**Original Research Article**

**ANTIBIOTICS SENSITIVITY AND MULTI-DRUG RESISTANTPOTENTIALS OF MICROBIAL ISOLATES FROM FOMITES AMONG HEALTH CARE WORKERS IN HOLLEY MEMORIAL HOSPITAL OCHADAMU**

**ABSTRACT**

Microbial contamination of some fomites were screened for, in which over 100 samples were collected from table, mobile phone and biro pen using a standard techniques from Holley Memorial Hospital Ochadamu, Kogi State, Nigeria. The organisms; *Staphylococcus aureus*(40%), *Escherichia coli* (15%), *Klebsiellapneumoniae* (5%), *Pseudomonas aureginosa* (5%), *Bacillus cereus* (10%), *Proteus mirabilis* (5%), and *Streptococcus pneumoniae*(20%) were isolated and identified using both morphological and biochemical techniques. The antibiotic sensitivity test that was carried out using disc diffusion method revealed that all the organisms were sensitive to tarivid but were resistant to septrin with varied zones of inhibition. However, the highest inhibition zone was recorded for perfloxacin(30.00 mm) on *Klebsiellapneumoniae*.All the isolates showed varying multidrug resistant pattern to the antibiotics used.

Key words: Microbial contamination, fomites, antibiotic sensitivity testing, multidrug resistant.

**Introduction**

Holley memorial hospital is located in the ancient town of Ochadamu, Ofu Local Government Area of Kogi State (longitude 7.3614o N, latitude 7.0283o E). The hospital was established in 1947 at a time the spread of epidemic diseases and other deadly diseases such as leprosy, small pox, measles and tuberculosis were ravaging Igala land leading to high mortality rate at that time. The menace of rampaging epidemic diseases in Igala land in the 40s and 50s was heightened and compounded by the near absence of basic health institutions. The centre took off initially as a leprosy clinic, rehabilitation and settlement centre but has metamorphosed into a full blown hospital rendering services in maternity, general outpatient department, medical wards, surgical wards, a full functional eye department, TB and leprosy control unit, audiology unit, orthopaedic unit, digital X-ray and ultrasound unit, HIV and AIDS program and a World Health Organization standard laboratory.

Fomites are inanimate objects that carry pathogens and aid the spread of infections. Diseases that spread by droplet transmission, faecal oral transmission, or contact transmission are often aided by fomites (Wayne *et al.,* 2002)*.*

Fomites become contaminated by direct contact with bodily secretions and soiled hands. Once contaminated, the transmission of pathogen from one fomite to another occurs easily, between animate and inanimate object and vice versa.

Variations in survival of pathogens make this spread a more complicated issue highly virulent microorganism, particularly those known to cause nosocomial infections in admitted patients such as *Enterococcus* species, Methicillin-resistant *Staphylococcus aureus, Klebsiellapneumoniae*., *Escherichia coli, Pseudomonas aeruginosa* and *Acinetobacter*species are capable of surviving for several days on hospital surfaces thereby causing nosocomial infection.

Microbiologists say that combination of constant handling with the heat generated by phone creates a prime breeding ground for many microorganisms that are normally found on the skin, *Staphylococci* particularly *S. epidermis* are members of the normal flora of the human skin, respiratory and gastro-intestinal tract. Nasal carriage of *S. aureus*occurs in 20%-50% of human, and is also found regularly on clothes, bed lines and other human environment (Melnick and Edward 2004).

The reservoir of any organism which may be animate object in the epidemiology of any bacteria disease is very important (Wayne *et al.,*2002).The pathogens grow and multiply in the reservoir on which the survival depends. Many epidemiological studies have confirmed that many contaminated surfaces play a major role in the spread of diseases. (Hendley*et al.,*1997, Noble *et al.,*2001).

**MATERIALS AND METHOD**

**Sample collection**

Above 100 samples were collected from table, mobile phone and biro pen for this study. The samples were collected using a sterile swab stick dipped in normal saline and aseptically swabbing the surface of the tables, mouth piece and the ear piece of mobile phones and also the whole body of the biro pen. The swab stick were carefully labelled and then taken to the laboratory.

 **Isolation of bacteria**

The sample collected were inoculated into Maconkey agar, nutrient agar and blood agar by streaking the surface of the agar plate aseptically and carefully labelled. The plates were incubated at 37oc for 24 hours. Colonies were sub cultured until a pure culture was obtained.

**Characterization and identification of bacteria isolates**

The morphological and biochemical tests were carried out using the methods described by Cappuccino and Sherman (1999) and Olutiola*et al* (2000). The bacteria isolates were identified to species level using the method of Cowan and Steel (1993).

#  Antibiotic Susceptibility Testing of the Isolates

# Kirby-Bauer method was adopted for the antimicrobial susceptibility using the Mueller-Hinton agar. TheidentificationofMultidrug resistant isolateswas recordedthrough the zone of inhibition measured to the nearest millimetres.

**RESULTS AND DISCUSSION**

**Table 1: Organism isolated from fomites in seven different wards of the hospital using biochemical screening.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/N | Ward/Dept. | Table | Phone | Biro pen |
| 1 | Laboratory | *Staph. aureus* | *Streptococcus pneumoniae* | *Staph. aureus* |
| 2 | Marternity | *E. coli* | *Streptococcus sp* | *Bacillus cereus.* |
| 3 | Surgical | *Staph. aureus* | *Bacillus cereus.* | *Staph. aureus* |
| 4 | Leprosy | *Klebsielapneumoniae* | *Pseudomonas aureginosa* | *E. coli* |
| 5 | paediatric | *Proteus mirabilis* | *Streptococcus pneumoniae* | *Staph. aureus* |
| 6 | Medical | *Staph. aureus* | *Streptococcus pneumoniae* | None |
| 7 | Theatre | *Staph. aureus* | *E. coli* | *Staph. aureus* |

**TABLE 2: Percentage occurrence of organisms isolated from different units of the hospital**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ORGANISM | TABLE | MOBILE PHONE | BIRO PEN | FREQUENCY OF ISOLATES | PERCENTAGE OF ISOLATES (%) |
| Staphylococcus aureus | 12 | 0 | 12 | 24 | 40 |
| *Escherichia coli* | 3 | 3 | 3 | 9 | 15 |
| *Bacillus* cereus | 0 | 3 | 3 | 6 | 10 |
| *Streptococcus pneumoniae* | 0 | 12 | 0 | 12 | 20 |
| *Klebsiellapneumoniae* | 3 | 0 | 0 | 3 | 5 |
| *Proteus* species | 0 | 3 | 0 | 3 | 5 |
| *Pseudomonas aureginosa* | 0 | 3 | 0 | 3 | 5 |
| TOTAL | 18 | 24 | 18 | 60 | 100 |

**TABLE 3: Antimicrobial sensitivity and resistance profile of isolated organisms**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Antibiotics/Isolates | *Pseudomonas**Spp*(mm) | *E. coli*(mm) | *Staph.aureus*(mm) | *Kleb. Sp*(mm) | *Strept. sp*(mm) | *Proteus sp*(mm) |
| Ciprofloxacin(CPX) | 19.00±0.0 (S) | 0.00 (R) | 16.00±0.3 (S) | 23.00±0.1 (S) | 0.00 (R) | 20.00±0.7 (S) |
| Gentamacin(CN) | 0.00 (R) | 15.00±0.1 (S) | 21.00±0.0 (S) | 16.00±0.1 (S) | 16.00±0.2 (S) | 18.00±0.0 (S) |
| Streptomycin(S) | 28.00±0.4 (S) | 29.00±0.5 (S) | 20.00 ±0.7 (S) | 28.00±0.3 (S) | 0.00 (R) | 20.00±0.5 (S) |
| Amoxicillin(AMX) | 0.00 (R) | 18.00±0.1 (S) | 0.00 (R) | 27.00±0.5 (S) | 18.00±0.3 (S) | 18.00±0.9 (S) |
| Augumentin(AU) | 10.00±0.9 (R) | 18.00±0.5 (S) | 26.00±0.2 (S) | 18.00±0.0 (S) | 17.00±0.2 (S) | 18.00±1.0 (S) |
| Tarivid(OFX) | 18.00±0.1 (S) | 17.00 ±0.8 (S) | 18.00±0.6 (S) | 25.00±0.1 (S) | 18.00±0.9 (S) | 17.00±0.5 (S) |
| Chloramphenicol(CH) | 0.00 (R) | 0.00 (R) | 18.00±0.5 (S) | 0.00 (R) | 16.00±0.3 (S) | 0.00 (R) |
| Sparfloxacin(SP) | 0.00 (R) | 0.00 (R) | 0.00 (R) | 24.00±0.5 (S) | 20.00±0.2 (S) | 0.00 (R) |
| Septrin(SXT) | 0.00 (R) | 0.00 (R) | 0.00 (R) | 0.00 (R) | 0.00 (R) | 0.00 (R) |
| Perfloxacin(PEF) | 0.00 (R) | 0.00 (R) | 0.00 (R) | 30.00±0.1 (S) | 21.00±0.4 (S) | 6.00±1.0 (R) |
| TOTAL SENSITIVITY | 3 | 5 | 6 | 8 | 7 | 6 |
| TOTAL RESISTANCE | 7 | 5 | 4 | 2 | 3 | 4 |
| TOTAL NORMAL | 0 | 0 | 0 | 0 | 0 | 0 |

KEY: S = SENSITIVE (≥ 17 mm), R = RESISTANCE (≥12 mm), N = NORMAL (12 mm-17 mm)

The hospital environment plays an important role in the transmission of organisms associated with nosocomial infection. Microorganisms can be transferred from person to person or from inanimate objects (fomites) such as table, mobile phones, biro pens, stethoscopes, patient hospital charts, computer keyboards to hands and vice versa (Goldblatt*et al*., 2007).

This study revealed that pathogens that could cause serious infections were loaded on tables, mobile phones and biro pens of health care workers which makes them potential vehicle for harbouring and spreading bacteria. (Tables 1)

The results (Table 2) from this study showed that the tables, mobile phones and biro pens of health care workers had bacterial contaminations, with a higher percentage of *Staphylococcus aureus*(40%),*Streptococcus pneumoniae*(20%), *E. coli* (15%), *Bacillus cereus* (10%), *Klebsiellapneumoniae* (5%) and *Proteus mirabilis* (5%).

It was observed that mobile phones harbour more pathogenic organisms than tables and biro pens because of constant handling of the mobile phones compared to tables and biro pen, as most people including the health workers at this 20th century are tending to be phone addict. Basically, some of these microorganisms that were isolated are part of the body normal flora but can be highly pathogenic in many cases and most of these pathogenic microorganisms weremultidrug resistant to new generation drugs.

Some other reasons why mobile phones may harbour more microorganisms than tables and biro pens is because mobile phones are kept inside bags and pockets thereby making it warm and encourages the growth of microorganisms compared to tables and biro pen that is always exposed to normal temperature. The result from this finding corroborate the findings of Brady *et al.*(2006) when they investigated the incidence of bacteria known to cause nosocomial infections among health care workers.

These pathogenic microorganisms isolated from tables, mobile phones and biro pens have a high clinical significance which cannot be over looked. For example, *Staphylococcus aureus*is an opportunistic organism which is capable of causing infection in man (Brady *et al.,* 2007). *Pseudomonaauregenosa*is associated with nosocomial infections including dermatitis, bacteriamia and respiratory tract infection. Its predilections to moist environment make it possible to exist on tables, mobile phones and biro pens due to constant handling by healthcare workers. *Streptococcus* species are known to cause pharyngitis and pneumonia. *Klebsiella*species can cause pneumonia with about 50% mortality in untreated cases (Munish and Asha, 2009), while *E*. *coli* and *Proteus* species are responsible for gastrointestinal infections in human (Josephson and Rubino, 2000).

Research has also shown that many of these microorganisms are destroyed by heat within hours due to drying. However, bacteria like *Staphylococcus* species are heat labile and can survive for weeks and multiply rapidly in warm environment (Brady *et al.,* 2006).

From the results (Table 3), ciprofloxacin was most sensitive in *Klebsiellapneumoniae* while *Streptococcuspneumoniae*and *E. coli* were resistant to it, gentamacin was most sensitive in *staphylococcus aureus* while *Pseudomonas aeruginosa* was resistant, streptomycin was most sensitive in *E. coli* and *Streptococcus species* was resistant, amoxicillin was most sensitive in *Klebsiellapneumoniae* while it was resistant in *Pseudomonas* species and *Staphylococcus aureus,* augumentin was most sensitive in *Staphylococcus aureus* while it showed the least zone of inhibition on *pseudomonas* species, tarivid was most sensitive in *Klebsiella* species, chloramphenicol was most sensitive in *Staphylococcus aureus*while *Pseudomonas* species, *E. coli*, *Klebsiella* species and *Proteus* species were resistant, sparfloxacin was most sensitive in *Klebsiella*species while *Pseudomonas* species, *E. coli*, *Staphylococcusaureus*, and *Proteus* species were all resistant, perfloxacin was most sensitive in *Klebsiella* species while *Pseudomonas* species, *E*. *coli* and *Staphylococcusaureus* were resistant but all isolates were resistant to septrin.The overall results of the present study demonstrated that the antibiotic resistance patterns detected in the isolates from these fomites, may have contributed to ineffective use of antibiotics in the treatment of gastrointestinal infections reported in Ochadamu community. As a result human health is at risk from infections caused by these organisms.

**CONCLUSION**

The bacteria isolated in this study are known pathogens, capable of causing both primary and opportunistic infections. Their presence on tables, mobile phones and biro pens is disturbing as they could cause nosocomial infection, thereby the health of patients attending hospitals seeking medical care may become vulnerable, especially surgical and immune compromised patients. The antibiotics sensitivity pattern of the isolates is worrisome and demand urgent attention.

**RECOMMENDATION**

Adequate control measures are recommended for health care workers. Sterilization of stethoscopes, mobile phones, biro pens, tables and all important fomites in the hospital setting that are capable of harbouring and transferring organisms should be carried out on a regular bases, most likely before and after use so as to reduce the spread of these nosocomial infections.

A campaign program should be embarked upon by the government or non-governmental organizations to sensitize health workers on the health hazard posed by fomites that are often underrated.Studies of other fomites that have been understudied should still be carried out.

**REFERENCES**

Brady RR, Fraser SF, Dunlop MG, Paterson-Brown S, Gibb AP. Bacterial contamination of mobile communication devices in the operative environment. *Journal of Hospital Infection,* 2007*;* 66:397-8.

Brady RR, Wasson A, Stirling I, McAllister C, Dainani NN. The incidence Bacteria known to cause nocosomial infection on healthcare workers’ Mobile phone.*Journal of Hospital infection,*2006; 62: 123-125.

Cappuccino GJ,Sherman N. Microbiology, A Laboratory; Biochemical activities of microorganism. 5th Edition. Benjamin/Cumming science publishing, California; 1999, PP. 133-187.

Cowan ST, Steel KJ.Manual for the identification of Medical bacteria. 3rd Edition, Cambridge University Press: 1993, pp. 45-68.

Goldblatt JG, Krief 1, Klonsky T, Hailer D, Milloul V,Sixsmith DM. Use of cellular telephones and transmission of pathogen by medical staff in New York and Israel. *Infection of hospital epidemiology*, 2007; 28: 500-503.

Hendley, J. O., Wenzel, R. P. &Gwaltney, J. M. J. (1997).Transmission of rhinovirus colds by self inoculation.*New England Journal of Medicine*, 288:136 1-1664.

Josephson KL, Rubino JR. Pepper ii characteristics and quantification of bacteria pathogen and indicator organism in household kitchens with and without the use of a disinfectant. *Journal of Applied Microbiology,*2000; 83: 731-50

Melnick J, Edward A. Medical Microbiology, 23rd edition.Mc grew- Hill professional, New York: 2004, pp. 233-234.

MunishG. Asha G. Mobile phone of dental professionals: A potential source of bacterial contamination- a bacteriological study*. Indian Journal of Dental science*, 2009, 186: 42-47.

Noble J. Text book of primary care medicine, (31d Edition). St Louis, Mosby: 2001, pp. 8:82-95.

Olutiola PO, Famurewa O, Sonntag HG.An introduction to General Microbiology, a practical approach.Bolabay publication Nigeria: 2000, pp. 112-178

Wayne P, Daniel T, Haydon A, Cleaveland S, Taylor LH, Karen LM.Identifying reservoirs of infection: A conceptual and practical challenge.*Emerging infections and Diseases*, 2002; 8(12): 10-317.