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Original Research Article

Operation Theatre Foot Wear (OTFW): A Potential Source of Health Care Associated Infections (HAI).

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Abstract: **Background**-.Surgical site infection is one the most common cause of increased morbidity and mortality among patients. Various factors can be responsible for such infections. There have been evidence in the past showing relation between items such as drapes and surgical gowns with post-surgical infections .Operation theatre footwear (OTFW) are often one of the most neglected items that are regularly worn in the operation theatre and are often contaminated with blood .Operation theatre foot wear (OTFW) contaminated with potential nosocomial pathogen are increasingly recognized as possible source of health care associated infections (HAIs). Aim of the present study is to assess the microbial contamination in the OTFW. **Materials & Method**- All the staff members posted in all major OTs of a tertiary care hospital were included in the study. Total 140 samples were obtained, out of which 70 samples were taken from OTFW while 70 samples were taken from sole of the staff members wearing OTFW. Two sterile swabs were used to collect sample, one swab was used to take sample from the OTFW surface and sole, while other swab was used to take sample from sole of the person wearing OTFW. Before sample collection sterile swab was moistened using normal saline and swab was rolled gently over surface and sole of OTFW, while second swab was gently rolled over the sole of the staff member wearing OTFW.Both the swabs were inoculated separately on culture media like blood agar and Mac Conkey media. These culture plates were incubated at 37^0C for 18-24 hours, after which growth was noted. Further identification was done using standard protocols. **Result**- out of 70 OTFW 24 (34.3%) were blood stained while 46 (65.71%) were not blood stained. Bacteria isolated from OTFW were predominantly Gram positive cocci that were 59 (84.3%) while gram negative bacteria were 11 (15.71%). Among gram positive cocci most commonly isolated were 49 CONS (70%) followed by eight Staphylococcus aureus (12%) and two Streptococci species (3%). Among Gram negative bacteria seven Pseudomonas aeruginosa (10%) were commonly isolated from OTFW followed by three Citrobacter species (3%) and one E. coli (2%).Out of 70 swabs taken from the soles of persons wearing these OTFW, 52 Gram positive bacteria (74.3%) were most commonly isolated as compared to Gram negative bacteria. Among gram positive bacteria (n=52) CONS 24 (46.2%) were most commonly isolated followed by 12 Staphylococcus aureus (23.07%), 10 Bacillus species (19.23%) and 6 Diptheroids (11.53%). Among gram negative bacteria (n=18) 12 Pseudomonas aeruginosa (66.66%) followed by six E.coli 6 (33.33%).

Keywords: Operation theatre, operation theatre footwear, health care associated infections, Coagulase negative Staphylococcus aureus.

INTRODUCTION

Post-operative infections are most common cause of increased morbidity and mortality among patients and are often associated with increased stay in hospital and economic burden on the patient (Herruzo-Cabrera, R. *et al.,* 2004; Mathur, P. *et al.,* 2012). Health care associated infections (HAI) are very commonly encountered among these patients and are often associated with infections with multi drug resistant bugs which results in limited therapeutic options for treatment (Ayelife, G.A.J. 1991). Operation theatre (OT) is one of the most important area of the hospital where various efforts are taken from the staff members to keep the area fully sterile in order to prevent post-operative infections. Not only the operation theatre but also the instruments and devices used during surgical

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procedure, drapes and surgical gowns can all contribute to post-surgical infections (Ayelife, G.A.J. 1991). There has been evidence in the past showing relation between these items with post- surgical infections. Operation theatre footwear (OTFW) is often one of the most neglected items that are regularly worn in the operation theatre and are often contaminated with blood and microbes. Operation theatre foot wear (OTFW) may serve as potential source of health care associated infections (HAIs). Aim of the present study is to assess the microbial contamination in the OTFW.

MATERIALS & METHOD

The study was conducted between Dec 2015 to Feb 2016 at a tertiary care teaching hospital. The study was cross sectional observational study. The permission for the study was obtained from institutional ethical committee (IEC). All the staff members posted in all major operation theatres (OTs) of a tertiary care hospital were included in the study. The staff comprised of doctor's, interns, nurses and cleaners. All the staff member were explained about the study and its importance in the local language and written consent was taken from the staff before sample collection. Total 140 samples were obtained, out of which 70 samples were taken from OTFW while 70 samples were taken from sole of the staff members wearing OTFW. Two sterile swabs were used to collect sample, one swab was used to take sample from the OTFW surface and sole, while other swab was used to take sample from sole of the person wearing OTFW. Before sample collection sterile swab was moistened using normal saline and swab was rolled gently over surface and sole of OTFW, while second swab was gently rolled over the sole of the staff member wearing OTFW.

After sample was taken, both the swabs were transferred to two different sterile test tubes and transported to Microbiology department for further processing. Both the swabs were inoculated separately on culture media like blood agar and Mac Conkey media. These culture plates were incubated at 37^0 C for 18-24 hours, after which growth was noted. Further identification was done using standard protocols.

As the study was a pilot study done in the institute so all the staff members posted in various major OTs between Dec 2015 to Feb 2016 were included in the study.

Inclusion criteria: All Doctors, interns, nursing staff and cleaners posted in major OTs in the defined period.

Exclusion criteria: Staff members with any lesion on the foot. Staff members not interested to take part in the study was excluded from the study. Data was analyzed using Microsoft Excel 2010.

RESULT

Out of 70 OTFW 24 (34.3%) were blood stained while 46 (65.71%) were not blood stained. Bacteria isolated from OTFW were predominantly Gram positive cocci that were 59 (84.3%) while gram negative bacteria were 11 (15.71%). Among gram positive cocci most commonly isolated were 49 CONS (70%) followed by eight Staphylococcus aureus (12%) and two Streptococci species (3%).Among Gram negative bacteria seven Pseudomonas aeruginosa (10%) were commonly isolated from OTFW followed by three Citrobacter species (3%) and one E. coli (2%).

Out of 70 swabs taken from the soles of person wearing these OTFW, 52 Gram positive bacteria (74.3%) were most commonly isolated as compared to Gram negative bacteria. Among gram positive bacteria (n=52) 24 CONS (46.2%) were most commonly isolated followed by 12 Staphylococcus aureus (23.07%), ten Bacillus species (19.23%) and six Diptheroids (11.53%). Among gram negative bacteria (n=18) 12 Pseudomonas aeruginosa (66.66%) followed by six E.coli 6 (33.33%). As shown in table-1. OT Staff Distribution shown in table-2.

Table-1 Showing distribution of organisms isolated from OTFW & sole of OT Staff

ORGANISMS	OTFW (n=70)	OTStaff member soles (n=70)
CONS	49 (70%)	24 (46.2%)
Staphylococcus aureus	08 (12%)	12 (23.07%)
Streptococcus species	02 (3%)	-
Bacillus species	-	10 (19.23%)
Diptheroids	-	06 (11.53%)
Pseudomonas aeruginosa	07 (10%)	12 (66.66%)
Citrobacter Species	03 (3%)	-
E.coli	01 (2%)	06 (33.33%)

Table-2 OperationTheatre Staff distribution

Staff	TOTAL (n=70)
Doctors	25 (36%)
Interns	12 (17.14%)
Nursing staff	23 (33%)
Cleaner	10 (14.3%)
Total	70

DISCUSSION

Operation theatre foot wear (OTFW) serves to protect wearer from exposure to blood or any other body fluids by patient undergoing surgical procedure. OTFW can serve as potential source of HAIs as there have been reports that have shown survival of bacteria on inanimate objects for many weeks (Kramer, A. *et al.*, 2006). Floor bacteria have been shown to account for up to 15% of airborne CFU with walking contributing to their re-dispersal from floor to air (Wiley, A.M., & Barnett, M. 1973). Disinfection of hospital ward and

OT floors demonstrated only temporary benefits with rapid re-colonization (Nelson, J.P. *et al.*, 1973), which highlights the need to prevent re-contamination from air, shoes and other objects.

In the present study known HAI pathogens were isolated; this finding is concordant with the findings of Nwankwo *et al.*, (2014) and Whyte, w. (1988).

CONS (Coagulase negative Staphylococcus aureus) is the most commonly isolated organism from OTFW as well as sole of the staff wearing the OTFW accounting to 70% and 46.2% respectively, followed by Staphylococcus aureus which is isolated from 12% of OTFW and 23.07% from soles of the staff wearing OTFW. There are no studies in which co-relation of micro flora of OTFW and sole of the staff wearing the OTFW is done, however studies done by Nwankwo *et al.*, (2014) and Whyte, w. (1988) shows that CONS and Staphylococcus aureus are most commonly isolated from OTFW.

In the present study among gram negative bacteria Pseudomonas aeruginosa is the most common organism isolated from 10% OTFW and soles of the staff 66.66% wearing these OTFW followed by Citrobacter species and E.coli. All these gram negative bacteria are known causes of HAIs and hence regular surveillance needs to be done to find out the co-relation between micro flora of the OTFW and soles of the staff with HAIs as the literature is scarce to draw any conclusion.

Presence of OTFW with bacterial contamination in major surgeries like open heart surgery or total hip arthroplasty where air borne contamination can be possible route of transmission of nosocomial pathogen while walking may lead to fatal infections that may put life of the patient at risk. In the present study we have isolated CONS, Staphylococcus aureus, Streptococcus spp, Bacillus spp and Diptheroids from OTFW. All these organisms have shown to cause post- surgical infections like lower limb arthroplasty infections etc (RitterM, E. H.E. *et al.*, 1980; Ritter, M.A. 1999; Al- Maiyah, M. *et al.*, 2005 & Copp, G. *et al.*, 1987).

CONCLUSION

The present study supports use of OTFW with regular surveillance on the methods of cleaning of OTFW and maintenance of OT sterility. In the present study we have demonstrated the presence of pathogenic bacteria on OTFW and sole of staff member wearing these OTFW which can be a potential source of HAIs, however further studies need to be done for reaching any conclusion in the role of OTFW and staff sole in spread of HAIs.

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