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Bacterial Contamination of Labor Wards and Delivery Rooms from Selected Primary Healthcare Facilities in Abia State

Mary Uche Kalu, Emmanuel Onwubiko Nwankwo, Ebubechi Uloma Okey-kalu*

Department of Microbiology, College of Natural Sciences, Michael Okpara University of Agriculture Umudike, P.M.B 7267, Umuahia, Abia State, Nigeria

***Corresponding author e-mail**: ulomamgbeokwere@yahoo.com

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Abstract

Bacterial contamination of the labor and delivery room is of clinical concern because it is one of the major risk factors of sepsis in neonates and most life threatening nosocomial infections for mothers after undergoing childbirth procedures. From six different Primary Healthcare Centres (PHC), 300 samples of fomites were taken. They were screened for the presence of bacterial pathogens. Preliminary identification of bacterial isolates was performed based on Gram stain reactions and standard microbiological methods. Antibiotic susceptibility testing was done using Kirby-Bauer disc diffusion technique. The isolates of clinical importance observed were *Staphylococcus aureus* (35.1%), *Bacillus* spp. (15.5%), *Streptococcus* spp. (14.8%), *Escherichia coli* (10.1%), Coagulase Negative *Staphylococcus* (CONS) (8.1%), *Proteus* spp. (7.4%), *Pseudomonas aeruginosa* (5.4%), *Klebsiella* spp. (1.3%). Eight (8) antibiotics used against *Staphylococcus aureus* which was the most prevalent isolate showed below 50% sensitivity. High level resistance to commonly prescribed and administered antibiotics was observed. The most frequently isolated bacteria in this study were consistent with the isolates which could cause nosocomial infections.

Keywords: Bacterial isolates, Antibiotic, Susceptibility, Primary Healthcare Centers

1. Introduction

Today the increasing number of antenatal deliveries and the effect of the hospital environment on women's birth experience have become critical issues. Hospital environments that prioritize medical safety come about as a result of the movement of labor from the home to the hospital and the labeling of birth as a pathological event (Omo-Aghoja, Aisien, Akuse, Bergstrom, & Okonofua, 2010).

Babies especially those who are premature or have low birth weight, lack effective structural barriers, protective endogenous microbial flora, and a fully developed immune system at birth (Omo-Aghoja et al., 2010). The newborn represents one of the pediatric population's most vulnerable groups, particularly neonates delivered in contaminated primary healthcare facilities, where frequent use of medical equipment and immature immune systems increase the risk of nosocomial infections (Nevalainen et al., 1993).

Nevertheless, nosocomial infections remain a major cause of morbidity and mortality in developing countries where infection rates are relatively high with poor infection control practices, lack of supervision and inappropriate use of limited resources (Weinstein & Hota, 2004). Neonatal infection's main pathogens vary not just between nations and nurseries, but also change within years in the same nursery.

Healthcare workers not only contaminate their hands after direct patient contact but also after

touching inanimate surfaces and equipment in the labor ward zone (the patient and her immediate surroundings) (Hamza, 2010). Inadequate hand hygiene before and after entering a labor zone may result in cross-transmission of pathogens and patient colonization or infection. A number of equipment items and commonly used objects in labor wards carry bacteria which, in most cases, show the same antibiotic susceptibility profiles of those isolated from patients (Hamza, 2010). This study will present new findings regarding the microbial contamination of inanimate objects and equipment in labor and delivery rooms.

The main aim of this study is to investigate the Bacterial contamination that is associated with labor ward environment in some primary health care (PHC) setting within Umuahia metropolis.

2. Materials and Methods

2.1 Study location

Six public primary healthcare center (PHC) with high caseloads of pregnant women were selected from the twenty public primary health facilities within the Umuahia North Local Government Area. These Primary Healthcare centers were Nkwoegwu PHC, Orieogwu PHC, Azueke PHC, Ndume PHC, Lodu PHC and World Bank PHC.

2.2 Sample collection and processing

Sterile cotton swab sticks were prepared by making the cotton end wet with physiological saline. These were used to swab various items in the labor and delivery room. To ensure maximal coverage of a surface area, the swab were rolled back and forth over each surface.

From 22 sources in six (6) different labor wards of the Primary Health Care (PHC) Settings within Umuahia North Local Government Area of Abia State, a total of 300 consecutive samples were collected. Of these 300 samples, 270 samples were collected from sources in the six labor rooms namely; Operating Lamp (OPL), Floor (FL), Wall (WL), Sink (SK), Suction tube (ST), Forceps (FC), Scissors (SC), Trolley (TR), Weighing machine (WM), the couches/beds, tables, light switch, chairs, beds, door/locker handlers, trolley, stretchers, sinks/faucets, intravenous stands, and oxygen cylinder. All samples were labeled properly and transported to Microbiology laboratory within 30 minutes for microbiological analysis.

Following collection, the swabs were inoculated into MacConkey agar, Blood agar and manitol salt agar (Oxoid Limited). The agar plates inoculated were incubated at 37°C for 24 hrs and the growth was inspected to identify the bacteria. Preliminary identification of bacteria was performed based on gram stain reactions, colony characteristics of the organisms like hemolysis on blood agar, changes in physical appearance in differential media and enzyme activities of the organisms (Cheesbrough, 2000).

2.3 Antibiotic susceptibility test

Following isolation and identification, the microbial isolates were subjected to antibiotic sensitivity testing using the disc diffusion techniques described by Bauer, Kirby, Sherris and Turck (1966). The following antibiotics were used: ceftriaxone (30 µg), septrin (30 µg), cefalexin (30 µg), amoxicillin clavulanate (30 µg), gentamicin (10 µg), ofloxacin (10 µg), ciprofloxacin (5 µg), amoxicillin (10 µg), reflacine (30 µg), ampicillin (10 µg), streptomycin (30 µg), ampiclox (10 µg), cefuroxime (5 µg), levofloxacin (5 µg) and erythromycin (10 µg).

The examination of the control and test plates were carried out after overnight incubation to ensure the growth is confluent or near confluent. Using a ruler on the plate's buttom, the diameter of each zone of inhibition was measured in millimeter.

3. Results

A total of 300 samples were collected and analyzed from labor wards and delivery rooms of 6 primary healthcare centers of which 148 yielded bacterial growth. Ten different bacterial pathogens were identified. The organisms isolated with their percentage of occurrence were *Staphylococcus aureus* 52 (35.1%), *Bacillus* spp. 23 (15.5%), *Streptococcus* spp. 22 (14.8%), *Escherichia coli* 15 (10.1%), Coagulase Negative *Staphylococcus* (CONS) 12 (8.1%), *Proteus* spp. 11 (7.4%), *Pseudomonas aeruginosa* 8 (5.4%), *Klebsiella* spp. 2 (1.3%), *Enterobacter* spp. 2 (1.3%) and *Micrococcus* spp. 1 (0.6%). The isolates showed below 50% sensitivity to a range of commonly prescribed and administered antibiotics such as amoxicillin, septrin, amoxicillin clavulanate, ceftriaxone and ampicillin.

Table 1. Frequency and distribution of bacterial isolates.

Isolates	No	Percentage (%)
S. aureus	52	35.1
Strept. spp.	22	14.8
CONS	12	8.1
Enterobacter spp.	2	1.3
E. coli	15	10.1
Pseudomonas aeruginosa	8	5.4
Proteus spp.	11	7.4
Klebsiella spp.	2	1.3
Bacillus spp.	23	15.5
Micrococcus spp.	1	0.6
Total	148	100

CONS – Coagulase Negative *Staphylococcus*

Table 2. Total distribution pattern of the bacterial isolates from fomites.

ITEMS	*S. aureus*	*Strept* spp.	CONS	*Enterobacter* spp.	*E. coli*	*Pseudomonas aeruginosa*	*Proteus* spp.	*Klebsiella* spp.	*Bacillus* spp.	*Micrococcus* spp.	Total No of Isolates (%)
Beddings	14	4	6		6	2	1		8		41 (33.8%)
Baby cot	1	1			1			1		1	5 (4.1%)
Bowel	1	1	1		1	2	5		1		12 (9.6%)
B.P app		1									1 (0.8%)
Weighing Machine								1			1 (0.8%)
Trolley	1	1							1		3 (2.4%)
Sink				1	1	1					3 (2.4%)
Floor	2			1	1		1		5		10 (8.2%)
Chair	8	4	1		1				4		18 (14.5%)
Lamp									1		1 (0.8%)
Cupboard			2			1			2		5 (4.1%)
Drawer	1										1 (0.8%)
Curtain	1				1						2 (1.6%)
Switch	2						1				3 (2.4%)
Drip stand	2	1					1				4 (3.3%)
Bed pan	2					1	1				4 (3.3%)
Forcep	1	1									2 (1.6%)
Scissors	1	1				1					3 (2.4%)
Gali pot		1							1		2 (1.6%)
Pillow		1									1 (0.8%)
Bathtub		1					1				2 (1.6%)
Isolates	37 (29.3)	18 (14.5)	10 (8.0)	2 (1.6)	12 (9.6)	8 (6.4)	11 (8.0)	2 (1.6)	23 (18.5)	1 (0.8)	124 (100%)

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Table 3. Antibiotic susceptibility of bacterial isolates.

		No of isolates sensitive to = N (%)											
Gram (-) Isolates	**Total No**	**PEF**	**CN**	**Z**	**AM**	**CRO**	**CPX**	**S**	**SXT**	**OFX**	**AU**	**PN**	**CEP**
Enterobacter spp.	2	2 (100)	2 (100)	1 (50)	1 (50)	0 (0)	2 (100)	0 (0)	0 (0)	2 (100)	1 (50)	0 (0)	0 (0)
E. coli	15	10 (66)	10 (66)	3 (20)	3 (20)	4 (26)	9 (60)	10 (66)	1 (6)	11 (73)	4 (26)	1 (6)	0 (0)
Psuedomonas aeruginosa	8	3 (37)	4 (50)	0 (0)	0 (0)	0 (0)	3 (37)	5 (62)	0 (0)	4 (50)	2 (25)	1 (12)	1 (12)
Proteus spp.	11	3 (27)	6 (54)	3 (27)	3 (27)	3 (27)	5 (45)	6 (54)	2 (18)	6 (54)	2 (18)	2 (18)	1 (9)
Klebsiella spp.	2	1 (50)	2 (100)	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)	2 (100)	2 (100)	1 (50)	2 (100)	2 (100)

		No of isolates sensitive to = N (%)											
Gram (+) Isolates	**Total No.**	**PEF**	**CN**	**APX**	**Z**	**AM**	**CRO**	**CPX**	**S**	**SXT**	**E**	**OFX**	**LEV**
S. aureus	52	36 (62)	23 (44)	7 (13)	38 (73)	13 (25)	21 (40)	27 (51)	37 (71)	17 (32)	27 (51)	31 (59)	22 (42)
Strept. spp.	22	13 (59)	10 (45)	10 (45)	14 (63)	10 (45)	13 (59)	13 (59)	9 (40)	10 (45)	11 (50)	11 (50)	15 (68)
CONS	12	5 (41)	6 (50)	5 (41)	5 (41)	6 (50)	5 (41)	8 (66)	9 (75)	6 (50)	7 (58)	0 (0)	8 (66)

OFX-Ofloxacin, PEF-Reflacine, CPX-Ciprofloxacin, AU-Augmentin, CN-Gentamycin, S-Streptomycin, CEP-Ceporex, SXT-Septrin, PN-Amplicin, Ampicillin, E-Erythromycin, CH-Chloramphenicol, APX-Ampiclox, LEV-Levofloxacin, Z- Zinnacef and CRO-Ceftriaxone, AM- Amoxycillin

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3. Discussion

Numerous bacteria have been found to be abundant in hospital environments, and contaminated surfaces have been shown to increase the occurrence of healthcare- associated infections, especially in the most vulnerable age groups (Infancy), where immunity is decreased (Orji, Mbata, & Kalu, 2005).

A total of 300 swab samples were collected from various surfaces in the labor/delivery rooms of the six (6) different PHCs. Of the 300 swab samples collected from various surfaces 148 (49.3%) were positive for bacterial growth. This is similar to the results obtained in Maiduguri by Okon et al. (2012) who sampled 267 hospital surfaces: 50.0% were positive for bacterial growth.

The predominant bacterial contaminant in this study was *Staphylococcus aureus* accounting for 35.1% of the organism isolated. This was similar to the findings of a study carried out in Sokoto, where *Staphylococcus aureus* was equally the most prevalent isolate (Saka et al., 2016). The higher prevalence of *Staphylococcus aureus* may be due to ubiquitous distribution in human body as part of the normal flora (normal microbiota) of the anterior nares, nasopharynx and the skin (Forbes, Sahm, & Weissfeld, 2007). *Staphylococcus aureus* has pre dilection for inanimate surfaces and are relatively resistant to drying, heat and sodium chloride, these properties allow its survival on inanimate surfaces. The predominance of *Staphylococcus aureus* as found in this study is contrary to the findings of Okon et al. (2012) whose predominant isolates was found to be CONS and also at variance to the work of Garcia-Cruz, Najera Aguilar and Arroyo-Helguera (2012) in Mexico, who reported a high prevalence of *Klebsiella* spp.

The source of CONS from this study could include the normal skin flora (microbiota) of medical personnel, patients and fabrics (Cheesbrough, 2000). However, clinical implication of CONS is more pronounced in immunocompromised patients, as entry into systemic environment could initiate infections, and some of the expectant mothers attending these PHCs are HIV positive. Although not considered a pathogen, *Bacillus* spp. was the second most common isolate in this study. The findings of Singh, Kaur, Gardner and Treen (2002), Gebremariam and Declaro (2014) showed this same organism as the most frequently isolated in their studies.

In this study, the most frequently bacterial isolates was coagulase negative *Staphylococcus* spp. followed by *Pseudomonas aeruginosa*. The same observation was reported by Ensayef, Al-Shalchi and Sabbar (2009) and Onwubiko and Akande (2015) although they did not state the proportion in their reports. It is known that both bacteria easily acquire resistance to antibiotics and can cause both superficial and fatal systemic infection (Turner & Craddock, 1973). *P. aeruginosa* has the ability to survive and spread in hospital environments as a result of acquisition of multiple virulence determinants and intrinsic resistance to commonly used antibiotics and also disinfectants (Turner & Craddock, 1973). This is why *Pseudomonas. aeruginosa* is regarded as a major life threatening agent that is responsible for many outbreaks of nosocomial infections (Orji et al., 2005).

The antimicrobial susceptibility pattern of clinically relevant pathogens tested, showed similar pattern with high resistant level to amoxicillin and ampicillin, moderate resistance to erythromycin, and ciprofloxacin and high sensitivity to streptomycin, ofloxacin and gentamycin.

4. Conclusion

This study confirmed that various surfaces in the delivery room were contaminated with known bacterial pathogens. Direct involvement of these surfaces in disease transmission was not investigated in this study, but the isolation of Coagulase Negative *Staphylococcus* (CONS), *Pseudomonas aerugionosa*, *Proteus* spp., *Streptococcus* spp., *Staphylococcus aureus*, including *E. coli* presents a serious concern for possible nosocomial transmission.

This study also showed high degree of bacterial load that is beyond the standard limits on both surfaces of the hospital. Therefore, it is important to evaluate and strengthen the infection prevention practice of the primary health care centers within the Umuahia metropolis. Moreover, stakeholders should also reinforce actions to decrease the pressure of antimicrobial resistance in this studied area.

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Conflict of Interest

The author's do not report any financial or personal connections with anyone.

ORCID

Author 1: Mary Uche Kalu
https://orcid.org/0000-0002-5738-7934
Author 2: Emmanuel Onwubiko Nwankwo
https://orcid.org/0000-0002-4025-0886
Author 3: Ebubechi Uloma Okey-kalu
https://orcid.org/0000-0002-4872-3801

Ethical Approval

This study was approved by the Abia State Primary Healthcare Agency Research Ethics Committee. (Date: 10th December, 2017). Number of ethics: (RP/REC/2017/338).

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