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RESEARCH ARTICLE

ANTIBIOTIC SENSITIVITY AND MULTIDRUG RESISTANCE TO MICROBIAL ISOLATES FROM FOMITES OF HEALTHCARE WORKERS AT HOLLY MEMORIAL HOSPITAL, OCHADAMU, NIGERIA

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Abstract

Aim and objective: Microbial contamination of some fomites were screened for, in which over 100 samples were collected from table, mobile phone and biro pen from Holley Memorial Hospital Ochadamu, Kogi State, Nigeria.
Methods: Using standard techniques, the samples were collected using a sterile swab stick dipped in normal saline and aseptically swabbing the surface of the fomites. The organisms; *Staphylococcus aureus* (40%), *Escherichia coli* (15%), *Klebsiella pneumoniae* (5%), *Pseudomonas aeruginosa* (5%), *Bacillus cereus* (10%), *Proteus mirabilis* (5%), and *Streptococcus pneumonia* (20%) were isolated and identified using both morphological and biochemical techniques. The antibiotic sensitivity test was carried out using disc diffusion method.
Results: this finding 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 *Klebsiella pneumoniae*. All the isolates showed varying multidrug resistant pattern to the antibiotics used.
Conclusion: The understudied fomites are cheap source of nosocomial infections and also showed varying degree of multidrug resistant pattern,
Keywords: Antibiotic sensitivity testing, fomites, microbial contamination, multidrug resistant.

INTRODUCTION

Holley memorial hospital is located in the ancient town of Ochadamu, Ofu Local Government Area of Kogi State (longitude 7.3614ºN, latitude 7.0283ºE). 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 infectious diseases that are often acquired through droplet transmission, faecal oral transmission, or contact transmission[1]. Contamination of fomites is made possible through direct contact with body fluids and contaminated body parts. Thus, pathogens transmit easily amongst fomites and even to the animate objects. The ability of pathogens to survival on fomites environment fosters their spread. Most virulent microorganism, causing hospital acquired infections among patients on admission like *Klebsiella pneumonia*, *S. aureus* (Methicillin-resistant), *Escherichia coli*, *Acinetobacter* species, *Pseudomonas aeruginosa* may survive on fomites for days thereby causing nosocomial infection.
Microbiologists have opined that the warmth generated by hone as well as the constant touching have assisted the breeding of many microorganisms especially the skin microfloral. *Staphylococci* species, *e.g. S. epidermisis* constantly found on the human skin git and respiratory tract. *S. aureus* (nasal carriage) are also

regularly found on clothes, other body parts and bed lines[2].

In the epidemiology and pathogenicity of any bacterial infection, the reservoir is a key factor[1].The pathogens grow and multiply in the reservoir on which the survival depends. Various epidemiological studies revealed that many contaminated surfaces play a key role in the spread of diseases[3,4].

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 in previous studies[5,6]. The bacteria isolates were identified to species level using the method as in previous study[7].

Antibiotic susceptibility testing of the isolates

Kirby-Bauer method was adopted for the antimicrobial susceptibility using the Mueller-Hinton agar. The identification of multidrug resistant isolates was recorded through the zone of inhibition measured to the nearest millimetres.

RESULTS AND DISCUSSION

The hospital fomites are important vector in the spreading and transmission of pathogens causing nosocomial infection. Pathogens may be acquired through person-person contact or through contaminated fomites. Hospital fomites include, table, mobile phones, stethoscopes, patient hospital charts, biro pens, computer hardware that may contaminate the hands and vice versa[8]. 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 (Table 1).

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	*S. aureus*	*S. pneumoniae*	*S. aureus*
2	Marternity	*E. coli*	*Streptococcus sp*	*B. cereus*
3	Surgical	*S. aureus*	*B. cereus.*	*S. aureus*
4	Leprosy	*K. pneumoniae*	*P. aeruginosa*	*E. coli*
5	Paediatric	*P. mirabilis*	*S. pneumoniae*	*S. aureus*
6	Medical	*S. aureus*	*S. pneumoniae*	None
7	Theatre	*S. aureus*	*E. coli*	*S. aureus*

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 *S. aureus* (40%), *S. Pneumonia* (20%), *E. coli* (15%), *Bacillus cereus* (10%), *K. pneumoniae* (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 were multidrug 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 corroborates the findings of a previous study that investigated the pathogenicity of bacteria causing nosocomial infections among health care staff[9].

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 (%)
S. aureus	12	0	12	24	40
E. coli	3	3	3	9	15
B. cereus	0	3	3	6	10
S. pneumoniae	0	12	0	12	20
K. pneumoniae	3	0	0	3	5
Proteus species	0	3	0	3	5
P. aeruginosa	0	3	0	3	5
Total	18	24	18	60	100

Table 3: Antimicrobial sensitivity and resistance profile of isolated organisms.

Antibiotics/Isolates	*Pseudomonas* sp(mm)	*E. coli* (mm)	*S. 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

S=Sensitive (≥ 17 mm), R=Resistance (≥12 mm), N=Normal (12 mm-17 mm)

These pathogenic microorganisms isolated from tables, mobile phones and biro pens have a high clinical significance which cannot be over looked. For example, *S. aureus* is an opportunistic organism which is capable of causing infection in man[10]. *P. aeruginosa* 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[11], while *E. coli* and *Proteus* species are responsible for gastrointestinal infections in human[12].

Research has also shown that many of these microorganisms are destroyed by heat within hours by desiccation. However, heat labile bacteria e.g. *Staphylococcus* species may survive for weeks and grow geometrically in warmth environment[9]. From the results (Table 3), ciprofloxacin was most sensitive in *K. pneumoniae* while *S. pneumonia* and *E. coli* were resistant to it, gentamycin was most sensitive in *S. aureus* while *P. aeruginosa* was resistant, streptomycin was most sensitive in *E. coli* and *S. species* was resistant, amoxicillin was most sensitive in *K. pneumoniae* while it was resistant in *Pseudomonas* species and *S. aureus*, augumentin was most sensitive in *S. aureus* while it showed the least zone of inhibition on *pseudomonas* species, tarivid was most sensitive in *Klebsiella* species, chloramphenicol was most sensitive in *S. 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*, *S. aureus*, and *Proteus* species were all resistant, perfloxacin was most sensitive in *Klebsiella* species while *Pseudomonas* species, *E. coli* and *S. aureus* were resistant but all isolates were resistant to septrin. The overall results of this study showed that the multidrug resistant patterns exhibited by 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.

Limitations of the study

The study was only limited to all the fomites mentioned and could not sample all the fomites in the hospital environment. More so, the study was limited to the hospital mentioned as all the hospital in Ochadamu could not be included during sampling.

CONCLUSIONS AND RECOMMENDATIONS

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.

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.

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AUTHOR'S CONTRIBUTION

Lamidi Y: writing original draft, conceptualization, methodology, investigation. **Chika OL:** Writing, review, and editing, supervision. **Iko-Ojo AR:** methodology, investigation, formal analysis. All

authors revised the article and approved the final version.

DATA AVAILABILITY

The data supporting the findings of this study are not currently available in a public repository but can be made available upon request to the corresponding author.

CONFLICT OF INTEREST

None to declare.

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