Original Article

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To Evaluate the Presence and Spread of Environmental Pathogens and their Sensitability. An Epidemiological Survey of the Microbiological Monitoring at Burns Ward Civil Hospital Karachi

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ABSTRACT

Objective: To evaluate the presence and spread of environmental pathogens and their sensitability at burns ward civil hospital Karachi.

Study Design: Descriptive observational study.

Place and Duration of Study: This study was conducted at Burns Center, Civil Hospital, Karachi during 2012**.**

Materials and Methods: Samples were collected of air and examined through air microbe index. Samples of water were collected from different sources. Similarly samples were also collected from clothes, nails, hairs and hands of all the Health care personnel working in the burns ward. These samples were sent for culturing to conclude for presence of bacteria.

Results: Staphylococcus Aureus was the major organism obtained from the samples in the burns ward. The organism was also detected from the nasal swabs taken from some staff members. Being the most common cause of nosocomial infection it is necessary to take appropriate steps to cut the probable route of transmission. E.coli and Pseudomonas strains were also detected from the environment of the burns ward. E.coli was also detected in the food trays of the patient a probable route of transmission. Many of these strains were resistant to antibiotics which made it further difficult to treat them. Strains of *Enterobacteriaceae,* Proteus Mirabilis, Klebsiella and Citrobacter were collected from our personnel and were responsible for some hospital acquired infections.

Conclusion: Staphylococcus Aureus was the major organism found. The major routes of transmission of opportunistic organisms were tap water and our staff members. Proper hygiene measures and awareness programs for the staff members should be carried out to aware them of the importance of hygiene.

Key Words: Nosocomail infection, Hospital aquired infection, hygiene prevalance, transmission of bacterial organisms

INTRODUCTION

Nosocomial infections are one of the most common complication affecting patients admitted in hospital, and in most of the cases are preventable. Nosocomial infections are stated as a contemplative threat to the healthcare facilities of a country as it not only affects patient's health but also the medical services as a whole[1]. According to WHO, nosocomial infection also called as "hospital acquired infection" can be defined as "in hospital by a patient who was admitted for a reason other than that infection [2]" or it can also An infection acquired be defined as "An infection occurring in a patient in a hospital or other healthcare facility in whom the infection was not present or incubating at the time of admission[3]. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility" [4]. Not only developing countries are facing it but developed countries like United States of America, in spite of implementing all the guidelines and firm policies for control, management and prevention of hospital acquired infections, are also under this severe dilemma.[5] According to a recent survey, about 1.7 million nosocomial infections in a year were observed in USA and these infections were responsible for about 99,000 deaths each year[6]. Another report estimated that in about 100 hospital admissions, 4.5 people of every 100 were infected [7]. According to a research in France 9000 people die each year from nosocomial infection[8.] The presence of nosocomial infections is based upon some principles which are combination of identifications of clinical findings and results of laboratory and other tests. Different teams were composed worldwide to observe this threat and according to their findings, any nosocomial infection can be prevented if strict guiding principles are pursued[9]. Pakistan being a developing country with limited healthcare facilities and poor environmental conditions is facing multifaceted problems due to these clamorous nosocomial infections comprising of exceedingly high figures[10]. As patients affected by various types of burns are pondered as high-risk

patients[11], these nosocomial infections sometimes present as a serious threat to their endurance and full recovery. The samples collected by us indicated that large number of patients admitted in Burns ward at Civil Hospital Karachi suffered from infections of blood stream, respiratory tract infections or most commonly infections spreading from the pre-existing wound. The risk of these different types of infections undergoes by a patient pretense a potential patient safety threat. The organisms which were detected in large quantity from the culture reports of these patients included Pseudomonas spp, Proteus spp, E.Coli and Bacillus Cereus.. This was the cause whish raised our concern an imdpelled us to analyze the chief source of these opportunistic organisms. After obtaining the result, we initiated to determine the major risk factors of these nosocomial infections and took the obligatory steps and carried out plans to control them so that this despairing situation can be managed and the number of infections can be minimized which will be a great help to decrease the high mortality rate of patients admitted in Burns ward. During the time period of our observation, we also paid special attention scrutinizing the activities of the staff working there and studied all the possible ways by which a patient can acquire these life-threatening infections in order to minimize the chances of nosocomial minfections.

As large number of patients hospitalized in Burns ward suffered from hospital acquired infections in many forms such as Blood Stream Infection (BSI), Urinary Tract Infection (UTI), Ventilator Associated Pneumonia (VIP) or Surgical Site Infection (SSI).so we develop this study to determine the level of hospital aquaired infection at first level and than to develop the plan to remove it. As a first step to find out the cause we collect specimens from all vulnerable sources of contact between the patients and the hospital environment as these may possibly be the most common means of contamination..

MATERIALS AND METHODS

Study Design: Descriptive observational study.
Setting: Burns center, Civil Hospital, Karachi.
Sample Size: 300
Sampling Technique: Non probability purposive sampling
Data collection Procedure: The data was collected from different places of the Burns ward including the staff working in that unit. For each type of sample following method was used.

Water Sampling: Burns ward at Civil Hospital Karachi receives chlorinated water supplied by Karachi Water & Sewerage Board. The samples for examination of the microbiological environmental pollution were obtained from tap water, running water, bath water, water supplies and surface sanitary areas. These samples were collected in a sterile glass bottle and were send for examined to measure the concentration of the opportunist bacteria. For quantitative analysis, dilutions of 10, 50, 100 and 200 ml water samples were filtered through sterile cellulose acetate filters (0.45 nm).The filters were incubated at 24 and 36 degree Celsius. The isolated strains of bacteria were identified through "Standard Methods of water and waste water guidelines" (APHA, 1985)[12].

Air Sampling: All the air samples was done by using the air microbe index. Over all 350 air microbe index were used in the Burns ward including ICU during random times of the day; sometimes during normal ward activities and sometimes in the absence of patients. The standard method of putting three 10-cm Petri dishes containing Nutrient agar, Blood agar and Sabouraud's agar were exposed in every room for one hour about 1 m away from every obstacle (Fischer's 1-1-1 scheme). After that all the dishes were incubated at 36 degrees Celsius for 48 hours and for every room, the mean dish values were taken as the Colony Forming Unit (CFU). A further identification of the bacterial charge in the air was made by the RCS-Biotest sampler.

Clinical Sampling: Samples from all patients of either age or sex have deep burns involving 10-100 % of body surface areas admitted in the Burns ward for more than five days were collected. Patients in Intensive Care Unit were also included in the sample. Samples from these patients were collected through cotton swabs from areas of burn and adjacent areas, biopsies and haemocultures inoculated into culture media. The media used for identification of organism included Bromothymol-blue lactose agar, Pseudomonas agar plates, Blood agar and Tryptose agars. Cultures were incubated at 36 degrees Celsius for over 48 hours.

Staff Sampling: To carry out staff sampling, samples were collected from all the staff currently working in Burns ward at Civil Hospital Karachi. The staff comprised of doctors, nurses, trainees, ward boys and students. Samples of nasal and pharyngeal swabs were collected to detect pathogens via culture tests. Hair and nail samples of the staff members were also investigated. Apart from these samples, some other samples were taken from clothes, gloves, clothes and other materials which can be responsible to create means of transfer of microbial pathogens between the patient and healthcare worker.

Others: Samples were also collected from other areas for example scrapings from walls, objects and instruments of the burns ward including ventilators of civil hospital Karachi. Samples were also collected from food trays of patients and food trolleys. Samples were obtained from corridor, nurses rest room, office, kitchen, staff washroom and Patients washroom.

RESULTS

The study comprised of about 300 samples from different part of the unit and 350 air microbe index measurements obtained from different areas of Burns ward.

The results from the communal analysis showed that many strains of Staphylococcus aureus were identified in the samples collected from the nurse's rest room, corridor and kitchen. Out of three hundred samples, 278 (92.7%) have it. According to the analysis of the nasal swab of staff members including doctors, this organism was found in more than 90% of the samples. The mode of transmission is quite simple like transmission from direct contact from colonized patients or sharing items like towel. The main point of concern arising from the study is that these identified microorganisms are resistant to Methicillin (MRSA), known to have an established connection with nosocomial infections, which makes the treatment of these severe infections, more complicated.

Table No.1: Sensitivity report of Staphylococcus aureus.

	corridor	Nurse rest room	Office	kitchen	Staff washroom	Patient washroom
Augmentin	R	R	R	R	R	R
Piperacillin + tazobactam	S	R	R	R	R	R
Gentamicin	R	R	R	R	R	R
Vancomycin	S	S	S	S	S	S
Linezolid	S	S	S	S	R	R

Table No.2: Sensitivity and resistance of P.aeruginosa with different antibiotic.

Antibiotic	Pseudomonas Aeruginosa
Ticarcillin clavulonic acid	R
Piperacillin	R
Imipinem	S
Ciprofloxacin	S
Amikacin	S
Gentamicin	S
Ceftazidime	R
Serotype	S
R= resistant, S= sensitive RS= intermediate	

Pseudomonas aeruginosa which is known for its ability to rapidly develop resistance against antibiotics. Despite its potential to cause community acquired infections, major infections from P.aeruginosa are hospital acquired. Strains of P.aeruginosa were identified in large number of samples. Majority of these strains were collected from the tap water. Air microbial index also detected that these organisms are present in the environment of ward, corridor and laboratory. Samples from walls of the ward and clothes of the staff also confirmed the presence of these organisms. Two major strains of P.aeruginosa, 0:11 & 0.6 were mainly detected. P.aeruginosa was found to be the second most common organism causing nosocomial infection in our hospital setting and it is fundamentally problematic for seriously ill patients in ICU of burns ward.

Gram negative bacterias are of great concern as they are known to be highly resistance to antibiotics. Many strains of E.coli were detected from the food provided to these patients. Strains of these organisms were also reported from the samples of hands and clothes of the personnel of Burns ward. Samples of water sources were also contaminated from E.coli. The high risk patients are the ones admitted in ICU, having intravenous line maintained, catheterized or admitted for a longer duration.

Many other infective agents were also identified from the samples including, *Enterobacteriaceae*, Proteus Mirabilis, Klebsiella and Citrobacter. These organisms were obtained from the hair, hands, clothes and gloves of the hospital staff which was considered to be the major route of transmission.

Table No.3: Organisms obtained from water environmental and other sources causing nosocomial infections.

Gram-positive organisms	Gram-negative organisms
Staphylococcus Aureus	Pseudomonas Aeruginosa
	E.coli
	Enterobacter
	Proteus Mirabilis
	Klebsiella
	Citrobacter

Nosocomial infections are one of the most important causes of morbidity and mortality, in every setup, throughout the history. Therefore the data of this study is extremely beneficial as it helps to manage the necessary steps that should be taken to prevent the infections in future.

DISCUSSION

A recent study estimated that Staphylococcus aureus is responsible for the major percentage of hospital acquired infections[13] as this bacteria is normally found on skin and noses of even normal person, who are then said to be colonized[14]

We acknowledge that nosocomial infections from all aspect medical science may not be discussed in this paper as the topic is very vast and varied. However our aim is to emphasize this serious but preventable and unfortunately largely ignored issue of nosocomial infections in Pakistan. Still we managed to come up with a number of considerations from our investigations. This research has led us to the finding of

some multi-resistant strains of organisms responsible for causing severe and devastating infections specially in the patients suffering from burn injuries as their damaged skin barriers makes them more prone to pathogens. Also the high-risk patients are the one's undergoing surgical procedures [15].

Most of the Patients in our burns ward, undergoing invasive treatments and infusion therapies through catheters are found to be victimized by the MRSA stains causing severe sepsis. As the sediment germs in the culture dishes of the stains are examined, they showed to have a notable resistance to the air and found to be present almost always during different periods of this analysis. This impelled us to perform a mapping in time of the air-patient system thought to be involved in the recirculation of pathogens, exclusive of understanding the significance of highly infectious germs even in this high environmental pathogenic charge. Misuse of antibiotics creates MRSA, a reason to cause clinical complications in admitted patients, lengthening their hospital stay and also adding the treatment costs.

During the analysis, some pathogens having varied resistance strains to disinfectants and antiseptic solutions were also observed. They included few gram negative bacterias such as Pseudomonas, E.coli, Enterobacter, Proteus, Klebsiella and Citrobacter.

Among these points of consideration, we would specially like to draw attention to Pseudomonas aeurignosa, being one of the most common pathogen causing pneumonia, sepsis and other severe infections in burn's patients[17]. The reason responsible for making it the most widespread causative agent in affecting patients is its unique structure and minimal growth requirement. It contains an extracellular protective and toxic substances, which include slime glycoprotein, haemolysin, fibrinolysin, lecithinase, elastase, DNAse and phospholipase which justifies its presence in multiple ecological niches. It also found to have ability to be resistant to most commonly used antibiotics and antiseptics[18].

A number of researches and investigations are available on this topic, but no conclusive point about mode of infection of these pathogens has been made. Researchers while studying proposed that these opportunistic organisms contaminate the hands of personnel's presumably by water splashes from sink during washing procedures[19], while some investigators suggested that pre-existing colonization in these patients is responsible for the endogenous infections by these microorganisms [20-22.]

The analysis of our research concluded that contamination of water supply and our personnel is the main route of transmission of these infections in hospitalized patients. Tap water being easily accessible is playing a vital role in this regard. Tap water especially rich with calcium or magnesium carbonate is found to be highly colonized from Pseudomonas [23-25.] The presence of this pathogen in tap water is considered as a strong evidence suggesting link between water and the patients.

Many research papers are accessible on this topic but still there is no real official support from health authorities for control of hospital acquired infections. The purpose of this paper is to alert the health policy makers, medical staff, microbiologists and other experts to judge more evidently the serious threat of nosocomial infections. There is an imperative need for active management of antibiotic usage. Proper hygiene must also be practiced by the staff members to cut off the major route of transmission of these opportunistic organisms. Appropriate nursing programs, well equipped routine microbiological screening and spread of personal awareness regarding protective measures against hospital infections is a key to minimize the risk factors. This serious issue should be given high priority and every effort should be made to reduce this problem. Only in this way this highly prevalent issue can be managed.

CONCLUSION

Staphylococcus Aureus was the major organism found. The major routes of transmission of opportunistic organisms were tap water and our staff members. Proper hygiene measures and awareness programs for the staff members should be carried out to aware them of the importance of hygiene.

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