

Isolation and Identification of Microbes Causing Urinary Tract Infections from Hands and Mobile Phones

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Abstract

Background: Hands and cell phones are the major source of cross-transmission of urinary tract infections. The aim of our study was to isolate, identify and evaluate Gram-negative bacteria from them.

Method: This study was conducted in visiting area of Civil Hospital Karachi, Pakistan. Analysis was done by 50 wet sterile cotton tipped swabs, 25 each from mobile phones and hands of their owners. Samples were transported in a Cary Blair transport media. Swabs were streaked on Nutrient agar, Blood agar and Macconkey agar. Organisms were identified by cultural, biochemical and microscopic characteristics. Frequency of bacterial species observed was evaluated.

Results: A total of 25 samples were collected from cell phones, out of 3 samples were positive cell phones were collected from 50 persons having age between 28 to 43 and standard deviation 14.8052 ± 22.222 rang. Rate of bacteria found *Serratia* (24%), *E. coli* (24%), *Pseudomonas* (12%), *Klebsiella* (12%), *Shigella* (8%) and *Proteus* (12%). While cell phones were contaminated by *E. coli*, *Klebsiella* and *Serratia* with percentage of 54, 31 and 15 respectively.

Conclusion: Mobile phones and hands are reservoir of pathogenic organisms. Patient attendants in hospitals and visitors are more susceptible to nosocomial infections through exchange of mobile phones as their hands and mobile phones were contaminated by microbes causing urinary tract infections. To prevent infectious diseases hospitals should have enough outlets for washing hands with an ample supply of water. Hygienic practice of keeping hands clean and frequent mobile disinfection practices may help to break transmission cycle of pathogenic bacteria.

Keywords: Urinary tract infections; Gram negative bacteria; Nosocomial infections; Disinfection practices

Introduction

It is an indisputable fact that infectious diseases are increasing day-by-day. In poor agricultural countries, patients of over 25% suffer from nosocomial infections. On the other hand, around 100,000 fatalities occur in U.S hospitals, as they are responsible for 1.7 million infections. It is certainly true that standard infection control instructions would be useful against one third of such infections [1,2].

Cellular appliance has become one of the most crucial supplements of executive and communal life undoubtedly; it has made a tremendous impact on our lives in this rapidly changing world. It is used as a fundamental source of communication by affluent societies to low income earner [3].

Furthermore, people who are in hospitals as attendants are more frequent to diseases and their mobile phones are more susceptible to contamination as their hands are contaminated because many people do not contemplate personal cleanliness and multiple users operate a single phone. This cross use of the phone by many users reveals it to a group of microorganisms [3]. These organisms are ubiquitous and find their ways into the phones through the skin. This is inevitability that some bacteria are the part of normal flora of the skin [4]. All microbiologists states that grouping of continuous handling by the phones creates a prime breeding ground for many microorganisms that are normally found on the skin. *Staphylococci*, particularly *Staphylococcus epidermidis* are members of the normal flora of the human skin, respiratory and gastrointestinal tracts [5].

Hands and mobiles are thought to be a great source of infection that is why they were chosen for the collection of samples. Samples

were collected randomly from the visiting area of Civil Hospital including patients and their visitors. Civil hospital is located in the working area of city, the roads around it are always busy with traffic. As people keep their cell phones with them, their cell phones get exposure to the polluted environment. In addition, it is among the largest and economical hospitals of Karachi, for this reason it is preferred by a vast majority of people. Mostly socio-economic people come here as they are served at a very low cost. However, unfortunately, sanitary rules are not applied here. The lack of availability of cleaning guidelines led to nosocomial infections simply. Hands act as a route of transmission of several infections as UTI. Many people show idleness in washing hands. A very few people are aware of the sanitary practices. Even medical staff show carelessness and treat patients with contaminated hands. As patients are already immunocompromised, they are more prone to get infection easily [6-8].

The Gram negative rods isolated from hands and mobile phones are all responsible for urinary tract infections. Unfortunately, in a country like Pakistan, personal hygienic rules are not followed. A common

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example is hastiness in washing hands after using washroom. The organisms like (*E. coli*, *Klebsiella*, *Serratia*, *Proteus*, *Pseudomonas* and *Shigella*) are transmitted from hands to mobiles and vice versa [9-11]. They are responsible for many infectious diseases like UTI (Urinary Tract Infection). Their presence in samples might be due to the mobile phones are used routinely all day long but not cleaned properly. People may do not wash their hands as often as they should. The aim of the present study was to evaluate the role of mobile phones and hands in transmission of bacteria (Figures 1 and 2).

Methods

The samples were collected aseptically with wet sterile cotton swab sticks dipped in Cary Blair transport media. The samples were taken from the mobile phones and hands (25 devices and 25 hands) from the waiting area of civil hospital, Karachi. Each swab was streaked on nutrient, blood and Macconkey agar. The plates were incubated at 37°C for 48 hours and observed for colonial characteristics. Bacteria were identified by their morphological and biochemical characteristics [12]. Gram staining was done for further recognition [13]. Biochemical reactions were done to verify each bacterial isolate by doing TSI, Citrate and Oxidase for the identification of Gram-negative bacteria [13] (Tables 1 and 2).

A total of 25 samples were collected from cell phones, out of which 3 samples were positive in this study, samples from hands and cell phones were collected from 50 persons having age between 28 to 43 and standard deviation rang 16.67 ± 9.266 .

Results

The test was run Kolmogorov Smirnov Test (K-S test) for normality statistic is 0.25312 the p-value was 0.53144 our data is normally distributed and significant. People were allocated in two

Bacteria isolated from hands	
Bacteria	% Count
<i>Serratia</i>	32
<i>E-coli</i>	24
<i>Klebsiella</i>	12
<i>Pseudomonas</i>	12
<i>Proteus</i>	12
<i>Shigella</i>	8

Table 1: Bacteria isolates from hands.

Bacteria isolated from mobile phones	
Bacteria	% Count
<i>E-coli</i>	54
<i>Klebsiella</i>	31
<i>Serratia</i>	15

Table 2: Bacteria isolates from mobile phones.

groups, those (35 patients) suffering from minor illnesses like diarrhea, urine infections and vaginal infections and those who were just patient attendants. Thirty eight were males. *E. coli* was detected in hands and cell phones of 6 patients having urine infection. Only one patient attendant had *E. coli* in his cell phone. *Serratia* was detected in hands and phones of 2 patients with urine infection. Hands of 5 patient attendants were contaminated with *Serratia*, however their cellular device showed no bacterial contamination. *Shigella* was isolated only in hands of 2 patients having diarrhoea. Hand and cell phones of 3 patients with urine infection showed colony of *Klebsiella* while only cell phone of 1 patient attendant had growth of *Klebsiella*. Hands and cell phones of females with vaginal infection showed growth of *Proteus* (3 females) and *Pseudomonas* (3 females) all data was analysis by spss version-11.

Discussion

Nosocomial infections continue to pose risks of increased mortality and morbidity rate in patients. The hands of Healthcare Workers (HCWs) play an important role in transmission of infections [8]. The mobile phones of HCWs seed many harmful pathogens, which act as a pool for nosocomial infections [14]. Thus, the etiological agents of nosocomial infections have found a significant way to spread in our hospitals. Mobile phones appear in direct touch with the hands, face, and act as a prepared site to inhabit various microbes.

Klebsiella, a Gram-negative rod, member of family *Enterobacteriaceae*, is a normal flora of human mouth, skin and intestine. People touch these body parts and then use their mobile phones with contaminated hands. That is how infection occurs.

E. coli is another Gram-negative rod, which is a normal flora of lower intestine. It causes diseases like diarrhea, abdominal cramping and nausea. It reaches our food through contaminated hand as its route is fecal-oral.

Serratia is another Gram-negative rod from a family *Enterobacteriaceae*. The most common species in the genus is *S. marcescens*. It causes nosocomial infections as it has a propensity to populate the respiratory, urinary tracts, and causes infection of eyes, blood and wounds. It can transfer by contaminated persons, medical devices, and direct contact to mucous membrane.

Serratia is also found in plants and animals. As it is very common, here that people pluck flower and leaves, touch domestic animals, and do not wash their hands. So, in this way *Serratia* causes contamination

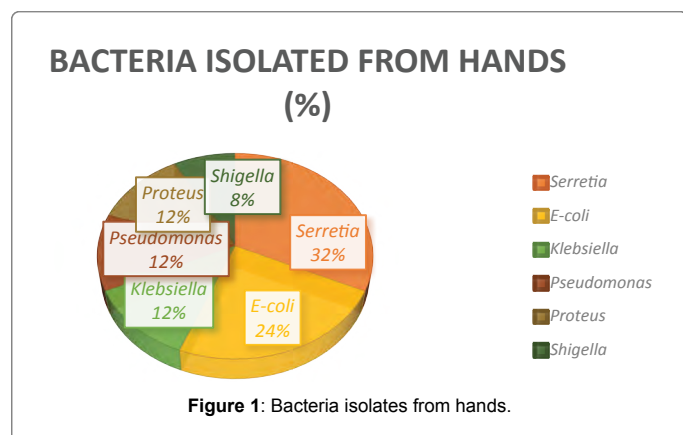


Figure 1: Bacteria isolates from hands.

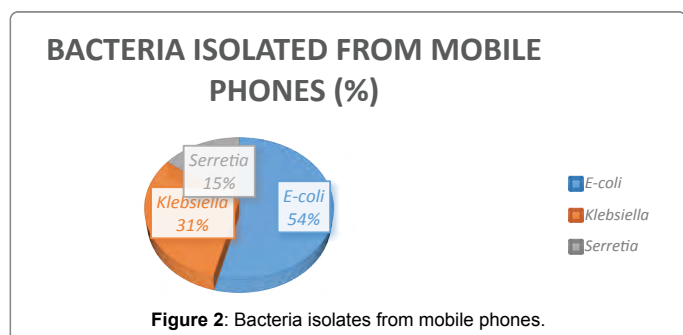


Figure 2: Bacteria isolates from mobile phones.

of hands. *Serratia* infections are related to hospitalization, likewise, invasive procedure such as intravenous catheterization, respiratory intubation and urinary tract manipulation.

Pseudomonas has an incredible ability to stay in hospital domain. It can cause pneumonia, diarrhea, enterocolitis, enteritis, meningitis etc. It contaminates respiratory therapy and anesthesia equipment, intravenous fluids and even distilled water. It also has a capability to survive in disinfectants, as it grows in hexachloroform containing soap solution, in antiseptics and in detergents. Its presence in wound site causes contamination of hands when a person itches that site.

The four Fs, fingers, flies, food and feces by contaminated water and polluted environment normally transmit *Shigella*. Our study reveals that *Shigella* is found in contaminated hands.

Proteus species are the root of hospital-acquired infections, for instance, urinary tract, wounds and burns etc Towards Europe; it is the second most commonly isolated bacteria after *E. coli*.

Hence, we are exposed to these types of organisms, which are very harmful for us. The most critical place for patients is hospital whilst numerous microbes grasp it. Microbiological standards in hygiene are obligatory for a healthy life, especially people present in hospitals, as visitors are very incautious about their hygiene. They do not wash their hands properly and then use mobile phones with contaminated hands. Therefore, organisms are transferred from hands to mobiles and infections occur when that contaminated mobile is used.

The major preventive effort should be taken by visitors is hand washing, so the bacteria will not transfer from their hands to mobiles. Awareness programs should be started so that people realize how to care themselves while in a hospital. Infections can be restricted by taking preventive steps.

Conclusion

Hands and mobile phones are vehicles of transmission of infectious diseases due to the nullifying of sanitary rules. Strict health hygiene should be practiced for prevention. Hands should be properly washed. Developing active preventive strategies like routine decontamination of mobile phones with alcohol containing disinfectant material might be effective in reducing cross infection. Another way to reduce bacterial contamination on mobile phones might be the use of antimicrobial additive materials. We can easily avoid spreading bacterial infection just by using regular cleansing agent and rearranging our environment.

Declarations

Conflict of interest: None to declare.

Ethics approval: Attested.

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Patient consent

Attested.

Availability of data and materials

All data generated or analyzed during this study are included in this article.

Authors' contributions

This study was directed and supervised by Dr. Nafisa Hassan Ali, Anum Liaquat Ali, Afia, and Tahira, had a major role in collection, analysis and interpretation of data. Anum and Umrah wrote the manuscript. All authors read and approved the final manuscript.

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