

Exploring the Pathogens Present at the Patient Care Equipments & Supplies to Sensitise the Health Care Workers for Preventing Health Care-Associated Infections among In-Patients

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Abstract

Health care-associated infection (HCAI) is an infection that a person acquires in hospital after 24 hours of his/her admission. A health care worker (HCW) does not have any right to provide another infection to in-patients. While caring the patients, HCW innocently or otherwise can transmit various pathogens to the patient. It is both ethically and legally wrong and HCW is answerable for it. The current study was conducted with the objectives to find out the rate of presence of pathogens at the patient care equipments & supplies, to identify the most common pathogens present at the patient care equipments & supplies and to identify such equipments & supplies that are at high risk of contamination. Investigator collected 1,145 samples of different equipments & supplies used for patient care from operation theaters, labour room & medical wards of a tertiary care hospital in New Delhi. The sample was collected from April 2012 to April 2013 by random sampling. Out of 1,145 samples, 112 were positive or contaminated with certain kind of pathogen. The finding revealed that the contamination rate of patient care equipments & supplies is 9.78 percent. The most common and frequent pathogen present at the equipments & supplies is *Pseudomonas* (39.29%) and water of oxygen humidifier is most commonly and frequently infected (47.32%). Nurses as the backbone of hospital should strictly adhere to the policies and protocols of the institution. She/he must update the knowledge of infection control practices and various methods of controlling HCAI including hand hygiene, disinfection of patient care equipments & supplies and cleanliness of environment. A Nurse should also transmit this knowledge to other team members so as to minimise the health care-associated infection rate.

The setting of a hospital is conducive to the development and spread of infection. Many studies suggest that either people or things around the patient can be the risk factor for infections. A Health Care-Associated Infection (HCAI) is defined as an infection acquired in the hospital by a patient who was admitted for a reason other than that infection (Ducel G, et al, 2002). It is an infection occurring in a person at hospital or other health care facility in whom the infection was not present or incubating at the time of admission. This also includes the occupational infection acquired by staff or faculty (Benenson, 1995).

Despite progress in public health & hospital care, infections continue to develop in patients admitted and the staff working there. Many factors cause the HCAs including decrease immunity status of patient, unsterile invasive procedures, overcrowding, poor en-

vironmental sanitation, contaminated patient care equipments & supplies, resistant pathogens present in the hospital environment, poor compliance of HCWs towards wearing PPE and hand hygiene, poor compliance towards norms and policy of institution. A survey conducted by WHO in 55 hospitals of 14 countries showed that an average 8.7 percent of patients admitted in a hospital get the infection from HCWs & hospital environment. At any time about 1.4 million people are suffering from HCAs (Tikhomirov, 1987).

HCAI is one of the leading causes of death among patients admitted in hospital (Ponce-de-Leon, 1991). Among all Health Care Workers, Nurses are the backbone of any health care institution. A Nurse provides round the clock services to the patients. She/he is the person who is responsible for the direct and indirect services to the patients and the administrators. She/he has a vital role in the prevention of HCAI among patients admitted in the hospital. A Nurse should know how the pathogens grow, multiply, spread and how she/he can prevent the transmission. She/he should know about the various kinds of sterilisation and dis-

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infection techniques, disinfectant solutions, their percentage, efficacy and life span. Utilisation of this knowledge can minimise the hospital infection rate and do justice with patient care.

Literature Review

HCAI increases the duration of hospitalisation of patients. Coella et al (1993) revealed that overall increase of hospitalisation of patients due to surgical wound infections was 8.2 days (3 days for gynaecology surgery, 9.9 days for general surgery & 19.8 days for orthopaedic surgery. Increased hospitalisation is not only a burden on patient and the care giver but also has adverse impact on the hospital.

A person admitted in the hospital acquires the HCAI by three main sources i.e. man (health care workers that includes doctors, nurses, technicians, hospital attendants, and house-keeping staff), material (hospital articles, instruments, patient care equipments & supplies) and environment (Table 1). HCWs should follow the protocols, policies and procedures set by the hospital administration. Many studies suggest that the HCWs are the main carrier of HCAI in a person admitted in hospital. The patient care equipments & supplies are also a leading cause of HCAI. A contaminated article or instrument used by HCW for a patient care is a transport vehicle for pathogens and a source of HCAI. The most common HCAI is through urinary catheterisation that can be caused by contaminated hands of HCW, contamination of catheter, contaminated lidocaine jelly, bad technique & poor compliance to standard procedure. Another leading cause of HCAI is procedures related to respiratory care like endotracheal intubation, nebulisation, and oxygenation. Contaminated instruments like laryngoscope blade, infected humidifier, contaminated water of humidifier may be the source of HCAI. Surgical procedures, or wound care if done with infected instruments, contaminated Cheatle forceps, poor quality of antiseptics or disinfectant and contaminated environment may be the other causes of HCAs.

In critical areas and operation theaters, the maintenance of environmen-

tal sterility is a challenge. Due to the excess traffic, irregular cleaning of area, the pathogens grow in the environment and come in the contact with patients or care providers causing blood stream infection or sepsis in patients.

The most common pathogens presenting in the hospital environment and at the patient care equipments & supplies are pseudomonas, staphylococci coagulate negative, acinetobactor, aerobic staphylococcus, gram negative bacilli, enterobacteria, K. pneumonie E. coli, gram positive bacilli, K. oxyytoca, yeast cells, and some fungal and parasitic pathogens.

Sood et al (2012) investigated 1,165 blood cultures,

Table 1: Sterilisation & Disinfection of Patient Care Equipments & Supplies

S.No.	Patient care equipment & supplies	How to Sterilise & Disinfect
1	Oxygen humidifier bottle	Disinfect once in 24 hours - Wash with water & detergent - Dip in Korsalex 5% for 5 minutes or Glutereldehyde 2.45 % solution for 20 minutes - Rinse with sterile water - Dry in clean area - Store in sterile bag / drapes - Don't top-up the water in bottle
2	Nebuliser tubings & cups	Disinfect tubing in every nursing shift. & cup after every use. - Dip in Glutereldehyde 2.45 % solution for 20 minutes - Thoroughly rinse with sterile water - Dry in clean area & store.
3	Cheatle forceps	In OT change in each nursing shift & in wards change once in 24 hours. - Clean with water & detergent. - Autoclave - store in dry sterile bottle
4	Laryngoscope blade	Disinfect after each use, if not used than once in 24 hours. - Clean with water & soap solution. - Alcohol based disinfectant(Bacillo 25/Spirit) - Dry it & store in bread box for ready to use.
5	Thermometer	Clean after each use / once in 24 hours Alcohol based disinfectant
6	Normal saline	Clean container with fresh saline
7	Infant weighing machine	Alcohol based disinfectant
8	Suction tube	Dip in Glutereldehyde 2.45 % solution for 20 minutes
9	AMBU bag	Disinfect after each use - Wash with soap & water - Dip in Glutereldehyde 2.45% solution for 20 minutes or korsalex 5 % for 5 min - Rinse thoroughly with water (sterile) - Dry & store - AMBU bag valve should be packed with sterile pad.
10	Injection tray	- Wash with soap & water - Autoclaving - Use sterile pad

of these 105 blood stream infections were confirmed microbiologically. Out of 105, 78 (72.9%) infection were gram negative, 20 were with *Acinetobacter* spp. *acinetobacter* and *Pseudomonas* were responsible for 42.9 percent of all blood stream infections.

The most prevalent blood stream infection pathogen is *Staphylococci* Coagulase negative. *E. coli* is the most prevalent pathogen isolated from urinary tract infections (Ghadiri et al, 2012).

Almirante & Limon (2012) showed that the most common organism causing CRBSI were *Staphylococcus*, *Klebsiella*, *Enterobacter* and *Pseudomonas*.

The patient care equipments & supplies most frequently used in health care setting are oxygen humidifier, nebuliser tubing, cheatle forceps, laryngoscope blade, thermometer, and normal saline for rinsing instruments, infant weighing machine, suction tube, ambu bag and injection tray.

The pathogens present at health care setting can be transmitted directly or indirectly. Direct contact transmission involves a contact of body surface to body surface and physical transfer of microorganisms between a susceptible host and an infected or colonised person at the time of patient care. Indirect transmission includes the contact of a susceptible host with contaminated intermediate object usually contaminated instruments, patient care equipments, dressings, needles and gloves.

Sterilisation and disinfection of equipments & supplies is vital for preventing the HCAs. The HCWs should know about the pathogens that can transmit through these equipments & supplies so that a strict follow-up can be achieved.

Objectives

This study was carried out:

1. To find out the rate of presence of pathogens at the patient care equipments & supplies.
2. To identify (a) the most common pathogens present at the patient care equipments & supplies, and (b) those at high risk for pathogenic contamination.

Methodology

In this prospective study, the researchers took the random sample of patient care equipments & supplies using swab sticks and TGB (thioglycolate broth) and sent them to microbiology laboratory for examination. Simple random technique was used for sampling. Two items were needed for sampling of patient care equipments & supplies: sterile swab stick - it is available in

sterile packet and TGB media - it is available from laboratories. After confirming the sterility of swab stick and TGB media, researcher washed his hands, took the sterile swab stick and the instrument or tubing; two strokes of swab stick were done on sterile instrument or tubing, then this swab stick was dipped in media thioglycolate broth and sent to laboratory. The complete procedure was done using sterile technique. This media with swab stick was incubated in laboratory at the optimum temperature and pH. The growth of various pathogens can be detected after 24 hours.

Fluids or water from wall-mounted oxygen humidifiers, ventilator humidifiers; disinfectants were taken in a 2 ml sterile disposal syringe and sent to laboratory. Any pathogens growing in in-use solution can be detected. Figures 1 & 2 show the prevalence of pathogens in hospital setting.

Data Collection Period: Data were collected for one year period from April 2012 to April 2013 at All India Institute of Medical Sciences, New Delhi. A total of 1,145 sample were taken from patient care equipments & supplies from different health care areas i.e. operation theaters, medical wards, labour room and maternity OT.

Samples were collected from the various patient care equipments & supplies i.e. Cheatle forceps, nebuliser tubings, infant weighing machine, Ambu bag valve, laryngoscope blade, thermometer, injection tray, suction tube using the swab stick and TGB media. In-use sampling of normal saline for rinsing instruments and water from oxygen humidifier were also taken.

Results and Discussion

Out of 1,145 samples, 112 were found positive or contaminated with pathogen. The rate of contamination of patient care equipments & supplies was 9.78 percent.

Fig 1: Distribution of Pathogens at the Patient Care Equipments & Supplies

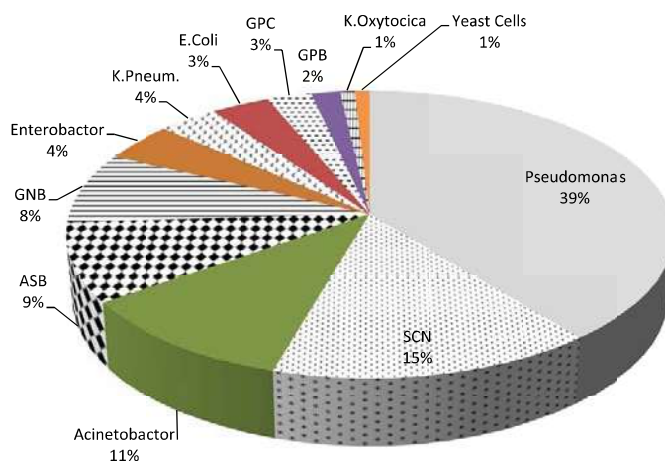
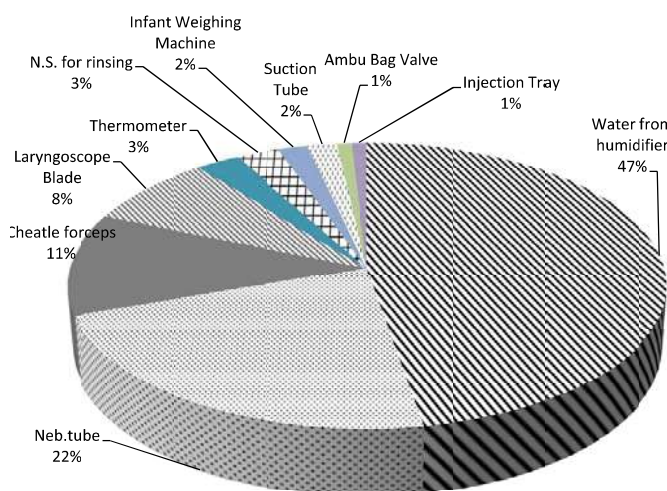


Fig 2: Patient Care Equipments & Supplies Contaminated with Pathogens



Of the 112 contaminated samples, 44 were contaminated with *Pseudomonas* (39.29%), 17 samples with *Staphylo Coagulase negative* (15.18%), 12 with *Acinetobacter* (10.71%), 10 were contaminated with aerobic staphylococcus bacteria (ASB) (8.92%), 9 were contaminated with Gram negative bacilli (GNB) (8.04%), 5 of enterobacteria (4.46%), 4 of *K. pneumoniae*, and *E. coli* (3.58%), 3 of gram positive cocci (GPC) (2.68 %), 2 of GPB (1.78%) & 1 of each yeast cell and *K. oxytoca* (0.89%). The most common and frequent pathogen present at the patient care equipments & supplies was *Pseudomonas*.

Of the 112 contaminated samples, 53 were from water of oxygen humidifier (47.32%) followed by 25 from nebuliser tubing (22.32%), 13 from Cheattle forceps (11.60%), 9 from laryngoscope blade (8.03%), 3 from normal saline, 3 from thermometer (2.68%), 2 from infant weighing machine (1.78%), 2 from suction tube (1.78%) and 1 sample was from Ambu bag valve and injection tray (1%). The most common was water from oxygen humidifier.

The study showed that the contamination rate of health care equipments is 9.78 percent which is almost equal to the health care-associated infection rate of United Kingdom (10%, 8.2%) (10, 11). In fact, every contaminated article may cause HCAI among patients. It was found that *Pseudomonas* is the most prevalent pathogen at the patient care equipment & supplies followed by *Staphylococci Coagulase negative*. *Pseudomonas* along with *Acinetobacter* is almost 50 percent responsible for nosocomial infections (Sood et al, 2012). Many other research studies also revealed that *Staphylococci Coagulase negative*

is a leading cause of blood stream infection among patients admitted in hospital (Almirante & Limon, 2012).

Conclusion

To prevent the HCAI the focus should be on three important routes i.e. man, material and environment. Health care workers should do hand hygiene, wear PPE, and follow the protocols of hospital. Sterilisation and disinfection of articles, equipments and supplies should be ensured and cleanliness of environment should be done.

Recommendations

1. A comparative study can be done to compare the rate of HCAI and findings of pathogens on patient care equipments and supplies.
2. An experimental study can be done to see the impact of sensitising programme on the findings of pathogens on the patient care equipments & supplies.
3. A study can be done to correlate the duration of hospitalisation & findings of pathogens on the patient care equipments.
4. A study can be done to assess the impact of CNE on the findings of pathogens on the patient care equipments & supplies.

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