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Study of risk associated with cross-infection in different occupational and routine public places

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ABSTRACT

A total of fifty samples were selected to study cross-infection among different occupational workers and public dealing places, of which forty-four samples were randomly selected from peoples engaged in different occupations, four samples from public urinals and two samples from the keyboards of public dealing places. It was reported that out of the fifty samples, thirty-three samples were found positive for growth of mixed colonial morphology of microorganisms on nutrient agar and blood agar media. Nineteen samples showed positive growth out of 34 samples taken from intact hands, all the six samples showed positive growth taken from infected hands and three out of four samples showed positive growth from injured hands. Further, all the four samples taken from public urinals showed profuse growth with different colonial morphology and one sample showed characteristic growth from the two keyboards samples.

Keywords: *Cross infection, Growth, Microorganisms*

1. INTRODUCTION

Some microorganisms are potential pathogenic that can easily relocate between different species of animals, plants, and humans. They can cause insignificant to major infectious diseases. A number of investigations had been done on the mode of transmission and cause of cross-infection of potential pathogens using specific or non-specific techniques which detects different pathogenic microorganisms. (Crossley and Peterson 2000).

Human body inhabits numerous microorganisms which can become pathogenic or non-pathogenic depending on the favorable conditions. For example, *Vibrio cholerae* causes diarrhea when it relocates in the human intestinal tract and *Staphylococcus spp.* is often occurs as normal flora of humans (on skin etc.), but can produce a wide range of infections. Further, the bacterial species live as non-pathogenic on one species will act as pathogenic for another species e.g., *Escherichia coli* and *Pseudomonas spp.* are normal flora of some birds can become pathogenic in humans and some animals. (Todar 2005)

The microorganisms are capable to survive for long period on hands or any other surface until washed by soap, antiseptic solution or disinfectant. It is possible that infectious germs can spread through sneezing, coughing, rubbing the eyes or using urinals/toilets and thus transfer to other family members or friends. (e.g., the sharing of hand, toothbrush, towels, gloves, mobiles, computer, vehicle, clothes, tap, washrooms, seats, TV remotes, cleaning objects like duster, etc.). Measles, Chickenpox and other viral or bacterial infections like Tuberculosis can spread through aerosol containing an infectious agent. The parasitic infection (e.g. *Giardiasis)* can spread through the infected soil to the mouth by direct or indirect contact. (Bjorksten 2006; Rodney 2001)

There are many investigations available to detect diversely present microbes. These investigations involve classical as well as rapid detection techniques (qualitative and/or quantitative). These procedures may take some minutes to more than 24 hours depending upon the technique used for identification. In microbiological investigations, biochemical tests are also available for qualitative identification. The commercial kits are available for quicker results. For isolation and identification, we need to send a suspected specimen of soil, water, swab or any object under specific terms and conditions to the laboratory or diagnostic centers. (Kiviharju et al 2008)

In this investigation, we used a simple classical standard plating technique to get an estimation of bacterial value from routine sites.

2. MATERIAL AND METHODS

2.1 Place of the experiment: All the work was carried out at KDC (KALRA DIAGNOSTIC CENTRE), Ludhiana (India). The study was done during the summer season. Samples were taken from occupational workers (intact, injured and infected hands), public urinals and keyboards.

2.2 Media preparation: Two media, Blood agar medium (readymade from Himedia) and Nutrient agar medium were used. The Nutrient Agar medium preparation is given below.

2.3 Preparation of nutrient AGAR

MEDIUM COMPOSITION

Peptone: 0.5%
Beef extract: 0.3%
Sodium Chloride: 0.5%
Agar: 2.0%

Preparation of nutrient AGAR Plates:

1. All materials were mixed together which were in powder form.
2. A twenty-eight gram of all components was suspended in 1 liter of lukewarm distilled water in borosilicate glass flask.
3. pH was adjusted to neutral (6.8 to 7.0) at 25 °C.
4. The mixture was heated to fully dissolve all components.
5. The dissolved mixture was autoclaved at 121°C for 15 minutes followed by plugged with help of cotton and gauze.
6. Once the nutrient agar autoclaved this flask was kept in a water bath under Temperature between 55 to 60°C
7. Nutrient agar was poured into Petri plate by following aseptic conditions near the flame.
8. Plates were placed on the sterile surface until the agar solidified under room temperature.

2.4 Sample collection: A total of 50 samples were selected for the experiment after scrutinizing the ware and tare of the samples. Out of fifty samples, forty-four samples were randomly selected from hands of peoples engaged in different occupations, four samples were selected randomly from public urinals and two samples were selected from the keyboards of public dealing places. Samples taken from hands were categorized into three types-Intact hands, infected hand, and injured hands. Among forty-four samples, thirty-four samples were taken from intact hands, four samples were taken injured hands and six samples were taken from nearby sites of the infected hands of the first-hand patient resisted cleaning and disinfection or dressing.

2.5 Procedure: The samples were taken randomly from different sites on the hand, keyboard, and urinals. A sterilized swab was rubbed on the hands, the inner side of the urinals, the surface of keyboards with the help of sterilized normal saline solution, that swab was directly inoculated on nutrient agar medium. The plates were incubated overnight after quality control and sterility check. All the samples were processed within 30-60 minutes after collection. Growth and number of colonies were observed and recorded by standard plate count method.

3. RESULTS AND DISCUSSION

All the samples were selected from the nearby regions of Ludhiana (Punjab). A total of 50 samples were selected for the experiment. Out of fifty samples, forty-four samples were randomly selected from peoples engaged in different occupations, four samples were selected randomly from public urinals and two samples were selected from the keyboards of public dealing places.

The results obtained after inoculation of the samples on media were given below in tabular form (Table-1).

Table 1: Estimation of bacterial value from different samples on media

S. No.	Growth	Collection site	S. No.	Growth	Collection site
1	+	Intact hand	11	-	Intact hand
2	-	Intact hand	12	+	Infected hand
3	+	Intact hand	13	-	Intact hand
4	+	Intact hand	14	+	Infected hand
5	+	Injured hand	15	+	Infected hand
6	+	Injured hand	16	+	Urinal
7	+	Intact hand	17	+	Urinal
8	-	Intact hand	18	+	Urinal
9	+	Infected hand	19	+	Urinal
10	+	Infected hand	20	+	Intact hand

21	+	Intact hand	36	-	Intact hand
22	+	keyboard	37	-	Intact hand
23	-	keyboard	38	+	Intact hand
24	-	Intact hand	39	+	Intact hand
25	-	Intact hand	40	+	Intact hand
26	+	Intact hand	41	-	Intact hand
27	+	Infected hand	42	-	Intact hand
28	+	Intact hand	43	-	Intact hand
29	+	Intact hand	44	+	Intact hand
30	+	Intact hand	45	+	Intact hand
31	-	Intact hand	46	-	Intact hand
32	+	Intact hand	47	-	Injured hand
33	+	Intact hand	48	+	Injured hand
34	+	Intact hand	49	-	Intact hand
35	-	Intact hand	50	+	Intact hand

- Results given in the table are average of triplicate
- + sign indicates the number of colonies was between the range of 10-300 cfu/ml

It was found that out of the fifty samples, thirty-three samples were found positive for bacterial growth on nutrient and blood agar media thus make about 66% positive growth (figure 1). Nineteen samples showed positive growth out of 34 samples taken from intact hands, all the six samples showed positive growth taken from infected hands and three out of four samples showed positive growth taken from injured hands. Further, all the four samples taken from public urinals showed profuse growth with different colonial morphology while only one sample showed individual colonial growth from the two keyboard samples. (Figure 2, Table 2).

Table 2: Enumeration of growth of the swab samples on media

S. No.	Type of samples	Total of number samples screened	Positive growth	Negative growth
1	Intact hands	34	19	15
2	Infected hands	6	6	-
3	Injured hands	4	3	1
4	Urinals	4	4	-
5	Keyboards	2	1	1
Total number of samples screened		50	33	17

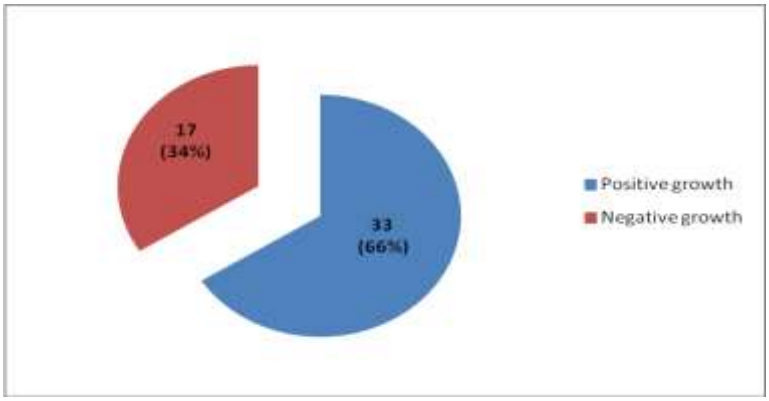

Fig. 1: Percentage of positive and negative growth of swab samples

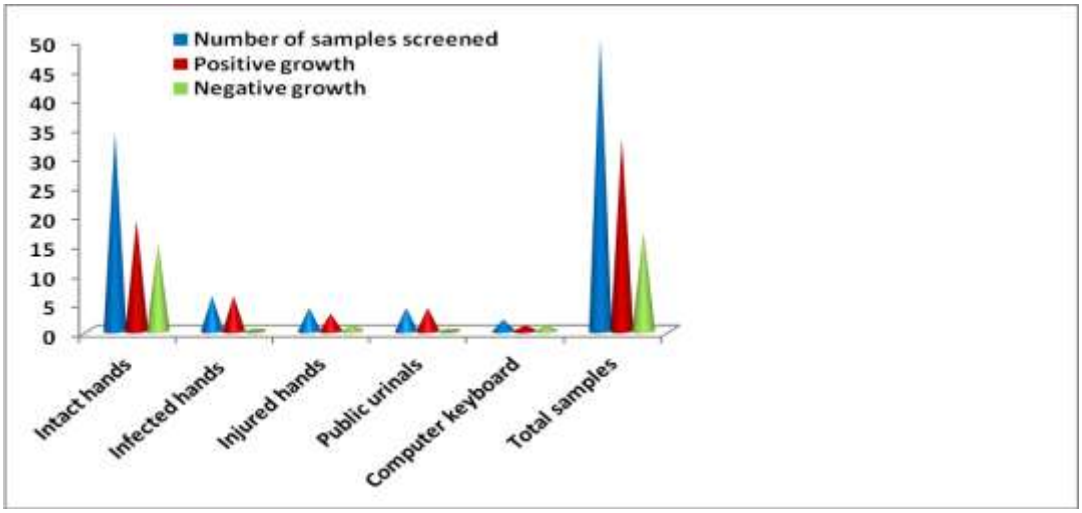

Fig. 2: Comparison of positive and negative growth with the total number of swab samples

Fig. 3: Nutrient Agar plate showing bacterial growth

On nutrient agar medium (Fig. 3) white, round, transparent or other types of colonies are bacterial growth. These colonies could be pathogenic or non-pathogenic. Because these colonies are a replica of what was present on hands, keyboards, urinals, that means, it might be possible that the growth present on the surface of hands, keyboards etc., is pathogenic, then we are under risk of getting an infection if we do not wash hands and vice versa. So, it is advocated to wash hands properly before taking and preparing the food.

It is seen that sometimes people do not wash their hands after urinating when they are on a journey or some other places where they do not get any soap or another antimicrobial agent easily catch an infection from contaminated locale objects. As an example, Viral gastroenteritis disease caused by Norovirus is most commonly affect humans of all ages, transmitted to the people who do not wash their hands and further spread very quickly within large groups of people in a few quarters of time to entire households or offices and to stop viral gastroenteritis infection, hand hygiene followed by body hygiene is the best way to get rid of the problem. Likewise, other infections are there which easily spread to people among the gathered mob. Some microorganisms are opportunistic pathogens such as *Pseudomonas aeroginosa*, *Streptococcus pneumonia, Clostridium difficile*, *Candida albicans* cause infection under favorable conditions for them to proliferate provided the host has low or lost immune power or in the condition where the first line defense of the host has been shattered. (Hartnell et al 2012; Pirofski and Casadevall (2012; Su et al 2003; Witt and Hart 1990)

The use of any sanitizer or any anti-microbial soap after hand sharing is good practice to reduce cross infection but sanitizers are not always fully effective for all type of infections like a virus and some fungi or bacterial pathogens. (Reynolds et al 2006)

The pyogenic pathogens (*S. aureus*, *Pseudomonas spp.* etc.) can transfer infection very easily through small injuries on hands. Sometimes, wounds transform into gangrene over time and may become a source of cross infection. Even unaided hug of an infected partner may cause transfer of fungal infections through contact of skin viz., dermatophytosis. Some infection may transfer while kissing between partners. Further, One infected person may spread infectious particles into the whole water pool during swimming thereby easily spread major pathogens. If infected food preparer did not wash their hands, can transfer infection to others through their unclean hands. Raw food or undercooked meat infected with bacteria or parasite potentially transfer infection to the peoples. e.g., neurocysticercosis by cauliflower or pork. (Montano et al 2005; White 2000; Monina et al 2007).

4. CONCLUSION

Maintenance of hygiene is the foremost habit to control cross infection among different occupational as well as domestic households. So, it is always advocated to maintain proper hygiene by the apposite washing of hands either with antimicrobial soaps or some other antimicrobial agents as a simple most effective way to control cross infection and nosocomial infections.

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