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Original Article

Prevalence of Multidrug Resistant Bacteria on Selected Hospital Surfaces in Paediatric wards of a Nigerian Hospital

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Abstract

The hospital surfaces are frequently contaminated with important health care associated pathogens. These surfaces represent a secondary reservoir for microorganisms. The study was conducted in 2013 to determine the prevalence of multidrug resistant isolates on selected hospital surfaces in paediatrics ward of UITH, Ilorin.
Samples were collected using ethylene oxide sterilized swab stick pre-moistened with sterile normal saline from selected non-critical surfaces and were aseptically cultured on media and incubated aerobically at 35-37ºC for 18-24hours. Identification of bacterial isolates was carried out using standard microbiological procedure. Isolates identified as Staphylococcus aureus were screened for MRSA using cefoxitin disk diffusion method, and the Gram negative isolates such as Klebsiella species and E.coli were screened for ESBL production using the double disk synergy test. A prevalence of 19.05% was recorded for MRSA production in this study with the highest occurrence found at the emergency paediatric units of the hospital. The prevalence of extended spectrum Beta lactamase production (ESBL) K. pneumoniae and E. coli was found to be 18.9%. It was only K. pneumoniae that was positive for ESBL production.
The isolation of MRSA from surfaces within paediatric wards is of great importance because of the immaturity of the immune system of paediatric population which may result in prolong hospital stay, increased cost of treatment and treatment failure may occur due to acquisition of multidrug resistant bacteria. Influx of patient's relation within the hospital wards should be reduced, however patients with multidrug resistant bacterial infection should be isolated and healthcare givers should observe the five moment of hand washing recommended by WHO.

***Key words**: Hospital Surfaces, Multidrug Resistance Bacteria, Paediatric wards*

Introduction

Healthcare settings represent an environment where both infected persons and those at increased risk of infection congregate. However, patients with infections or carriers of pathogenic microorganisms admitted to hospital are potential sources of infection for other patients and staff. Patients who become infected in the hospital are a further source of infection.[1, 2]

It is quite difficult to directly link non-critical hospital surfaces and medical equipments to infection transmission.[3] Transmission can occur either directly or indirectly when healthcare worker's hands or gloves become contaminated by touching contaminated surfaces or after touching patients, or when patients comes in direct contact with a contaminated surface. Pathogens that have been linked to transmission via contaminated environmental surfaces and medical equipments include MRSA, VRE, *Clostridiumdifficile*, *Acinetobacter species* and *Norovirus.* Except for *Norovirus*, these organisms pose clinically important antimicrobial resistance problems and are among the most common causes of healthcare associated infections in hospitals [4].

Neely and Maley[5] highlighted that 42% of 12 nurses who had no direct contact with patients, contaminated their gloves by touching objects in the room of patients

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with MRSA in wounds or urine. Weber et al.[6] emphasised that admitting a new patient to a room previously occupied by a MRSA or VRE-positive patient significantly increases the odds of acquisition for MRSA or VRE.In a study by Otter *et al*[7] they reported cultures of ten standardized highly touched surfaces, and found that 59% of these surfaces were contaminated in the rooms of some patients with heavy gastrointestinal colonization by MRSA.

Antimicrobial resistant pathogens that causes healthcare associated infections pose an on-going and increasing challenge to hospitals, both in the clinical treatment of patients and in the prevention of the cross-transmission of these problematic pathogens.These pathogens include methicillin-resistant *Staphylococcusaureus*(MRSA), vancomycin-resistant*Enterococcusspecies,* extended-spectrum β-lactamase producing *Escherichiacoli*, *Klebsiellaspecies,* and fluoroquinolone or carbapenem-resistant Enterobacteriaceae or *Pseudomonasaeruginosa*[8]. The role of fomites and the inanimate hospital environment in the transmission of infection has been debated for many years. However, there is increasing evidences that contaminated surfaces; especially those frequently touched by hands can contribute to the spread of health care associated pathogens. The aim of this study is to determine the prevalence of multidrug resistant organism on selected hospital surfaces in the paediatric wards of the University of Ilorin Teaching Hospital Ilorin.

Methodology

This study was conducted at the University of Ilorin Teaching Hospital, a tertiary health centre and the only referral centre in Kwara state. It is in the North Central region of Nigeria, the hospital has over 450 beds capacity with various subspecialties. The paediatrics ward has over 115 beds capacity.

The study was a cross-sectional study of indoor hospital surfaces within the five (5) paediatric wards namely (neonatal intensive care units, paediatric medical ward, paediatric surgical ward, emergency paediatric unit I and II.). The study populations were bed rails, bed lockers, radiant warmers, incubators, trolleys, medical tables, door handles and wash sinks.

All the study population that falls within the five (5) paediatric wards were included in the study and outdoor surfaces and other indoor surfaces not within the population was excluded from this study. Total population survey was employed, and a total of 201 samples were collected from the various surfaces within the five (5) wards. Ethical clearance was obtained from the ethics and research committee of UITH before the commencement of the study.

Samples were collected using ethylene oxide sterilized swab stick pre-moistened with sterile normal saline from the selected surfaces (bed rails, bed locker, radiant warmers, incubators, trolleys, door handles, medical tables and wash sinks) which were inserted in bijou bottle containing 5ml of sterile Stuart's transport medium and was then transported to Microbiology lab of University of Ilorin Teaching Hospital within 30minutes of sample collection.

Laboratory analysis of samples was carried out within 2 hours of sample collection. The media were prepared aseptically according to the manufacturer's instructions. The samples were cultured on sheep blood and MacConkey agar to enhance growth and proper identification of the organisms, which was then incubated aerobically at 35-37ºC for 18-24hours. After aerobic incubation, visible colonies on plates were examined visually for macroscopic characteristics of aerobic bacteria: colony size, shape, colour, consistency, odour, elevation and hemolysis. Gram staining (microscopy) was carried out to determine the morphology of the bacteria, followed by a battery of biochemical reaction specific for *Staphylococcusaureus, Klebsiella and E. coli*Theisolates were screened for MRSA production using cefoxitin disk diffusion method [8, 9] and ESBL production using DDST method.

Discussion

Contamination of surfaces within the hospital can increase the prevalence of health care associated infections, especially at both extreme of live due to lowered immunity; because numerous organism abounds the hospital environment. A total of 201 swab samples were collected from various hospital surfaces from the five different paediatric wards of the hospital. Of the 201 swab samples collected from various

surfaces such as the bed rails, lockers, incubators, radiant warmers, medical tables, door handles and the wash sinks. 141 (70.1%) were positive for bacteria growth as shown in Table 1. This finding agrees with the result of a similar study in Maiduguri by Okon *et al*[11] who sampled 267 surfaces and 70.0% were positive for bacteria growth with varying number of bacterial isolates per sampled surfaces.

The bacterial isolates in this study were retrieved from surfaces made of different materials. It was suggested by Schmidt. *et al* that copper surfaces are usually less contaminated within the wards, though there was no copper among surfaces sampled in thus study. All aerobic bacteria were retrieved from aluminium surfaces, and this includes the bed rails and the lockers which had the highest number of organism 86.0 and 69.9% respectively. These two surfaces are surface that comes in frequent contact with the patient, relatives and health care workers. One these surfaces majority of the isolates present on them were both MSSA,MRSA and the ESBL producer *K. pneumoniae*.This report agrees with the result of Bhalla *et al*[3] who demonstrated that MRSA frequently recovered from bed rails and the bed side lockers. Though it is often difficult to directly link non-criticalhospital surfaces and medical Equipments to infection transmission according to Bhalla *et al*[3]. Transmission can occur directly when health workers hand or gloves become contaminated by touching contaminated surfaces. Pathogens that have been linked to transmission via contaminated surfaces and medical equipment include MRSA. ESBL producers rarely contaminate surfaces except in areas where there is faecal contamination. *K. pneumoniae* often contaminate surfaces in the ward than *E. coli.*

The prevalence of methicillin resistant *Staph aureus(MRSA)* obtained was 19.0% while that of methicillin susceptible *Staph aureus*(MSSA) was 81.0%, and the prevalence of extended spectrum beta lactamase producers was18.9%; and it was only *K. pneumoniae* that was positive for ESBL production. *Staph aureus* used to be the most recognised pathogen with health care associated infections, and the primary reservoirs for MRSA in the hospital are the colonized or infected individual who readily contaminate medical equipment and the environment within their vicinity. MRSA can survive on dry environmental surfaces for months as reported by Kramer et al [4].

In this study, there varied contamination of the surfaces in the various wards. The MSSA were majorly found in both the NICU and PMW with 35.2% and 27.5% respectively, while MRSA were more in the two Emergency of the Paediatric unit. The ESBL producer *K. pneumoniae* was more in the Emergency unit and the Paediatric medical ward. The wide spread use of antibiotics for both therapy or prophylaxis in the wards could be responsible for the increased number of these isolates in the wards. The more an antimicrobial agent becomes widely used, bacteria resistance to this drug emerge and may spread in the health care setting. This problem is particularly critical in developing countries where more expensive second line antibiotics may not be available or affordable, according to Duce et al [12, 13]. The high contamination of the Emergency unit may be due to the fact that this ward is usually the place of first contact where patients are usually admitted first before transfer to other wards for follow up. The least contaminated ward is the neonatal intensive care unit. This is not surprising as movements into this unit are always restricted, relatives are rarely allowed in and the movement of the health care workers and that of the mothers are coordinated.

The findings of this study revealed that there are pathogenic aerobic contaminants on noncritical hospital surfaces within the Paediatric ward of the University of Ilorin Teaching Hospital. The leading aerobic bacteria contaminant from this study are the MRSA, and the ESBL in a smaller proportion. The isolation of this multidrug resistant isolates from these surfaces is an indicator of potential threat of this microorganism in areas where found, and this require an urgent surveillance. Though cleaning and disinfection of non-critical hospital surfaces should be encouraged at least every 2 hours and regular hand washing on the part of the health care workers before and after every procedure.

References

1. Boyce, JM. New insights for improving hand hygiene practices. *Infect Control HospEpidemiol.* **(**2004). **25**(3); 187-188.
2. Weber, DJ and Rutala, WA. Understanding and Preventing Transmission of Healthcare- Associated Pathogens Due to the

Contaminated Hospital *Environment Infect control and Hospital Epidemiology*,(2013). **34** (5);449-452.
3. Bhalla, A. Pultz, NJ. Gries, DM. Ray, AJ. Eckstein, EC. Aron, DC. &Donskey, CJ.Acquisition of nosocomial pathogens on hands after contact with environmental surfaces near hospitalized patients. *Infect Control HospEpidemiol.*(2004). **25;** 164-167.
4. Kramer, A. Schwebke, I. Kampf, G. How long do nosocomial pathogens persist on inanimate surfaces? A systematic review.*BMC Infectious Diseases.*(2006). **6;** 130.
5. Neely, AN. And Maley, MP. Survival of*Enterococci* and *Staphylococci* on Hospital fabrics and plastic.J ClinMicrobiol.(2000). **38** (2); 724-726.
6. Rutala, WA and Weber, DJ and the Health- care Infection Control Practices Advisory committee(HICPAC). (2008). Guideline for Disinfection and Sterilization in Health –care Facilities.
7. Otter, JA. Havill, NL. Adams, NMT. Boyce, JM (2006). Extensive environmental contamination associated with patients with loose stools and Methicillin- resistant *Staphylococcus aureus* colonization of the gastrointestinal tract. Presented at the 16th Annual Scientific Meeting of Society for Health- care epidemiology of Africa, Chicago, IL Abstract 15.
8. Hidron, AI. Edwards, JR. Patel, J. Horan, TC Sievert, DM. Pollock, DA and Fridkin, SK. Antimicrobial- Resistant Pathogens Associated with Healthcare- Associated Infections; Annual Summary of Data Reported to the national Healthcare Safety Network at the Centers for Disease Control and Prevention, 2006-2007. *Infection Control and Hospital Epidemiology*.(2008). **29**;996 -1011.
9. Forbes, PE. Sahm, DF. Weissfeld, AS. Bailey and Scott's Diagnostic Microbiology, China; Mosby Elsevier, 12th Edition.(2007). 78-91, 221- 232.
10. Cheesbrough, C. District Laboratory Practice in Tropical Countries Part 2. Cambridge, UK; Cambridge University Press. Pages (2006). 74- 75, 64-70.
11. Okon, KO. Osundi, SI. Dibal, J. Ngbale, T. Bello, M. Akuhwa, RT. Balogun, ST. and Uba, A. (2012). Bacterial contamination of operating theatre and other specialized care unit in a tertiary hospital in Northeastern Nigeria.*African Journal of Microbiology Research.* **6** (13) 3092 – 3096.
12. Ducel. G. Fabry, J. and Nicolle, L. (2002). Prevention of hospital- acquired infections. A practical guide 2nd edition.WHO/CDS/CSR/EPH/2002, 12.
13. Schmidt, MG, Attaway, HH. Sharpe, PA. John, JJ. Kent, A. Morgan, SA. Fairey, SA. Singh, S. Steed, LL. Cantey, JR. Freeman, KD. Michels, HT and Salgado, CD. (2012). Sustained Reduction of Microbial Burden on Common Hospital Surfaces through Introduction of Copper.*J ClinMicrbiol.* **50** (70 2217-2223.