

Original Article

Organisms in operative site in an urban hospital of Dhaka city: An urgent need to develop an infection control program in Bangladesh

Mohammad Murshed¹, Saima Kamar²

¹Department of Microbiology, Holy Family Red Crescent Medical College, Dhaka; ²Department of Microbiology, Jalalabad Ragib Rabeya Medical College, Sylhet

Abstract

The study was carried out to evaluate the presence of organisms in operative and post operative room in an urban hospital of Dhaka city. Environmental samples were collected from different sources of surrounding of patient in operative and post operative room. A total of 120 samples were collected from the floor, bed sheets, OT instruments, dressing materials, nasogastric and endotracheal tube, catheters, etc. The most predominant isolated organism was *E. coli* (40%) followed by *S. aureus* (24%). Microbial isolates were obtained from the hands of hospital staffs and attendances in the same hospital and the percentage of prevalence of *E. coli* was more in the hands of attendances (60%) than hospital staffs (40%); but the presence of *S. aureus* and *Pseudomonas spp.* were less in attendances hands than hospital staffs hands. The other organisms that were present in hands of hospital staffs and attendances were *Proteus spp.*, *S. epidermidis*, and *Klebsiella spp.* An effective infection control practices like hand washing and the use of hypochlorite solution, glutaraldehyde and sanitation with 70% ethyl alcohol was found to be very effective in reduction of microbial contaminates in operative and post operative room.

Key words: Infection control, Hand washing.

Introduction:

Nosocomial infection (NI) is now a becoming a big issue in hospital practice in Bangladesh. Prevalence of NI in post-operative patients was found to be higher (49.0%) than pre-operative patients (15.9%)¹. In bacterial analysis of hospital acquired infection, Ashraf *et al.* (1973) found that the predominant causative organisms for the post operative wounds were *E. coli* (37.5%), *S. aureus* (21.7%), *Pseudomonas spp.* (15.1%), *Streptococcus spp.* (8.4%), *Proteus spp.* (2.7%) in the surgery wards of Dhaka Medical College Hospital².

Since healthcare associated infection (HAI) is transmitted via hands of healthcare workers, as experimented by Ignaz Semmelweis in 1846, hand washing remains the single most important means to prevent infection³. Healthcare workers are a major route through which patients become infected;

microorganisms are transmitted by staff from one patient to another or from the environment to the patient. Since these strains tend to be multiple antibiotic resistances, they pose a major difficulty in treating systemic infections⁴.

There are various sources and risk factors which mediate the transmission of post operative surgical site infection. The relationship of these risk factors depends on bacterial characteristics and surgical site characteristic. The control of transmission of post operative nosocomial infection also depends on the management system of different hospitals⁵.

Cleaning and disinfection of environment surfaces are established components of hospital infection control to prevent health care associated infection⁶. It is also reasonable to disinfect floors given the minimal cost and added antimicrobial activity. Hypochlorite solution used for disinfection of hospital environment and alcohol, chlorhexidine, glutaraldehyde was used for disinfection of hospital equipments in different studies⁷.

✉ Correspondence:

Dr. Mohammad Murshed
Associate Professor of Microbiology
Holy Family Red Crescent Medical College Hospital
1, Eskaton Garden Road, Dhaka-1000.
E-mail: murshed77@hotmail.com

Therefore, the present study is an attempt to investigate the impact of surrounding environment and hands of HCWs and attendances in transmitting surgical site infection in a private hospital of Dhaka city and importance of developing an infection control program in Bangladesh.

Materials And Methods:

The study was carried out from July 2010 to June 2011 to evaluate the presence of organisms in operative and post operative room in an urban hospital of Dhaka city. A total of 120 samples were collected monthly from bed sheets of surgical ward, post operative room and OT, floor of OT, surgical ward and post operative room, different OT and post operative equipments, nasogastric and endotracheal tube, catheters, Sucker and tubes, Oxygen cylinder, ECG, Echo machines, dressing materials and others in operation theatre during operation and dressing materials during dressing, by eight times swabbing (15x15 cm area) with sterile swab stick which remoistened with saline water and immediately inoculated in relevant culture medium. Liquids samples were agitated frequently and sterile swab stick was impregnated aseptically. The swab stick was rubbed on to Blood and MacConkey agar plate on the sampling site⁶.

Samples were also collected from both hands (10 nail folds, 8 inter digital spaces and both palms) of surgeons and OT nurses, patient's attendants with no skin problem throughout the year by five finger impression technique⁸. All specimens were inoculated into Blood agar, McConkey Agar and Mannitol Salt Agar media and incubated at 37°C overnight. Bacterial isolates were identified by colony morphology, staining and appropriate biochemical tests.

Bacterial isolates were identified by colony morphology, staining and appropriate biochemical tests. Isolates were put into antibiotic susceptibility test by Kibry-Bauer disk diffusion technique, using panel of antibiotics as per recommendation of National Committee for Clinical Laboratory Standards, USA⁹.

Hypochlorite [bleaching liquid (chlorox) 1/10 dilution in water] is used to disinfect soiled floor, trolleys, tables, bedside lockers, beds; etc. Routine cleaning is done by using ordinary detergents (mostly quaternary compounds). Disinfection is done when spillage of body fluid occurs. Gluteraldehyde (Cidex) is used for semi critical equipments like endotracheal tubes, endoscopes, laryngoscopes. For unsoiled trolley, ECG machine, Echo machine, stethoscope, thermometer: 70% ethyl alcohol is used. Soap, antimicrobial soap and providone iodine (provicep) and alcohol based hand rub were used as hand washing materials.

Results:

Environmental samples were collected from different sources of surrounding of patients in operative and post operative of private hospital. A total of 120 samples were collected from the floor, bed sheets, OT instruments, dressing materials (cotton, gauze), nasogastric and endotracheal tube, catheters, etc. *E. coli* (40%) was the predominant organism followed by *S. aureus* (24%), *Pseudomonas* (12%), *Proteus* (10%) (Table 1). The commonly prevalent organisms in floor, bed sheet and trolley were *E. coli* and *S. aureus*. *Pseudomonas* was usually found in sucker and tubes and dressing materials was a good resource of *E. coli* and *S. aureus*. *Proteus*, *Citrobacter*, *Acinetobacter* was also collected from patients surrounding environment. It was also observed that equipments used in the operation theatre contained less organisms than post operative room. Twenty Samples were taken monthly from palms, inter-digital spaces of both hands of surgeons, post operative nurses and attendances for quantitative and qualitative analysis in private managed hospital. It was observed that the attendance hands contained more bacteria than that of Hospital staffs and *E. coli* was the predominant organism. The percentage of prevalence of *E. coli*, *S. aureus* and *Pseudomonas* were more in attendants' hands than in the hands of health care workers The other organisms that were present in hands of hospital staffs and attendances were *Proteus*, *S. epidermidis*, *Klebsiella* and *alpha-hemolytic Streptococcus*. (Figure I).

Hand washing is one of the major components for infection control in post operative room. Plain soap, antimicrobial soap and alcohol based hand rubs are usually used in clinical settings. In this study it was observed that alcohol based hand rub was the best for reduction of microbial load from hand in private hospital. The first six month (July 2010 to December 2010) in post operative room of private hospital plain soap and antimicrobial soap was used. Then from January 2011 to June 2011 alcohol based hand rub was introduced and there was dramatic reduction in the counts of total and faecal coliform per hand wash of nurse and surgeons; are shown in Figure II.

But on the other hand, by introducing disinfectants like hypochlorite, gluteraldehyde (Cidex) and 70% ethyl alcohol, there were a significant reduction of microbial load from various critical and non critical items of operative and post operative room (Figure III).

Table-I: Organisms in patents surroundings of operative and post operative room in private hospital.

Source (n)	<i>S. aureus</i>	<i>E. coli</i>	<i>Pseudomonas</i>	<i>Proteus</i>	Others*
Floor (15)	4	3	2	-	1
linen bed sheet (15)	4	5	1	2	2
Trolley (15)	3	4	-	3	1
Catheter (15)	-	6	-	2	1
Sucker and tubes (15)	2	3	5	-	2
OT instruments (15)	-	1	-	-	2
Oxygen cylinder (15)	3	5	1	-	1
Dressing materials (15)	4	6	1	1	2
Total (n=120)	20 (24)	33 (40)	10 (12)	8 (10)	12 (14)

*Bacillus spp, alpha-haemolytic Strep, Citrobacter spp. Acinetobacter spp. etc.

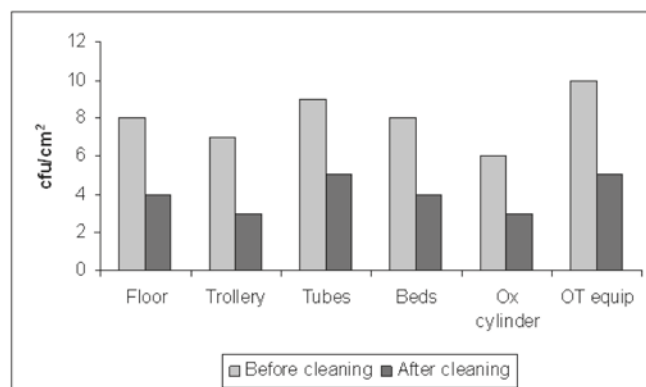


Figure III: The effect of disinfectants on different types of post operative equipments and floors in private hospital.

Discussion:

Hospital acquired infection is a problem affecting the hospitalized patients both in developed and developing countries. In developed countries many interventions were made to control hospital acquired infection. But in developing countries like Bangladesh no emphasis has yet been given in this field. The hands of hospital staffs and attendance are of special concern as they are prime source for surgical site as well as post operative hospital acquired infection. Without any skin problem, palms and inter-digital spaces and nail folds of health care workers (HCW) and attendances were examined for microorganisms. It was also observed that bacterial growth was higher on the hands of patient's attendance than that of health care workers (HCWs). This is due to the fact that the attendants are usually stayed on the patient's bed and or sometimes on the floor and most of the attendants was ignorant about personal hygiene.

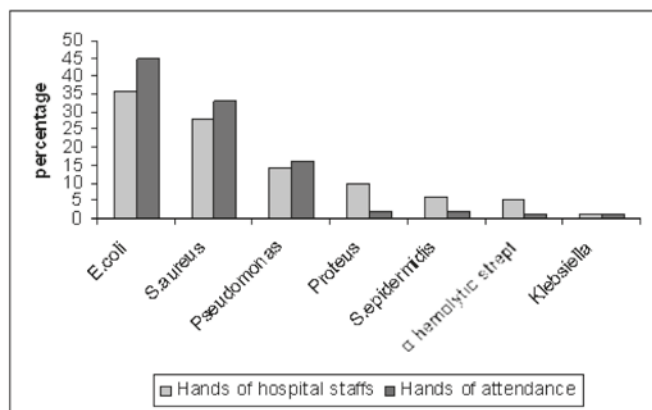
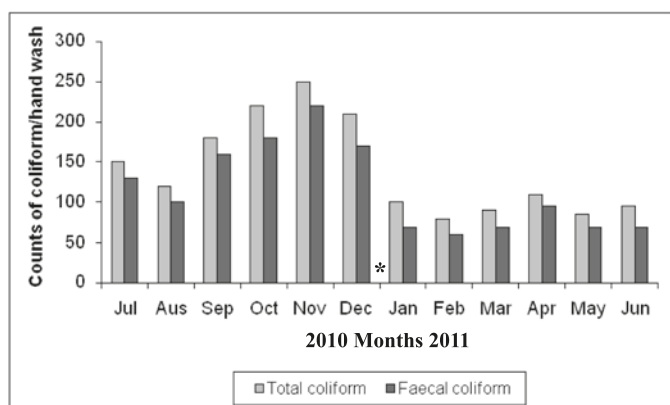


Figure I: Microorganisms isolated from hands of hospital staffs and attendances in private managed hospital.



* After intervention.

Figure II: Reduction of total and faecal coliform after introducing alcohol based hand rub in private hospital.

Hand washing is more than half of whole infection control program. After implementing alcohol based hand rub the presence of microbes in hand flora reduced dramatically. It is also observed that alcohol based hand rub is much more effective then antimicrobial soap against microbes of hands. Compliance with hand washing using soap and water by health care workers has been measured below 50% in most observational studies in European and American Hospitals⁸. It is also documented by Rotter (2001)⁸ that hand rubbing with alcohol is more efficacious than hand washing with soap in reducing the total microbiological load on health care worker's hands in Intensive and post operative care unit. After introducing alcohol based hand rub in a ward of the private hospital, the microbial load of hands of health care workers reduced dramatically. But in public hospital, it is not easy to formulate.

The high level of contamination reported on health care equipment in this study is of particular concern. A large numbers of potential pathogenic, opportunistic and multi resistant organisms also identified on sampled equipment. Since the emergence of penicillin resistance *S. aureus* in the 1950s, the number of organisms' resistance to antibiotic therapy has increased significantly¹⁰. This increase in microbial resistance has been attributed to the overuse of antibiotics, increasing numbers of immune-compromised and critically ill patients and lapses in infection control, most importantly in terms of hand washing and cleaning of equipment. Seventy percent alcohol was found to be a highly effective means of reducing contamination on healthcare equipment in the study. Cleaning protocols involving 70% alcohol were more effective than cleaning protocols involving detergent, antiseptic soap, and single and double paper wipes. This finding suggests that regular cleaning of stethoscopes, aurioscopes, diagnostic ultrasound and endoscopes with 70% alcohol is sufficient to reduce the risk of nosocomial infection significantly¹¹.

Healthcare workers are a major route through which patients become infected; microorganisms are transmitted by staff from one patient to another or from the environment to the patient. In addition to activities that involve direct contact with patients or body fluids and secretions, touching contaminated environmental surfaces may result in the acquisition of pathogens on the hands¹².

Cleaning and disinfection of environment surfaces are established components of hospital infection control. It is also reasonable to disinfect floors given the minimal cost and added antimicrobial activity. It was found in the investigation that by using disinfectant like hypochlorite solution, glutaraldehyde, the hospital premises are partially free from microbes. Quaternary ammonium compounds and hypochlorite solution used for disinfection of hospital environment and alcohol, chlorhexidine, glutaraldehyde were used for disinfection of hospital equipments in different studies^{6,7}. Disinfectants may pose a danger to personnel, patients and the environment and require special safety measures. Today, disinfectants are one of the leading allergens affecting health care personnel¹³.

Environmental surfaces (bedside table, bed nails) in close proximity to the patient have been demonstrated to become contaminated with epidemiologically important microbes such as ESBL and MRSA. This study demonstrate that important hospital acquired pathogens (ESBL, MRSA) can survive on environmental surfaces for an extended period of

time and this may allow for environmentally mediated disease transmission. For this reason, those surface should be disinfected regularly and need to be clean after patient discharge^{14,15}. Advances in infection control practices include improved operating room ventilation, sterilization methods, barriers, surgical technique, and availability of antimicrobial prophylaxis. Despite these activities, post operative infections remain a substantial cause of morbidity and mortality among hospitalized patients¹⁴.

Institutional policies and practices must be developed and adhered to. In particular, optimal hand washing and glove use must be facilitated and reinforced, as transmission of organisms between patients occurs primarily on the hands of staff members. Isolation guidelines to identify and segregate patients who have an increased risk of transmitting infection to other patients or staff are also essential. Many national or local standards and regulations will also prevent hospital acquired infection, and institutions must be in compliance. These regulations cover hospital construction, municipal water supply, laundry management, food handling, waste disposal, sterilization and other reprocessing procedures, as well as standards for pharmacy and microbiology laboratory practice.

Reference:

1. Mohiuddin M, Haq JA, Haq MM, Huq F. Microbiology of nosocomial infection in tertiary hospitals of Dhaka city and its impact BJMM 2010; 04(2): 32-37.
2. Ashraf, S.A. and Prodhan A. Study of pattern of infections in the surgical wounds of DMCH. Bangladesh Med. Journal 1973;1: 105-110.
3. Semmelweis I. Etiology, concept, and prophylaxis of childbed fever. Carter KC, ed. 1st ed. Madison, WI: The University of Wisconsin Press, 1983.
4. Boyce JM, Potter-Bynoe G, Chenevert C, King T. Environmental contamination due to methicillin resistance *Staphylococcus aureus*: possible infection control implications. Infection Control Hosp Epidemiol 1997 ;18:622-627.
5. Murshed M, Shahnaz S, Alam SMK, Rahman MM, Malek MA: Isolation of post operative hospital acquired infections in a private hospital of Bangladesh and determination of clonal relationship of *E. coli* by Pulsed field gel electrophoresis. BJMM 2012; 6(2): 07-10
6. Dharan S, Mouruga P, Copin P, Bessmer G, Tschnaz B, Pittet D. Routine disinfection of patients' environmental surfaces. J Hosp Infect. 1999; 42: 113-117.

7. Danford D, Nicolle LE, Hume K, Alfieri N, Sims H. Nosocomial infections on nursing units with floors cleaned with a disinfectant compared with detergent. *J Hosp Infect.* 1987;10:229-235.
8. Rotter M. Arguments for alcoholic hand disinfection. *Journal of Hospital infection.* 2001. 48 (supplement A): S4-S8.
9. National committee for Clinical Laboratory Standards. Performance standard for antimicrobial susceptibility testing. Supplement M100-S9. NCCLS, Wayne, PA. 1999.
10. Levy S. Factors impacting on the problem of antibiotic resistance. *J antimicrob Chemother* 2002. 49:25-30.
11. Schabrum S, Chipchase L. Healthcare equipment as a source of nosocomial infection: a systematic review. *J Hosp Inf* 2006.63 :239-245.
12. Ray AJ, Hoyen CK, Taub TF, Eckstein EC, Donskey CJ. Nosocomial transmission of vancomycin resistance enterococci from surfaces. *J AM Med Assoc.* 2002.287:1400-1401
13. Schnuch A, Uter W, Geier J, Frosch PJ, Rustemeyer T. 2001. Contact allergies in healthcare workers. Results from the IVDK. *Acta Derm Veneorol.*78:358-363
14. Ratula WA, Weber DJ. Surface disinfection: should we do it. *J Hosp Inf.*2001;48:S64-68
15. Jarlier V, Nicolas M, Fournier G, Phillippon A. ESBL conferring transferable resistance to newer β -lactam agents in Enterobacteriaceae: hospital preventable and susceptibility patterns. *Rev. Infect. dis* 1988.10:867-878.