



Full Length Research Article

EVALUATION OF COMMENSAL BACTERIAL FLORA OF HEALTH CARE WORKERS, BIO-MEDICAL WASTE MANAGEMENT AND HOSPITAL ACQUIRED INFECTIONS: A POSSIBLE LINK?

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ABSTRACT

Hospital-acquired infection (HAI) negatively impacts on patient outcomes and causes substantial additional resources to be deployed. About 25% of patients admitted to hospital and nursing homes in the country acquire hospital acquired infections

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INTRODUCTION

Hospital-acquired infections (HAI) negatively impacts on patient outcomes and causes substantial additional resources to be deployed (Vincent, 2003; Haley *et al.*, 1980). Globally there is growing concern over HAIs and the number of deaths attributed to such infections that are potentially preventable. In emerging economies like India, HAI are a major cause of death and disability for patients as per study done by WHO. Today over 1.4 billion people worldwide are suffering from infections acquired in hospitals. About 25% of patients admitted to hospital and nursing homes are affected by hospital acquired infections. (Ducel, 2002). Standard universal practices and safe disposal of Bio Medical waste (BMW) would help in reducing the burden microflora in the health care setting. However link, if any, between HAI, Health Care Worker (HCW) and BMW could help in understanding and formulating the effective prevention strategies and in subsequent reducing of the HAIs.

Aims & Objectives

The main objectives of the study were

- To determine the presence of commensals bacterial flora of and potentially pathogenic micro-organisms in the hand and nasal swabs of health care workers (HCWs).
- To establish the link between commensal bacterial flora bio medical waste management practises and hospital acquired infections
- to find out if there is any link between bio medical waste management and hospital acquired infections

MATERIALS AND METHODS

A study using a combination of microbiological techniques was conducted to see the presence of pathogens like methicillin sensitive *Staphylococcus aureus* (MSSA), methicillin resistant *Staphylococcus aureus* (MRSA), *Pseudomonas spp.*, *Escherichia coli*, *Streptococcus epidermidis*, *Klebsiella spp.*, *Acinetobacter spp.*, and vancomycin-resistant *Enterococci* (VRE) etc. that are known to cause HAI. This study was carried out as second part of an ongoing pilot study among the HCW's (both males and females) of a large, 1531 bedded, tertiary care hospital, in New Delhi, India over a period of three months from June to August 2013. Subjects were fully informed about the design and purpose of the study and a written informed consent was

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obtained. A sample size of 100 randomly selected HCWs, (consisting of doctors, nurses, undergraduate medical students, nursing attendants and sweepers in equal numbers i.e 20 from each category), working in five departments of Vardhman Mahavir Medical College and Safdarjung Hospital, (VMMC&SJH), New Delhi, were included in study. The departments included were Intensive care units (ICU's), Labor rooms, Pediatrics ward, Casualty and the Burns department. The hand and nasal swabs of the study population and swabs from the waste bin were taken, under all aseptic precautions, and transferred to a sterile brain heart infusion broth. It was then transported to the Microbiology laboratory. Here, each sample was plated within an hour on Mac Conkey's agar and Blood Agar media and then processed as per standard protocol (textbook of Microbiology, Cruikshank). The isolates were identified by standard bacteriological methods, i.e. smear examination by Grams stain, motility by Hanging drop and appropriate biochemical tests. The antimicrobial susceptibility tests were performed by disc diffusion technique and the findings were recorded.

RESULTS

A total of 100 HCWs participated in the study. Five categories of health care workers i.e. doctors, nurses, undergraduates medical students, nursing attendants and sweepers were included in studies in equal number that is 20 from each category. Hand imprints and nasal swabs of all the study subjects were taken, processed and analyzed for pathogens. Samples were also collected simultaneously from Waste bins of these wards.

Nasal Swabs

6% *Staphylococcus epidermidis* were isolated. Major pathogens isolated were Methicillin sensitive *Staphylococcus aureus* (MSSA) (63%), Methicillin resistant *Staphylococcus aureus* (MRSA) (15%) and *Klebsiella* species (14%). Some isolates of *Staphylococcus epidermidis* (6%) and *Pseudomonas* species (2%) were also found.

Hand Imprints

Major pathogens isolated were Methicillin sensitive *Staphylococcus aureus* (MSSA) (40%), *Klebsiella* 23%). The distribution of the study subjects as per the occupation and the organism isolated is shown in Table

Bio-medical waste Samples

Samples were also taken from 05 waste bins from each site in the hospital included-02 yellow, 02 blue and 01 black from each departments from where the samples of the study subjects were taken. Major pathogens isolated from the bins of the different departments were *Staphylococcus* Major pathogens isolated from the bins of the different departments were *Staphylococcus aureus*, *Acinetobacter spp.*, *Klebsiella spp.*, *Enterobacter spp.*, and *Pseudomonas spp.*

On comparison with the pathogens isolated from the hand and nasal swabs of the study subjects working in the respective

departments, it was found that the similar micro-organisms that were isolated from the waste of different departments were also isolated from the hand imprints and nasal swabs of the study subjects who were working there.

Analyzing Observational Checklist

In our hospital we follow colour coding for bio medical waste i.e. yellow, blue and black. The hospital has a waste management plan and a waste management team. The waste management team is headed by the Medical Superintendent and consists of doctors from various departments, both clinical and teaching and waste handling staff. There is also an authorization from Pollution Control Board for hospital waste management. (bhawna s et al., ?)

For waste segregation, there are different colored bins/bags kept in all the departments which are emptied regularly when they are less than 3/4th filled. There are clearly defined procedures for collection of wastes from specified units of the hospital by an external agency, appointed and selected by the government. The collection of waste from different departments is done on regular basis. The sharps are collected in puncture resistant containers. There are 12 trolleys available for internal segregated transportation. The containers are washed and disinfected after emptying. The collected waste is stored in a specified area identified specially for this purpose. They are inaccessible to unauthorized persons and animals. There is no separate storage room for radioactive waste. The untreated waste is not stored for more than 48 hours. For waste treatment, there is an incinerator, microwave, and shredder facility. There is neither any water softener nor any effluent treatment plant at our Institute. At our Institute we are only doing segregation at the point of generation and maintaining records, for final Bio medical waste disposal (incineration/ deep burial) it is given to an external agency.

DISCUSSION

The present study addressed certain aspects of HAI and the pathogens isolated from the HCW working in a tertiary care hospital and derived some equivalent and some contrasting results. In our study MSSA is the most common organism isolated from the hand and nasal swabs from study population from different wards. In a study undertaken by Paul *et al* to find out the prevalence of bacterial contamination on the hands of doctors in the Medicine and Dermatology wards of Medical College Kolkata, a tertiary care hospital, results showed that there was significant contamination of the doctors' hands at entry (59.1%) and at exit (90.9%). Overall, *Staphylococcus* species was the predominant organism (59% at entry and 85% at exit), amongst the gram negative organisms, *Escherichia coli* (4.5%), *Pseudomonas spp.* (4.5%), *Enterococci* (13.6%) and *Klebsiella spp.* (9%) were the main isolates. (Paul *et al.*, 2011). In another study by Pittet *et al*, Gebreyesus A *et al*, showed that hand flora from the health care workers can significantly transfer the pathogens to patients and the carriage rate was higher among nurses and doctors. (Pittet *et al.*, 2006; Gebreyesus *et al.*, 2013) These findings are similar to our study. In present study MSSA is followed by MRSA, *Klebsiella spp.*,

Pseudomonas spp., *Acinetobacter spp.* and *Enterobacter spp.* MSSA was most commonly isolated from the hands of doctors and was least common from nursing staff. MSSA was the most common pathogen isolated from the nasal swabs of the study population followed by MRSA, *Klebsiella*, *Pseudomonas* and *Staphylococcus epidermidis*. It can also be linked to the pathogens isolated from hand imprints since almost same pathogens were isolated both from hand imprints and nasal swabs (Iskandar *et al.*, 2009). It can be implied that many common pathogens isolated from the patients' samples are similar to the hand and nasal swab samples of the HCWs. HCWs can transmit these pathogens to the patients during their management. So, to prevent the hospital acquired infection regular reinforcement and teaching of HCWs regarding hospital infection prevention, bio medical waste management and safety is necessary.

Major pathogens isolated from the bins from the different departments were- *Staphylococcus aureus*, *Acinetobacter spp.*, *Klebsiella spp.*, *Enterobacter spp.*, and *Pseudomonas spp.*, which were similar to the pathogens isolated from hand and nasal swabs. From the above observations it was construed that there could be a link between the microflora isolated from HCWs, patients having HAI and the waste areas. A study conducted at Department of Environmental Health, School of Public Health, Seoul National University, Seoul, Korea for detection and hazard assessment of pathogenic microorganisms in medical wastes showed a number of (opportunistic) pathogenic bacteria, including *Pseudomonas spp.*, *Lactobacillus spp.*, *Staphylococcus spp.*, *Micrococcus spp.*, *Kocuria spp.*, *Brevibacillus spp.*, *Microbacteriumoxydans*, and *Propionibacterium acnes*, all capable of causing HAI (Park *et al.*, 2009). A study conducted by School of Science and Technology, University of Northampton, Northampton NN2 6JD, UK suggests that when the waste is properly contained and managed, it should not pose a significant risk in terms of the spread of the four bacteria namely: methicillin resistant *Staphylococcus aureus* (MRSA), methicillin sensitive *Staphylococcus aureus* (MSSA), *Clostridium difficile* (*C. difficile*) and vancomycin-resistant *Enterococci* (VRE) (Tudor *et al.*, 2010). Thus, medical waste should be carefully controlled and monitored to prevent HAI/ nosocomial infection associated with the exposure to these wastes.

The data collected from the observational check list showed that adequate amount of facilities are present at the institution for the proper management of hospital waste. Results of the survey showed there are appropriate practices when it comes to the handling, storage, and disposal of wastes (which is outsourced to an external agency) generated in comparison to the hospitals in Andhra Pradesh, Maharashtra and Uttar Pradesh. A study conducted at these states to check for waste management awareness and practices showed that there were gaps in segregation and use of colour codes. Dumping biomedical waste on the roads outside the hospital is still prevalent in many parts of the country and access to Common Waste treatment facilities is still limited. Surveillance, monitoring and penal machinery was found to be deficient and these require strengthening to improve compliance with the Bio-medical Waste Management Rules and safeguard the

health of employees, patients and communities from several states of the country (Hanumantha Rao, 2009). In the present study, there are defined methods for handling and disposal of these wastes, starting from the personnel responsible for collection, through those who transport the wastes to the disposal site. Moreover, there are specific regulations / guidelines for segregation of wastes.

On the basis of the present study, it is recommended that an already existing CME and training programme of our institution needs to be further strengthened through repetitions, role-plays, sub-teaching, hauling with negative and positive incentives by managers of health-care. A mass drive launched by the Health care facilities to generate awareness regarding serious environmental and health hazards of bio-medical waste at all levels has invariably been shown to be of significant use. All measures should be adopted to inform the HCWs about legislation regarding bio-medical waste management. Workshops, seminars, exhibition etc. must be organized from time to time with representatives from various units related to bio-medical waste management. Information about the risks linked to health care waste can be displayed by poster exhibitions in hospitals, at strategic points such as waste bin locations, giving instructions on waste segregation. These posters should be explicit, using diagrams and illustrations to convey the message that could be understood by all HCWs as well as general public who make regular visits to health care establishment. All the Government agencies and private health care facilities, local help groups and general public should work together to find a proper bio-medical waste management and handling procedures, which should be in accordance with the spirit of Bio-medical waste (Management & Handling) Rules, 1998. Bio-medical waste management programme or HAI cannot successfully be implemented without the willingness, devotion, self-motivation, cooperation and participation from all sections of employees of any health care establishment.

Conclusion

Commensal bacterial flora of HCWs Can be possibly linked to improper waste management practises which is also linked to hospital associated infections. These possible linkages can be addressed by following recommendations of hospital infection committee and Bio medical waste management team. Presence of pathogenic organisms in the hands of HCWs was a manifestation of poor compliance of Bio medical waste management hospital acquired infection control practices. Possibility of link between these three can be further confirmed by doing a larger epidemiological studies. Molecular biology and demographics would prove the role of flora of health care workers, Hospital acquired infections and Bio Medical Waste management practises. This study can be treated as indicator study; a larger population study is needed before confirming the possible link between above three parameters.

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