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Bacteria Associated With Health-Care Acquired Infections from Two Selected Hospitals in Kano Nigeria

S.I. Bale[1*], M.D. Mukhtar[2], F.A. Rufa'i[3]

[1,2,3]Department of Microbiology, Faculty of Life Sciences, Bayero University, Kano, PMB 3011, Kano-Nigeria.

**Corresponding Author: fatihurufai@gmail.com, Tel.:+2348105925771*

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Abstract- Health-Care acquired infections cause menace to public health most especially the missed potentials among them which tends to be resisting the activity of therapeutic drugs used against them and in spite, causes greater menace to the integrity of the health and in turn burden the quality of life leading to high morbidity and morbidity rate. A sum of 150 samples of wound, urine and blood were obtained from patients with a clinical evidence of Health-Care acquired infections as described by NNIS. The entire sample were cultured on their respective culture media and then passed for biochemical tests, followed by Antibiotics susceptibility testing using disk diffusion method according to the guideline of the Clinical Laboratory Standard Institute. We found that, Gram-positive cocci namely *S. aureus, Strep sp.* and CoNS were the bacteria associated with Health care acquired infections. Wound swab site tends to be the most frequent site of infection with S. *aureus* as the most predominant species. However, Gram-positive were found to be resistant to cefuroxime while Gram-negative were sensitive to Cefoxitin with Imipinem having the highest activities against all the bacteria.

Keywords- Burden, Menace, Surveillance, Morbidity, Antimicrobial

I. INTRODUCTION

Health care acquired infections (HCAIs) are infections that occurs during treatment of medical or surgical conditions [1,2].Health-care associated infections first appear 48hrs or more after hospitalization or within 30days after having received healthcare[3,1]. These infections have a strong clinical manifestation due to their worsening underlying medical conditions and their increased mortality and morbidity rate; as such most Patients are more likely to be vulnerable to it. Many microbial infections are already present in or on the patient's own body and only cause problems when the body's defenses of the host are weakened or breached by surgery or other medical procedures [4]. It has been reported that microorganisms can also cause Infections either by direct contact or through a contaminated hospital environment resulting to Health care acquired infections [4]. This imposed defeat in function and increased stress for patients with more than 1.4 million people who are at risk of being infected and consequently leading to their death [5]. Accordingly, there is little knowledge on the bacteria associated with health care acquired infections due to the poorly developed surveillance systems and inexistent control methods; as such this study is vital to carried out.

II. RELATED WORK

The prevalence of HCAIs is already substantial in developed countries, where it affects from 5% to 15% of hospitalized patients and as high as 50% in ICU [8,1]. In Nigeria, there is scarce knowledge of the risks of Health care acquired infections, while In Kano State Nigeria, a report on Health care acquired infections includes the agents of postoperative site infections SSIs. On the basis of existing literature, *Staphylococcus aureus* was found to be the most predominant causative agent of health-care associated infections worldwide. But a complication is that, there is little knowledge on the burden of nosocomial infections due to the poorly developed surveillance systems and inexistent control methods [9].Because while getting care for other diseases many patients probably acquired other infections such as respiratory infections and it becomes troublesome to spot the prevalence of any Health care acquired infections in continuation of a primary care facility [6,7,1]. However, with increasing infections, there is an increase in prolonged hospital stay, long-term disability, increased antimicrobial resistance, increase in socio-economic disturbance, and increased mortality rate. [10].These infections get noticed only when they become epidemic, yet there is no institution or a country that may claim to have resolved this endemic problem [11]. It has been reported that, Health care acquired infections imposed defeat in function and increased stress for patients and are one of the major causes of death [12]. The economic cost of the infection is notable due to prolonged stay in the hospital and indirect cost with more than 1.4 million people who are at risk of being infected [11]. The prevalence of Hospital acquired infection is very higher in developed countries, where it affects up to 20 percent of hospitalized patient [10].In the hospital environment, health cared acquired bacteria

usually colonize the respiratory tract, urinary and gastrointestinal tracts and wounds of patients leading to pneumonia and urinary tract infection [11].

III. METHODOLOGY

Study Population and Hospitals
Aminu Kano Teaching Hospital (AKTH) and Murtala Muhammad Specialist Hospital (MMSH) were selected for this study. These Hospitals were chosen on the basis of frequent hospital attendance of both urban and rural patients from all the Local Government Areas of the State. Only patients with illness not caused by their underlying illness 2 days after admission were selected as the study population.

Ethical Approval
An ethical clearance was obtained from the ethical committees of Aminu Kano Teaching Hospital, Kano as well as Kano State Hospital Management Board before the commencement of this study.

Data and Sample Collection
A total samples of 150 none duplicated Urine, wound and blood were obtained from the entire two study area (AKTH=75 and MMSH=75).

Bacterial Isolation
In vitro characterization of bacteria was carried out using standard culture and biochemical tests. Each specimen was streaked on to differential and selective culture media (Oxoid, Ltd, UK) including CLED, Chocolate, Mannitol salt agar and MacConkey agar for investigation of bacteria [2].

Biochemical tests
All the isolated organisms were Gram-stained and Biochemical test was carried on the bases of their Gram reaction standard biochemical reactions, including catalase, coagulase, indole, citrate and oxidase, urease and motility [12]. Reading of the culture was done after overnight incubation at 37^0c.

Antimicrobial sensitivity testing
This test was carried out using disk diffusion method according to the guideline of the Clinical Laboratory Standard Institute [13]. In which a bacterial suspension adjusted to 0.5 MacFarland on to Muller- Hinton agar was evenly strict on a plate to ensure even distribution of inoculum in confluents lawn of growth [14]. Antibiotics impregnated Oxoid disc of Cefoxitin (30µg), Gentamicin (10µg), Cefuroxime (30µg), chloramphenicol (30µg), Erythromycin (15µg) and Amoxicillin (10µg) for Gram positive isolates while Imipinem (10µg), Chloramphenicol (30µg), Amoxicillin (10µg), Cefoxitin (30µg), Gentamicin (10µg) and Tetracycline (30µg) (Gram negative) were placed on the surface of the agar with the aid of forceps. After the disc were placed, the lid of the plate was replaced, inverted and was incubated at 35°C inside Air incubator for 18hours While Staphylococcus against Cefoxitin plate were incubated for a full 24hrs before reading. Results of other disc were taken after 18hrs except *Staphylococcus* against Cefoxitin for phenotypic detection of MRSA which was re-incubated for a total of 24hrs before reading [14]. Following incubation, Zone sizes of inhibition were measured to the nearest millimeters using a vernier calliper. The zone size was recorded on a recording sheet which was interpreted using [15] guidelines to determine the susceptibility or resistance of the organism to each drug tested indicated as either susceptible (S), Intermediate (I) or resistant (R) [16,17].

Data Analysis
Descriptive statistics were used to report prevalence rate and cumulative prevalence of Health care acquired Infection.

IV. RESULTS AND DISCUSSION

Table 1 shows the distribution of bacterial agents isolated from patients with HCAIs in two Hospitals Kano State, Nigeria. Out of the overall sample collected; 63.3% were positive bacterial isolates, 74.7% were Gram-positive while 25.3% were gram-negative. Gram positive *Staphylococcus aureus* are predominant specie in all the sample while Gram-negative *E. coli* the most frequent isoalated from Urine sample at AKTH with the incidence of 40%. Wound swab sample tends to be the most frequent sample with highest percentage of isolates 53.7% followed by urine and then blood with frequency of 31.6% and 14.7% respectively.

Antimicrobial susceptibility pattern of Gram positive isolates associated with HCAIs for both study area are shown in table 2 and 3 where majority of the Gram-positive isolates were sensitive to all antibiotics used except Amoxycilin and Cefuroxime which tends to be less effective against the isolates (i.e most of the gram positive isolates are resistant to Amoxicilin and Cefuroxime)

Table 4 and 5 shows the antimicrobial susceptibility patterns of Gram-negative isolates from both AKTH and MMSH respectively. Most of the Gram-negative isolates were sensitive against the tested antibiotics, at AKTH (100% to Imipenem, 82% to tetracycline and 65% to Cefoxitin while at MMSH, 100% to both Imipenem and tetracycline, 86% to Cefoxitin and 57% to both Chloramphenicol and gentamicin) while some were resistant to some antibiotics (at AKTH, 100%, 71% and 59% were resistant to Amoxicilin, Gentamicin and cholramphenicol while at MMSH, 86% were only resistant to Amoxicilin).

Table 1: Distribution of Bacterial agent Isolated from patients with HCAIs in the two Hospitals, Kano State

Organism	Wound Swab 51(53.7)		Urine 30(31.6)		Blood 14(14.7)		Total n(%)
	AKTH n(%)	MMSH n(%)	AKTH n(%)	MMSH n(%)	AKTH n(%)	MMSH n(%)	
S. aureus	14(44)	10(53)	1(10)	7(35)	2(50)	4(40)	38(40)
Strep. Sp.	2(6)	0(0)	0(0)	0(0)	0(0)	3(30)	5(5)
CoNS	7(22)	9(47)	2(20)	7(35)	1(25)	2(20)	28(29)
E. coli	1(3)	0(0)	4(40)	3(15)	0(0)	1(10)	9(10)
P. aeruginosa	3(9)	0(0)	2(20)	0(0)	1(25)	0(0)	6(6)
Kleb sp.	5(16)	0(0)	1(10)	3(15)	0(0)	0(0)	9(10)
Total	32(33.7)	19(20)	10(10.5)	20(21.1)	4(4.2)	10(10.5)	95(100)

Key; CoNS; Coagulase Negative Staphylococci
AKTH: Amino Kano Teaching Hospital; MMSH: Muritala Muhammed Specialist Hospital

Table 2: Antimicrobial susceptibility pattern of Gram positive bacterial isolates from HCAIs suspected patients at AKTH

Antibiotics	*S. aureus*		CoNs		*Strep sp.*		ATCC25923		TOTAL	
	S	R	S	R	S	R	S	R	S	R
GN 10µg	13(77)	4(23)	9(90)	1(10)	2(100)	0(0)	1(100)	0(0)	25(83)	5(17)
FOX 30 µg	14(82)	3(18)	10(100)	0(0)	2(100)	0(0)	1(100)	0(0)	27(90)	3(10)
E 15µg	14(82)	3(18)	4(40)	6(60)	0(0)	2(100)	1(100)	0(0)	19(63)	11(37)
C30µg	16(94)	1(6)	6(60)	4(40)	2(100)	0(0)	1(100)	0(0)	25(83)	5(17)
AML10µg	0(0)	17(100)	0(0)	10(100)	1(50)	1(50)	1(100)	0(0)	2(6)	28(94)
CXM30 µg	0(0)	17(100)	0(0)	10(100)	0(0)	2(100)	1(34100)	0(0)	1(3)	29(97)

S: sensitive; R: resistance; GN: gentamycin; FOX: cefoxitin; E: erythromycin; C: chloramphenicol; AML: amoxycilin; CXM: cefuroxime

Table 3: Antimicrobial susceptibility pattern of Gram positive bacterial isolates from HCAIs suspected patients at Muritala specialist hospital

Antibiotics	*S. aureus*		CoNs		*Strep sp.*		TOTAL	
	S	R	S	R	S	R	S	R
GN 10µg	18(86)	3(14)	16(89)	2(11)	3(100)	0(0)	37(88)	5(12)
FOX30µg	16(76)	5(24)	18(100)	0(0)	3(100)	0(0)	37(88)	5(12)
E 15µg	20(95)	1(5)	18(100)	0(0)	2(67)	1(33)	40(95)	2(5)
C 30µg	17(81)	4(19)	14(78)	4(22)	3(100)	0(0)	34(81)	8(19)
AML 10µg	3(14)	18(86)	1(6)	17(94)	0(0)	3(100)	4(10)	38(90)
CXM 30µg	0(0)	21(100)	18(100)	0(0)	0(0)	3(100)	0(0)	42(100)

S: sensitive; R: resistance; GN: gentamycin; FOX: cefoxitin; E: erythromycin; C: chloramphenicol; AML: amoxycilin; CXM: cefuroxime

Table 4: Antimicrobial susceptibility pattern of Gram-negative bacteria isolates from HCAIs suspected patients at AKTH

Antibiotics	*E. coli*		*Klebsiella sp*		*P. aeruginosa*		TOTAL	
	S	R	S	R	S	R	S	R
IMP10µg	5(100)	0(0)	6(100)	0(0)	6(100)	0(0)	17(100)	0(0)
C30µg	4(80)	1(20)	2(33)	4(67)	1(17)	5(83)	7(41)	10(59)
AML10µg	0(0)	5(100)	0(0)	6(100)	0(0)	6(100)	0(0)	17(100)
FOX30µg	3(60)	2(40)	3(50)	3(50)	5(83)	1(17)	11(65)	6(35)
GN10µg	0(0)	5(100)	1(17)	5(83)	4(67)	2(33)	5(29)	12(71)
TE30µg	3(60)	2(40)	6(100)	0(0)	5(83)	1(17)	14(82)	3(18)

S: sensitive; R: resistant; IMP: imipenem; C: chloramphenicol; AML: Amoxicillin; FOX: Cefoxitin; GN: gentamycin; TE: tetracyclin

Table 5: Antimicrobial susceptibility pattern of Gram negative bacteria isolates from HCAIs suspected patients at Muritala Specialist Hospital

Antibiotics	*E. coli*		*Klebsiella sp.*		TOTAL	
	S	R	S	R	S	R
IMP 10µg	4(100)	0(0)	3(100)	0(0)	7(100)	0(0)
C 30µg	3(75)	1(25)	1(33)	2(67)	4(57)	3(43)
AML10µg	0(0)	4(100)	1(33)	2(67)	0(0)	6(86)
FOX 30 µg	3(75)	1(25)	3(100)	0(0)	6(86)	1(14)
GN 10µg	2(50)	2(50)	2(67)	1(33)	4(57)	3(43)
TE 30µg	4(100)	0(0)	3(100)	0(0)	7(100)	0(0)

S: sensitive; R: resistant; IMP: imipenem; C: chloramphenicol; AML: Amoxicillin; FOX: Cefoxitin; GN: gentamycin; TE: tetracyclin

Discussion

Healthcare-associated infection (HCAIs) is one of the major public health problems around the world, however it vary from one country to the other because of the differences in surveillance approach. It can result to high morbidity and mortality [17,1]. In this study, 150 non duplicated clinical samples were analyzed. Ninety five (63.3%) samples were showed to be positive from all the sample process of which MMSH have highest isolated organisms of 49(51.6%) and AKTH with 46(48.4%). [17] Report in their study that most of their identified patients is from gynecology 103(26.1%) followed by medical 102(25.9%) and surgical ward 99(25.1%). Morgan and Johns (2016) report in their study that the risk of developing a health-care associated infection (HCAIs) increases linearly by age; a 2011 prevalence study reported a 11.5% HCAIs prevalence rate in patients over the age of 85, which decrease significantly with younger age 11.27% in 75-84 group, 10.64% in 65-74 and 7.37% in patients under the age of 65 [22,23]. The overall most frequent sample of infection is wound swab 51(53.7%) followed by Urine 30(31.6%) then blood 14(14.7%). the highest positivity was found in wound swab 32(33.7%) in AKTH, 20 (21.1%) from urine in MMSH and 19(20%) from wound swab also in MMSH, the least positivity 4(4.2%) and 10(10.5%) was found in blood at both AKTH and MMSH respectively. While surgical site infections account for the largest proportion of HCAIs in the age group of under 65, HCAIs in the elderly are primarily attributed to urinary tract infections (Smith *et al.,* 2008). From a total number of isolates obtained in this study, Gram-positive isolates were the commonest 74.7% while Gram-negative 25.3% of the total numbers of isolates were the least; this correspond with findings of [19,20] where Gram-positive cocci 55.6% have been reported as the most commonly associated organisms with hospital acquired infections while [19] reported that Gram negative isolates 77.5% is the most commonly organism associated with HCAIs.

In this study, high resistant were observed in Cefuroxime (30µg), Amoxicilin (10µg) and Cholramphenicol (30µg) with least resistant of the isolates to Imipinem (10µg) and cefoxitin (30µg). This finding corresponds with what was obtained by [21] where Amoxicilin was resistant to almost all the isolates 84.6% and 75.0% to *E. coli* and *P. aeruginosa* respectively while imipinem has the least resistant activity (7.7% and 6.9% for *E. coli* and *Strep Sp.* respectively at MMSH). In Uganda, [19,20] reported 97% of the isolates resistant to Amoxicilin (10µg) [23].

V. CONCLUSION AND FUTURE SCOPE

Conclusively, Gram-positive cocci namely *S. aureus, Strep sp.* and CoNS were the bacteria associated with Health care acquired infections. Wound swab site tends to be the most frequent site of infection with S. *aureus* as the most predominant species. However, Gram-positive were found to be resistant to cefuroxime while Gram-negative were sensitive to Cefoxitin with Imipinem having the highest activities against all the bacteria. Accordingly, Specific health care awareness by the clinician and paramedical staff to the general public is urgently recommended. However, local factors of the spread of health care acquired infections could be identified and quantified under an effective medical surveillance system, so as to prevent the spread of the infections within the community.

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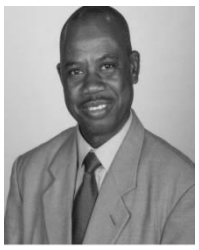
AUTHORS PROFILE

S.I. Bale hail from Ballah village, Ilorin town of Kwara state. He obtained ND in computer science from Kwara state polytechnic, PGDE in Education at FCE Kano, BSc Microbiology and MSc Pharmaceutical Microbiology from Bayero University Kano. He attended many international and local conferences and published many research articles. His major research area is Public Health and General Microbiology.



M. D. Mukhtar is a Professor of Pharmaceutical Microbiology, in the Department of microbiology, Faculty of life Sciences, Bayero University, Kano- Nigeria. His major areas of Research interest include Public Health, Chemotherapy, Pharmacology, Drug Research, Pharmaceutical Microbiology, Microbial Physiology and General Microbiology. He has published Hundreds Research Articles in reputable national and international journals, and more than ten published books. He attracted uncountable number of Research grant from national and international bodies and developed varieties of academic projects. He is member of more than twenty professional associations and a life member of Nigerian Society of Microbiology since 2003. He has 30 years of teaching in the university, and he supervised hundreds of undergraduate and post graduate students. He was a reviewer and editor in varieties of reputable national and international journals and has been contributing in maintaining their high peer review standards.

F. A. Rufa'i obtained Bsc Microbiology and M.Sc. (Medical/Pharmaceutical) Microbiology in the Department of microbiology, Faculty of life Sciences, Bayero University, Kano-Nigeria. He is currently working as a Researcher at Nigerian Institute for Trypanosomiasis Research. In Research areas he talks about Trypanosomes, pharmaceutical and medical microbiology, and Public Health. He published many research articles in local and international journals, and attended many national and international workshops and conferences. He is a member of Nigerian Society of Microbiology, American Society of Microbiology, and Association of Pharmaceutical Research.

