BACTERIAL CONTAMINATION IN A SPECIAL CARE BABY UNIT OF A TERTIARY HOSPITAL IN JOS, NIGERIA.

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ABSTRACT

BACKGROUND
Nosocomial infections pose a great challenge on healthcare systems. Although surfaces in neonatal wards, umbilical stump wounds and catheter are responsible for a high number of nosocomial infections due to bacteria. The aim of this study was to determine the bacterial profile of air and surface contamination in the special care baby unit of a tertiary hospital in Jos, Nigeria.

METHODS
Surface and air samples were cultured and antibiotic susceptibility of isolated bacteria were determined.

RESULTS
The bacterial profile of air and surface samples showed that Klebsiella was the most common bacteria followed by Staphyllococcus; while the least was Escherichia. Most of the bacteria were isolated from the out-born term area of the special care baby unit. All the bacteria isolated were susceptible to ceftriaxone and meropenem.

CONCLUSION
This study showed that all areas of the special care baby unit of the hospital have bacterial, indicating that these are a potential source of cross-infection from healthcare workers to the neonatal patients.

KEYWORDS: Nosocomial, bacteria, special care baby unit, neonate.

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INTRODUCTION

Nosocomial infections cause considerable morbidity and mortality and pose high financial burden on health care systems.[1] Although surface contact, surgical procedures, umbilical stump wounds and catheters are responsible for a high percentage of nosocomial infections, bacterial and fungal air contaminations in hospitals particularly special care baby unit (SCBU) have an important role in development of hospital infections.[13].

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It has been shown that many bacterial pathogens can survive as bio-aerosols and even be spread over long distances, leading to resultant infection.[2-4] The indoor air quality of neonatal wards of hospitals has become a critical part of hospital management protocol.[2-4] A number of studies have indicated that indoor air contamination of hospital wards including neonatal wards by bacteria pose potential hazards to patients in the wards.[2-6]

Common human pathogens, such as Escherichia coli, Enterococcus spp, Acinetobacter spp and Staphyllococcus aureus can survive for long periods on surfaces of equipment, work surfaces, resuscitaires and formites that can potentially transmit bacteria.[6&7]

In spite of environmental conditions, example dryness, temperatures and ultraviolet radiations, which may prevent microorganisms from growing in unfavourable environments, they still reach new hosts through the air. The incidence of airborne infections has increased in recent years, because many new hospital buildings are sealed and have self-contained circulating air systems for temperature control.[7&8]

Controlling airborne pathogens in SCBU is not only important for the safety of the neonates, but it is also important for hospital personnel. Various contamination control procedures can limit exposure as well as risk of infection.[7-9] Although, it is not possible to eliminate all nosocomial infection, their incidence can be reduced significantly through implementation of appropriate infection control programs. In a bio-aerosol study carried out by Obbard and Fang in a hospital in Singapore, it was observed that the major factor influencing the level of airborne bacteria was occupant density.[10] Similar findings were reported in other studies, but in addition factors such as architectural design and age of the hospital building were said to play significant role in biocontamination.[11&12]Despite the increasing understanding of hospital microbial hazards and control measures, studies on the surface-bound bacterial contamination and airborne contamination are still very limited.[11&12] The purposes of this study, therefore, were to examine surfaces as well as airborne contamination by bacteria in special care baby unit, and also determine the antibiotic susceptibility of the bacterial pathogens.

MATERIALS AND METHODS

Collection and transport of specimen:
Air and surface samples were taken from all the different sections of the special care baby unit in a tertiary hospital facility in Jos.

Sampling:
The evaluation of bacterial contamination in the special care baby unit (SCBU) was performed using settle plate and swab methods.

Settle plate method:
Air sampling was performed with settle plate methods. Petri dishes containing blood, nutrient, mac-conkey agar media were transported to the SCBU in sealed polythene bags. The plates were labeled appropriately and placed at least one meter above the ground in the Out-born term and preterm rooms, the In-born term and preterm rooms, Septic treatment room, the neonatal I.C.U as well as the Isolation room of the SCBU. The plates were exposed for 2hours after which they were covered with their lids and taken to the laboratory in sealed polythene bags and incubated at 37°C for 24hours.

Swab method:
Surface swab specimens were collected from predefined surfaces (baby cots, baby incubator handles, resuscitaire) with cotton tipped applicators pre-moistened with sterile saline from the special care baby unit of the hospital. The swabs were immediately inoculated onto plates that contained blood, chocolate and mac-conkey agar medium for the growth of bacteria.

Processing of samples:
The culture plates streaked with swab samples along with those exposed in air were incubated at 37°C under aerobic conditions for 24hours. After incubation, the colonies obtained were identified using biochemical tests which included catalase, coagulase, oxidase, urea utilization, triple sugar iron agar, citrate.

The antibiotic susceptibility testing of isolated bacteria were carried out using disc diffusion method and Mueller hinton agar as described by the clinical and laboratory standard institute (CLSI).[13]

The concentration of airborne bacteria was expressed as colony forming units per square meter (CFU/m^2) where as the concentration of the surface-bound bacteria was expressed as colony forming unit/plate (CFU/P).

RESULTS

Bacteria were present in different areas of the special care baby unit (SCBU) of the hospital. Of the 300 plates used for the sampling, total frequency of bacteria were identified in each area of the SCBU as shown in Table 1. The result in table 1 showed that Klebsiella spp (38.1%) and Staphyllococcus aureus (28.1%) were predominantly isolated followed by Pseudomonas aeruginosa (19%) and Escherichia coli (14%).

The frequency of bacteria was highest (61.9%) in the Out-born term unit of the SCBU, followed by In-born preterm unit (9.3%). All the other units of the SCBU had bacteria frequency of 4.8% each.

The results in table 2 showed that the percentage susceptibility of organisms isolated range from 66.7% to 100%.

DISCUSSION

The hospital environment is one of many places that is contaminated with a variety of pathogenic and non-pathogenic microorganisms that can persist on surfaces for prolonged periods[11 & 12]. Several studies have shown that the hands and gloves of healthcare workers readily acquire pathogens after coming into contact with contaminated hospital surfaces and they can subsequently transfer these organisms to patients

and inanimate surfaces that they touch[11 & 12]. The results of the bacterial colonies isolated from different areas of special care baby unit (SCBU), showed that the SCBU environment of a hospital is a potential reservoir of bacteria such as Klebsiella spp, Staphyllococcus aureus, Pseudomonas aeruginosa and Escherichia coli (E. coli), and this is similar to other studies[14]. Escherichia coli are the most common gram-negative bacterium, causing mainly urinary tract infections [15]. Pseudomonas aeruginosa is also very common, especially in causing lower respiratory tract infections[16]. Of great significance is the finding that even resuscitaires which are disinfected regularly, were found to be colonized by bacteria. The frequency of bacteria isolated from different areas of the SCBU are varied, but majority of the bacteria were Klebsiella and Staphyllococcus found primarily in the Out-born term area. This logically means that the neonates from peripheral hospital admitted into the Out-born term area may contribute to nosocomial infection in the SCBU. Previous prospective studies have shown that nurses can contaminate their hands with Klebsiella spp during "clean activities"[17]. The result also indicates that surfaces in the SCBU may increase the number of nosocomial infections and therefore the length of stay exceeds the average of 15 days, as stated in the guidelines on the management of multidrug resistant organisms in health care settings[18].

In this study, all the bacteria isolated, were susceptible to meropenem and ceftriaxone. The Staphyllococcus, E. coli and Klebsiella were susceptible to amoxicillin-clavulanic acid. Pseudomonas was susceptible to gentamicin, ceftriaxone, ciprofloxacine and meropenem.

In a prospective study by Qudiesat et al, organisms such as Staphyllococcus aureus, Enterococcus faecalis, Klebsiella spp and Escherichia coli were isolated from the neonatal ward of a government hospital[19].

Since we did not genotype the organisms isolated from the different SCBU areas, we cannot confirm that the isolates from the Out-born term area of the SCBU was the source of the isolates found in the other areas of the SCBU.

CONCLUSION

The special care baby unit requires more attention because of the structural features that favours the dissemination of pathogens in addition to the presence of neonates in the unit with higher risk of acquiring infections. The organization of the space between baby cots and equipments, as well as the application of cleaning protocols for those surfaces according to the specificities of the units are very important. In addition, providing orientation to patient relatives and visitors about hand washing techniques, and regular education of workers may reduce dissemination in the environment and the acquisition of pathogens.

Table 1: Frequency of bacterial colonies isolated from different areas of the special care baby unit of a tertiary hospital

Organism genera	OBT CFU	OBP	IBT	IBP	NICU	EBTR	STR	IR	TOTAL(%)
Staphylococcus	4	-	1	-	-	-	-	1	6 (28.6)
Klebsiella	6	1	-	-	-	1	-	-	8 (38.1)
Escherichia	1	-	-	1	-	-	1	-	3 (14.3)
Pseudomonas	2	-	-	1	1	-	-	-	4 (19.0)
Total (%)	13(61.9)	1(4.8)	1(4.8)	2(9.3)	1(4.8)	1(4.8)	1(4.8)	1(4.8)	21 (100)

OBT= out-born term
OBP= out-born preterm
IBT= in-born term
IBP= in-born preterm
NICU= neonatal intensive care unit
EBTR= exchange blood transfusion room
STR= septic treatment room
IR= isolation room

Table 2: Antibiotic susceptibility pattern of bacterial isolated from the special care baby unit of a tertiary hospital.

Antibiotics	Organisms genera %S(%R)			
	Staphyllococcus	Escherichia	Klebsiella	Pseudomonas
Ampicillin	100(0)	100(0)	87.5(12.5)	_
Amoxicillin-clavulanic acid	100	100(0)	100(0)	_
Gentamicin	83.3(16.7)	100(0)	100(0)	100(0)
Ceftriaxone	100(0)	100(0)	100(0)	100(0)
Ciprofloxacine	100(0)	66.7(33.3)	100(0)	100(0)
Meropenem	100(0)	100(0)	100(0)	100(0)

S= Sensitive
R= Resistance

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