Antibiotic susceptibility pattern of *Staphylococcus* species isolated from telephone receivers

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ABSTRACT

Introduction: Microorganisms are transferred to everyday objects from the environment and infected individuals. Pathogenic microbes are transmissible from the air, skin, hands and other interpersonal contacts and cause diseases most of the time. This study centres on the microbial assessment of telephone receivers, their ability to transfer bacterial infections and the isolation of these microorganisms from receivers, with an emphasis on *Staphylococcus aureus* and its antibiotic susceptibility pattern.

Methods: 1,591 isolates were obtained from roadside telephone booths in 16 different locations in the Lagos metropolis. They were all characterised using the Cowan and Steel's manual, after which the antimicrobial susceptibility pattern of the most frequently-occurring isolate was determined.

Results: Of all the locations, Oshodi was found to have the largest number of microorganisms, with Akoka having the least. The organisms were Providencia, Klebsiella, Citrobacter, Enterobacter, Proteus, Escherichia, Staphylococcus, Bacillus, Streptococcus, Micrococcus and yeast. *Staphylococcus* spp. was the most frequently occurring, making up 20.2 percent of the total number of isolated organisms, followed by Bacillus (18 percent), while Enterobacter and Citrobacter were the least common. 44 percent of the total Staphylococcus screened for an antimicrobial susceptibility pattern showed high resistance to most of the antibiotics used.

Conclusion: This result could be related to the emergence of Staphylococcus-resistant strains, especially in a highly-populated area where there are health and hygiene problems and where drugs are abused. Precautions should be taken to prevent the spread of infectious diseases through the use of public telephones.

Keywords: antibiotic resistance, antimicrobial susceptibility pattern, *Staphylococcus aureus*, telephone receivers

Singapore Med J 2009; 50(2): 208-211

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INTRODUCTION

Microorganisms are ubiquitous, and a mixture of microbes are often transferred to everyday objects from the environment and infected individuals. Pathogenic microbes are transmissible via air, skin, food, water and other interpersonal contacts, and in most cases, they cause diseases and infections. Transmission of these infectious agents typically involves their escape from the host and entry into a new host.[1,2] These organisms can also be transmitted through the sharing of instruments and materials, such as bedding and telephones. The telephone system, for example, is an instrument or system used in sending sounds and messages across a distance through a cable. It is a device used for the conversion of sound into an electrical impulse that is converted back into sound at the receiving end, and has to a large extent promoted the transmission of pathogenic microbes. Due to the importance of communication, people now use telephones everywhere and in all areas of life, such as in their homes, offices, schools, churches, mosques, hotels and hospitals, and it is used by both the healthy and the sick.[3] During usage, bacterial agents can be transferred from an infected individual or an asymptomatic carrier of a microorganism to the surface of telephones through either direct contact with parts of the body, such as the mouth, ear and skin, or by indirect contact with aerosols, saliva droplets and infectious particles, to other users of the telephone.

Organisms from the normal flora can be transmitted onto phone receivers via sneezing or coughing. The proliferation of bacteria in the mouth is due to the presence of food particles in the mouth, which can be passed onto the telephone receiver when talking as

Table I. Distribution of organisms isolated from telephone receivers.

Organism	No. (%)
Escherichia coli	126 (7.9)
Klebsiella pneumoniae	91 (5.7)
Proteus vulgaris	92 (5.8)
Citrobacter spp.	49 (3.1)
Providencia alcalifaciens	168 (10.6)
Streptococcus spp.	238 (15.0)
Staphylococcus spp.	322 (20.2)
Bacillus subtilis	287 (18.0)
Micrococcus spp.	182 (11.4)
Enterobacter spp.	20 (1.3)
Yeast	16 (1)
Total	1,591 (100)

Table II. Antimicrobial susceptibility patterns of *Staphylococcus aureus* strains isolated.

Antibiotics	% of sensitivity	% of resistance
Gentamicin	100.0	0.0
Cotrimoxazole	0.0	100.0
Chloramphenicol	66.7	33.3
Amoxicillin	40.7	59.3
Erythromycin	0.0	100.0
Oxacillin	55.6	44.4
Tetracycline	33.3	66.7
Augumentin	40.7	59.3

droplet aerosol.[4] Direct contamination of the telephone receiver by microorganisms from the hand, throat and skin of users also occurs.[5] The microorganisms are continuously disseminated from the mouth and the nasal cavity when someone sneezes, coughs, laughs, talks and breathes into the surrounding air and this can in turn be transmitted to susceptible healthy individuals by way of the respiratory tract. The microorganisms are well adapted to transmission by way of nasopharyngeal secretions and saliva droplets and are highly resistant to drying and desiccation, thus their easy movement from one host to another.[6] Telephone boxes located in hostels, lobbies, corporate offices and public centres are possible transmitters of these pathogenic microbes. Some of the known normal flora sometimes cause diseases when the tissue defences of the host are lowered, e.g., Staphylococci can be carried frequently from the nose and moistened areas of the skin, where they do not cause diseases, but when they land on other parts of the body, they may cause diseases or infections especially in immunosuppressed individuals.

The direct dissemination of bacteria from people is of particular importance in the assessment of telephones for the presence of microorganisms. Bacteria can be liberated from human beings through three principal means, viz. activities involving the respiratory tract, such as sneezing, coughing, talking, laughing; movements that shed bacteria-bearing particles from the body, skin wound or discharge from body lesions; and re-dissemination of organism-bearing particles from dust in phone booths, streets and sidewalks. In Lagos, however, one of the major means of communication is by telephone, and the government has placed several telephone booths in strategic areas of the state. Every local government has at least two booths, depending on how large and populated the area is. Most densely populated areas have cheaper rents that are affordable for everyone even though they lack good infrastructure and are poorly kept; whereas areas with better sanitation and good infrastructure are sparsely populated because of the high rent. Regardless of the area, however, all have telephone booths that are accessible to the public. The aim of this study was to isolate bacterial agents that can be transmitted by telephone receivers and to screen Staphylococci (being the most commonly-isolated microorganism) for their antimicrobial susceptibility patterns.

METHODS

500 swabs were collected from roadside telephone booths in 16 different locations in the Lagos metropolis. The locations were selected randomly from all the local government areas in the state. All the swabs were collected with aseptically-moistened swab sticks using normal saline solution and transported to the laboratory in coolers containing ice packs. The swabs were then streaked onto blood agar and MacConkey agar plates and incubated at 37°C for 18–24 hours. Microscopy and Gram staining were carried out on the isolated organisms for presumptive identification, after which the isolates were characterised according to Cowan and Steel's manual.[7] Antimicrobial susceptibility tests were carried out using the disc diffusion method of Clinical and Laboratory Standards Institute.[8] The most frequently-occurring organism was inoculated and streaked aseptically on Muller-Hinton agar plates, after which the antibiotic discs were placed on them and incubated at 37°C for 18–24 hours. The plates were observed after 24 hours for culture results.

RESULTS

Out of 500 swabs collected from different public telephone centres in the Lagos metropolis, 1,591 organisms were isolated. Samples collected from Oshodi were found to have the highest number of isolates, while samples

collected from Akoka had the least number of isolates. Of all the isolates, *Staphylococcus* spp. was most frequently isolated (20.2%) from all 16 locations, followed by Bacillus, (18.0%), and the least occurring organism was *Enterobacter* spp. (1.3%). (Table I). Table II shows the antibiotic susceptibility patterns of 27 *Staphylococcus aureus* (*S. aureus*) isolated and identified by tube catalase test, out of which 12 (44%) were resistant to oxacillin.

DISCUSSION

It was noticed from this study that the frequency of isolation of the bacterial agents vary with location and species. Oshodi was found to have the highest number of microorganisms, with Akoka having the lowest number of isolates. This can be explained by the fact that Oshodi is a densely-populated area with a high level of activity. It is also a market place with debris, waste materials, perishable food items and diseased individuals all over its environs, and hence Oshodi is highly polluted, with a high presence of airborne microorganisms that could settle on the telephone. On the other hand, Akoka, which is sparsely populated, has less activities within its environment and therefore a lower level of pollution.

The occurrence of *Staphylococcus* spp. was also the highest among all the isolated organisms, with *S. aureus* making up 8.4% (27) of the total. This high occurrence may be due to its resistance to drying which favours its transmission and its presence as part of the normal flora of the nose, mouth and skin. Its transmission from one host to another susceptible host is known to be responsible for epidemic pyogenic infections in hospitals as well as epidemic diseases. However, this study agrees with earlier work conducted by other researchers who reported that *S. aureus* makes up about 20% of the microbial load in the air. They also reported that the organism is constantly disseminated from the nasal cavity during talking, breathing and even exercising.[9] 44% of the total number of strains screened for antimicrobial susceptibility patterns showed strong resistance to most of the antibiotics used. This may be associated with the practice of self-medication and the indiscriminate use of antibiotics, which has led to *S. aureus* becoming resistant to relatively safe antibiotics. It is noteworthy that this organism is present in all the samples. It is known to be a normal component of humans' indigenous microflora and is carried asymptomatically in/on a number of body sites. Its transmission from these sites causes both endemic and epidemic diseases.[10] Thus, staphylococcal infection can be transmitted by the holding of telephones contaminated with *S. aureus*.

The isolation of *S. aureus* was closely followed by *Bacillus subtilis*, which is known to be free-living in the soil, atmosphere and water.[11] The presence of the *Bacillus* spp. on the telephone may be a result of the unhygienic handling of the telephone receiver. *Streptococcus pneumoniae* found in the oral and nasal passages was also isolated. Infections that are caused by it include pneumonia, meningitis, endocarditis, otitis, bronchitis, bacteraemia and sinusitis.[12] Other organisms isolated include *Micrococcus* spp. which causes micrococcal infections associated with that of *Staphylococcus* spp. e.g. abscess. Some yeast or yeast-like organisms are parasites for people, e.g. *Candida albicans*, which generally produces an ulcerative condition of the mouth and throat, and may later be localised in some internal organs and produce infections. However, a previous report by O'Connor et al showed the lack of occurrence of methicillin-resistant *S. aureus* (MRSA) on municipal public telephones.[13]

The susceptibility patterns shown in this study suggest that it is absolutely necessary to obtain sensitivity reports before the initiation of antibiotic therapy in suspected MRSA patients. It should also be noted that antibiotic sensitivity testing is only a guide and that conditions *in vivo* may be different from those obtained *in vitro*. The ultimate decision to utilise a particular antibiotic depends on such factors as toxicity, costs and serum attainable levels. This study agrees with other studies that MRSA, besides having established itself as a major hospital pathogen, is now beginning to prevail in a wider community.[14] The emergence of MRSA in the community is a major public health threat because these strains are resistant to β-lactam antibiotics, which are used empirically to treat a variety of infections, including pneumonia.[15,16] The result of this study is worrying because most resistant strains were isolated from areas with isolated risk factors, such as health and hygiene problems, sharing of contaminated items, having active diseases and crowded living conditions. Most of the transmission therefore appears to be from people with active MRSA skin infections.

In conclusion, it can be established that the number of microorganisms that are constantly present on public telephone receivers depends on the frequency of usage and location of each particular telephone. The telephone could be a very good source of infectious diseases. Further studies should be carried out to determine the rate of infection through the use of public telephones.

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