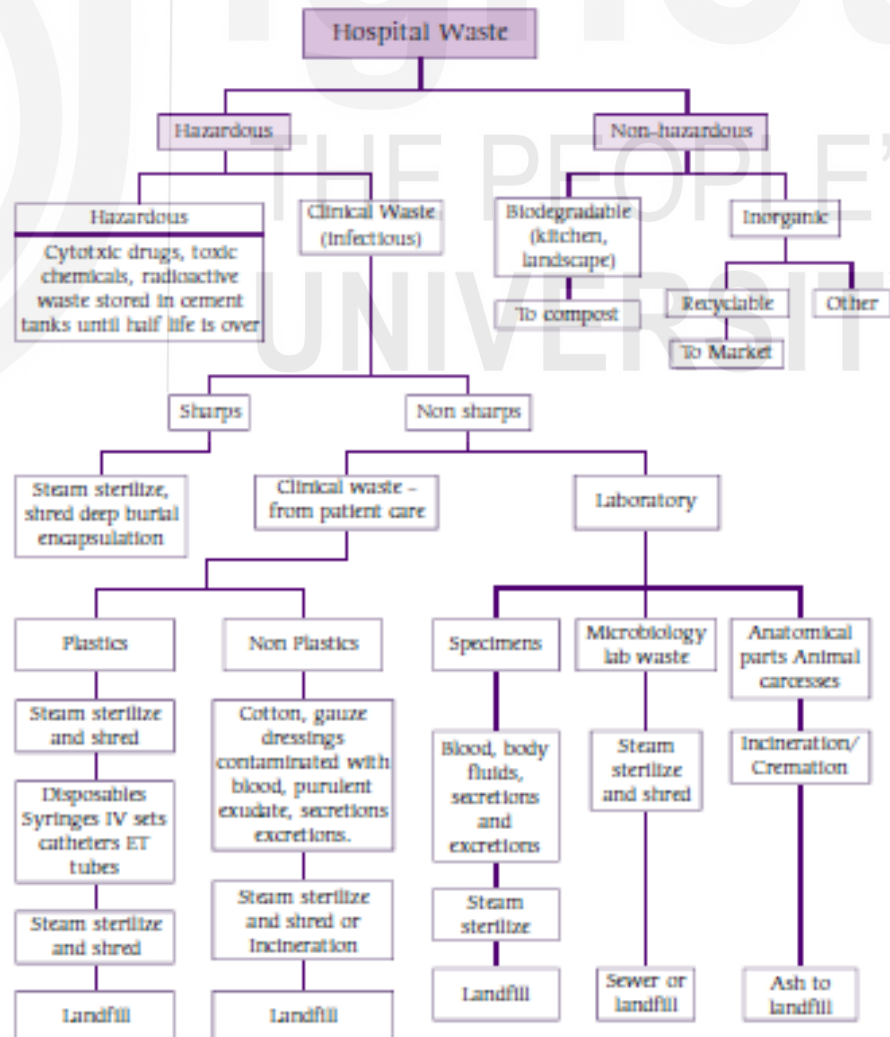
Box: Good practices in prevention of infection

- Displaying suitable and sufficient warning signs, including the biohazard sign.
- Putting in place appropriate decontamination and disinfection procedures.
- Putting in place the means for the safe collection, storage and disposal of contaminated waste. This includes the use of secure and identifiable containers after treatment if appropriate

- Testing, where it is necessary and technically possible, for the presence of biological agents outside primary physical containment.
- Setting out the procedures for working with (and on-site transport of) biological agents or material that could contain them.
- Where appropriate, making effective vaccines available to employees who not already immune.
- Putting in place good occupational hygiene measures including the provision of appropriate and adequate washing and toilet facilities. Where appropriate, eating, drinking or smoking is prohibited in any workplace where there is a risk of contamination with biological Workplace



BIOHAZARD



1.7 INFECTIONS ACQUIRED IN HOSPITAL LABORATORIES

The laboratory is an area of high risk. There are two main types of laboratory activity that could result in exposure to biological agents:

- intentionally working with the agents and increasing the risk of exposure
- working with materials that may contain biological agents

1.8 INFECTIONS ACQUIRED IN OPERATION THEATRES

Infections of the surgical site in patients is common in developing countries. Around 2 to 5% of patients undergoing surgical procedures suffer from surgical site infections. These infections cause significant patient morbidity and mortality and burden healthcare systems with immense costs. Infections can be acquired either through the endogenous organisms present in the patient's own body or through airborne organisms present in the operation theaters. These organisms originate primarily from the skin and hair of individuals in the operating room. Caps, gowns, and masks are designed to prevent such shedding. The number of persons present in the OT as well as their level of activity, the type of surgery, the quality of air provided, the rate of air exchange, the quality of staff clothing, the quality of cleaning process and the level of compliance with infection control practices, all influence airborne contamination. Common organisms associated with surgical site infections are *Staphylococcus aureus*, coagulase-negative staphylococci, *Enterococcus* spp. and *Escherichia coli*.

1.9 INFECTIONS ACQUIRED IN INTENSIVE CARE UNITS

Infections in a Critical Care Unit (CCU) or Intensive Care Unit (ICU) can have serious implications for the patient. Immunity of these patients are already at its low and they are thus at high level of susceptibility to microorganism present in the ICU room. More than 20% of all the infections acquired in hospitals are from ICU. Common infections in ICU are urinary tract infections, pneumonia, intravascular infections and surgical site infections due to the devices used in the ICU. Because of the increase in invasive devices and procedures, patients may have to be kept on antibiotics for longer periods of time. Long-term or frequent exposure to antibiotics can increase the incidence of antibiotic resistance in these patients.

Check Your Progress - 2

1. What are fomites? What organisms are transmitted through fomites?

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2. What are life threatening infections peculiar to the health care workers?
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3. How the HCWs are exposed to these infections?
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4. What is latex allergy? What are the symptoms associated with latex allergy?
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5. What type of infections can be acquired in operation theater environment and intensive care units respectively?
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1.10 KEY WORDS

Droplet nuclei: Dried-out residual of droplets possibly containing infectious pathogens

Fomites: Objects or materials which are likely to carry infection, such as clothes, utensils, and furniture

HBV Hepatitis B Viral infection may be life threatening. In HCW it is most commonly acquired through needle stick injury.

HVC HBV Hepatitis C Viral infection may be life threatening. It is also acquired through needle stick injury

MDR – TB Multiple drug resistant tuberculosis is an emerging public problem. HCW is at a greater risk than general population.

Nosocomial infections: Also known as hospital-acquired infections, hospital-associated infections, and hospital infections. These infections are not present in the patient at the time of admission to hospital but develop during the course of the stay in hospital

PEP: Post-Exposure Prophylaxis is prophylactic treatment given to HCW who is accidentally exposed to risk of HIV, HBV, and HCV most commonly through needle stick injury.

Seroconversion: The period of time during which HIV antibodies develop and become detectable

1.11 LET US SUM UP

Hospitals are meant for infectious patients. It means the environment of hospital is full of harmful microorganisms. All health care workers not necessarily only doctors and nurses are at risk of getting these microorganisms introduced into their body. Once contaminated with these microorganisms the person does not manifest symptoms or signs of the pathogen in all cases. Only if the microorganisms are in high volume and the immunity of the staff is low, the symptoms of the disease develop. The microorganisms can be transmitted by many ways. Most important ones are air-borne and by needle pricks. The most important life threatening infections peculiar to health care workers are HIV/AIDS, HCV, HBV and multiple drug resistant tuberculosis. Detection, treatment and prevention of hospital acquired infections in health care workers is important because such infections may be life threatening as the causative organisms are mostly resistant to antimicrobial agents and post exposure preventive prophylaxis may be life saving. Allergic reactions to natural latex is also a life threatening biological hazard. Prevention of infections in health care workers is everyone's responsibility. The hospital should have hospital infection control committee in place and do its job diligently. The personnel should follow the standard precautions and should have access to all the necessary personal protective equipment.

1.12 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1. Health care-associated infection (HCAI), also referred to as “nosocomial” or “hospital” infection, is 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. HCAI can affect patients in any type of setting where they receive care and can also appear after discharge. Furthermore, they include occupational infections among staff.
2. A person may be infected with a microorganism but may not be clinically sick. These individuals are known as asymptomatic cases or latent carriers of the microorganism. Only when the load of the microorganism is more than a minimum level an individual may show symptoms. Additionally, the immunity level of the person will determine the severity of the disease. Very low and advanced age decreases the immunity. There are some diseases like AIDS which decreases the general immunity of the body and thus make the individual more susceptible to opportunistic infections.
3. The air-borne infections are the most common in a hospital setting. These microorganisms are suspended in air if they are of very small in size. If heavier, they remain on the floors, curtains or equipment present in the hospital wards. There is constant chance of getting infected with these air-borne pathogens for health care workers. If the HCW does not wear proper gloves and masks and does not follow the hand hygiene, he is bound to get infected with these pathogens.

Check Your Progress 2

1. Fomites are inanimate objects which become contaminated with pathogenic bacteria and then spread infection to others. Most gram-positive bacteria, including vancomycin-resistant enterococcus (VRE), methicillin-resistant *Staphylococcus aureus* (MRSA), and *Streptococcus pyogenes*

can survive for months on dry surfaces. Many gram-negative species, such as *Acinetobacter* spp., *Escherichia coli*, *Klebsiella* spp., *Pseudomonas aeruginosa*, *Serratia marcescens*, or *Shigella* spp. can survive on inanimate surfaces for months. *Bordetella pertussis*, *Haemophilus influenzae*, *Proteus vulgaris*, and *Vibrio cholerae*, however, persist only for days.

2. The most important life threatening infections peculiar to HCW are HIV and AIDS, hepatitis B and hepatitis C viral infections and MDR-tuberculosis
3. HCWs are exposed to are HIV and AIDS, hepatitis B and hepatitis C viral infections through contamination of body fluid of an infection patient most commonly through accidental needle stick injury. Exposure to MDR tuberculosis occurs through droplet exposure in infectious disease wards.
4. Contact by hypersensitive individual with medical and dental disposable gloves, dental dams, airway and intravenous tubing etc supplies containing natural latex result into latex allergy. Latex allergy symptoms may include hives, itching, stuffy or runny nose. It can cause asthma symptoms of wheezing, chest tightness and difficulty breathing. Symptoms begin within minutes after exposure to latex containing products. The most severe latex allergy can result in anaphylaxis. Allergic skin problems can occur following direct contact with allergic latex proteins in latex glove products. Symptoms may include immediate itching, redness and swelling of skin that touched the item containing latex.
5. Common organisms associated with surgical site infections are *Staphylococcus aureus*, coagulase-negative staphylococci, *Enterococcus* spp. and *Escherichia coli*. Common infections in ICU are urinary tract infections, pneumonia, intravascular infections and surgical site infections due to the devices used in the ICU.

1.13 REFERENCES AND SUGGESTED FURTHER READINGS

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Useful websites

- National Quality Occupational Safety and Health Administration Hospital eTool (health care hazards, infection, housekeeping, nursing homes) <http://www.osha.gov/SLTC/etools/hospital/hazards/infection/infection.html>
- Guidance on risk controls in hospitals and laboratory environments:
 - Biological agents: <http://www.dh.gov.uk/biosafety/biologagents.pdf>
 - Human remains: <http://www.dh.gov.uk/pubns/web01.pdf>
- European Agency for Safety and Health at work: <http://www.europe.osha.eu.int/OSHA>
- National Institute for Occupational Health and Safety (USA): <http://www.cdc.gov/niosh/homepage.html>
- World Health organization (WHO): <http://www.who.int/en>
- YouTube video on universal precaution: <https://www.youtube.com/watch?v=zHipFSCnaVM>
- YouTube video on Infection Control: Basic Infection Prevention Techniques: <https://www.youtube.com/watch?v=QgqTW0FjN08>
- Posters, slides, and video information are available on the CDC Web site: <http://www.cdc.gov/ncidod/dhqp/ppe.html>