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HOSPITAL REFRIGERATORS-CAN BE A SOURCE OF NOSOCOMIAL INFECTIONS

Microbiology

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ABSTRACT

Introduction: Nosocomial infections (NI) are a major public health concern, contributing to increase morbidity, mortality and health care cost. Hospital equipments has been identified as likely source of Hospital acquired infections (HAI).Considering that, Hospital refrigerators from different departments were chosen for study. Methods: study plan in two phases. Phase 1); to determine extent of Bacterial and Fungal colonization in hospital Refrigerators. Phase 2); Evaluate efficacy of infection control measure .Result: Study reported (Phase 1)- 59% (59/100) samples were positive for various Bacterial and Fungal isolates. Among Bacteria, predominant isolates were Staphylococcus aureus38% and Pseudomonas aeruginosa36%;among fungal isolates Aspergillus species and Candida species were common .Phase2)-study documented good effect of cleaning measure as positive cultures were only 18.8%(17/90).Conclusion: Study emphasize that like other devises and equipments, Hospital Refrigerator can be a source of Nosocomial infection if temperature of refrigerators and infection control measures are not followed strictly by hospital staff.

KEYWORDS:

Nosocomial infection, equipments, source of infection.

INTRODUCTION

Nosocomial infection presents a widespread problem in today's health care environment and 4% to 10%of hospitalized patients acquiring an infection annually. It is estimated in the US that 17 to 25 billion dollars added to health cost every years a result of NIs. It is a leading cause of death among hospitalized patients resulting17500-70000death annually in USA [1]. The presence of diagnostic and therapeutic procedure requiring equipment and instrument which get contaminated and are difficult to sterilize has added to the risk of acquiring infection in modern hospitals.[2] Factors predispose to Nosocomial infections are extremes of age, diabetes, surgery, invasive procedure, factors related to treatment;, immunosuppressive therapy, blood transfusion patient on indwelling devices[3,4]

Common Nosocomial infections are BSI, Urinary tract infection, Surgical site infection, Pneumonia, skin and soft tissue infection etc Infection acquired in hospital may be caused by Bacteria viruses and fungus[4] ,can be parasites [2].The source of infection can be 1).Endogenous (self infection) 2) Exogenous or cross infection (acquired from other person in hospital)[2].The Exogenous, source can be animate or inanimate hospital environment (surfaces and medical equipments) can become contaminated with Nosocomial pathogen. [5] Other source could be person hand clothes of staff, wound dressing, dust, fomites, fluid and disinfectant, food, inadequately sterilized instrument and equipment[2].There are several study also reveal about colonization of equipment by patient and hospital staff flora e.g., Nasal carriage methicillin resistant Staphylococci colonizing over intravascular devices [6],Therapeutic Ultrasound equipment [7], Stethoscope[8]other Equipment [1] High financial and individual costs associated with NI make the identification of sources of infection and development of adequate cleaning protocols a necessity in all area of health care .Study done by S.Shchabraun et.al reported that one third of infection acquired in the health care setting could be prevented by thorough hand washing adequate cleaning of equipment. [1]

Refrigerators are among the hospital equipment used nearly in every department for different purposes included in study, with aim; Phase 1) to determined prevalence of Bacterial and Fungal growth in refrigerators in various departments and sections. Phase2) To know efficacy of infection control measure. This information will be valuable to understand that hospital Refrigerators can be a reservoir of variety of Bacterial and Fungal infection in hospital if their maintenance is poor and basic infection control measure(hand hygiene)are not followed strictly.

Good number of article available regarding maintenance and contamination on food keeping refrigerators [9] but not enough data available for hospital refrigerators.

METHODS

A total 10 hospital refrigerators included in study from;1&2) Modular OT used for medicine and appliance, 3)General OT, 4)Medicine and ICU use for medicine and infusion sets, 5)NICU medicine and vaccine,6)Labor room for medicine,7)Serology and, biochemistry for kits, samples 8)Pharmacology for drugs vaccine water,9) Media room, 10) from refrigerator use to keep samples in microbiology. (refrigerators use for keeping relevant article from department.)

Study planed in two Phase:-Phase1a) A total 100 samples were collected from **10** refrigerators;10 from each refrigerator; 5 for Bacterial and 5 for Fungal culture from 5 locations ;Handle, Upper compartment, lowermost compartment, Upper and lower part door including gasket.*Phase1b*)Two more(total-20) samples were collected from each refrigerator handle immediately after wiping with 70% alcohol [1]. *Phase2*) Repeated sampling procedure done with a total 90 samples were collected after fortnightly cleaning of refrigerators , one refrigerator was not included in study because no standby instrument available.

For Bacterial culture sample were inoculated on Sheep Blood agar and MacConkey agar [Himedia] and kept in incubator and For Fungal culture, swabs inoculated on duplicate Saboraud dextrose agar, one kept in incubator 37 degree & other at room temperature. Identification of Bacteria and Fungi involve standard techniques; colony characteristics, gram stain, biochemical reaction, slide culture, Lactophenole cotton blue stain [10-12] MRSA also identified with standard technique [11]. For bacterial culture negative reports were only given after 48 hrs of incubation and after 2weeks of observation in case of fungal growth.

RESULT

Phase1a) Out of 100 samples59 %(59/100) found positive, 92 %(46/50) for Bacteria and 26%(13/50) for fungal isolates. Among 100 sample 21% were polymicrobial and 12% were monomicrobial and following isolates recovered in *pase 1a*) study, describe in Table -1.

TABLE- 1
PHASE- 1(Distribution of isolates)

S. no.	Pathogen	Out of 50 samples (Bacterialisolates)	Out of 50 samples (Fungalisolates)
1.	Staphylococcus aureus	19(38%)	
2.	Pseudomonas aeruginosa	18(36%)	
3.	Cons	13(26%)	
4.	Klebsiella pneumoniae	9(18%)	
5.	Serratia spp	6(12%)	
6.	E.coli.	1(2%)	
7.	Acinetobacter spp.	2(4%	
8.	Gram positive bacilli	13(26%)	
9.	Aspergillus spp.		8(16%)
10.	Candida albicans non albicans		6(12%)
11.	Fusarium spp.		2(4%)
12.	Acremonium		1(2%)
13.	Penicillium spp.		1(2%)
14.	Sporothrix .schenckii		1(2%)

Staphylococcus aureus and Pseudomonas aeruginosa were came as predominant bacteria and *Aspergillus and Candida* species were predominate among fungal isolates .Total 80%(8/10) swabs from handles came positive for bacteria *Staphylococcus aureus and Coagulase negative staphylococci (Cons),10%(1/10) only with Staphylococcus aureus, 10%(1/10)* showed growth of Cons and Pseudomonas aeruginosa. No fungal isolates observed on handle culture.*Phase1b*) All swabs after wiping handle with70% alcohol were reported negative. All 5 swabs came positive from refrigerator use to keep samples, indicate frequent cleaning is desirable. Phase2) Out of 90 samples collected after fortnightly cleaning, 17(18.8%) were came positive for bacterial and fungal growth; 15were polymicrobial, 2 were monomicrobial. Bacterial isolates were 37.7 % (17/45), Fungal isolates were 11 %(5/45). All handle culture came positive for bacteria *Cons or and Staphylococcus aureus (S.aureus)*. It was observed that positive culture decrease in number following infection control measure as well as their CFU/swab by 20 -25% of range. Following isolates found in *Phase2)* depicted in (Table-2).

TABLE – 2
PHASE-2 (Distribution of isolates)

S no.	Pathogen	Out of 45 samples (Bacterial isolates)	Out of 45 samples (Fungal isolates)
1.	Staphylococcus aureus	11 (24.4%)	
2.	pseudomonas aeruginosa	8 (17.7%)	
3.	Cons	10 (22.2%)	
4.	Klebsiella pneumoniae	3(6.6%)	
5.	Serratia spp.	2 (4.4%)	
6.	Acinetobactor spp.	--------	
7.	Gram positive bacilli	5(11%)	
8.	Aspergillus spp.		2(4.4%)
9.	Candida albicans non albicans		2(4.4%)
10	Fusarium spp.		1(2.2%)
11.	Acremonium SPP		-
12.	Penicillium spp.		-
13.	Sporothrix schenckii		-

In both phase 86.2% (25/29) strain of *Staphylococcus aureus reported* as MRSA.

DISCUSSION

Certain hazards are inherent in modern hospital and that hospital acquired infection is one of them [2] they affect 1 in 10 patient admitted to hospital annually. The European prevalence of infection in Intensive care study (EPIC) Involving over 4500 patients demonstrate that .ICUpatients are particularly high risk as result of mechanical ventilation, use of invasive procedure and their immunocompromised status [4] NI are frequently caused by environmental organisms and have been linked to a wide variety of contaminated hospital equipment suggesting that the risk of NI following contact with equipment is high [1,5]Equipment used in the non-critical setting is less likely to have standard cleaning protocol than Equipment used in critical setting making it largely to carry large no of microorganism.[1]

Present study on various hospital refrigerators showed colonization of various Bacteria, *Staphylococcus aureus and Pseudomonas aeruginosa, Cons,klebsiealla spp Serratia spp and Acinetobacter spp, Gram positive bacilli,* and Fungus like *Aspergillus, Candida albicans, Fusarium, Penicillium spp* nearly similar to study done by SemasS.et.al. on Food refrigerators[13],as no study found on hospital refrigerators. Organism isolated S. *aureus,Cons Pseudomonas aeruginosa Acinetobactor spp.klebsiella pneumoniae serratia spp, Candida albicans,nonalbicans Candida* and other fungi found to be responsible for different type of infections e.g. Blood stream infection(BSI)[14], UTI, SSI, Pneumonia[3,4]with varied range. Patient from surgical ward, ICU, [14], are on high risk .High rates most likely related to devices like ventilators, urinary catheter and central venous lines [3,4,14].

Health effect of isolated fungi; *Aspergillus niger, Aspergillus flavus* is ranging from allergic bronco pulmonary disease to disseminated infection [12]. Candida is well known cause of BSI and G.U. infection, [3,12] *Fusarium spp. mainly cause keratitis, Penicillium* cause allergic reaction and known for producing mycotxin, *Sporothrix schenckii* is a dimorphic fungus may cause skin and lung infections[12].In present study 86.2%(25/29) *S.aureus* were MRSA, and further makes treatment difficult also reported by Noelle B.F.et.al [6].

Phase-2) Study found marked decrease in positivity of culture, illustrated good effect of cleaning and maintenance of refrigerators but both phase reveals100% positive sample from handles and growth of *S.aureus* in 89.4%(17/19), suggest frequent cleaning of handle and hand hygiene care needed.

CONCLUSION

Current study indicate that further research are needed for illustrate growth in this instrument and for its maintenance as no exact guideline available for hospital refrigerators. Optimum temperature is important for medicine, vaccine, media, multi dose vials. Temperature should be maintain at 40 degree F or below; because above40 degree F. Bacteria grows rapidly, so power backup should be available for refrigerators and appliance thermometer should keep in refrigerators to record temperature.[9]Refrigerator should clean frequently; once a week advised in a study for food refrigerator[9,13]Exterior may be clean with soft cloth and front grill condenser coil with toothbrush and vacuum cleaner to ensure efficiency ,top performance[9]

Exogenous source of infection should be identified with frequent surveillance, and act on their route of transmission. That is possible by frequent hand washing according to standard guideline, follow universal precaution and maintain basic cleanliness.

The best studies of cross colonization event of patient from the inanimate environment use molecular epidemiologic techniques identify pathogen, measure the quality of environmental cleaning, hand hygiene over time and link contaminated surface and colonization in geographic and temporal dimension[5].Strict guidelines should follow for decontamination, cleaning of all equipments and appliance beside other measure to decrease NI.

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