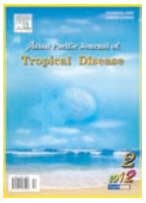
Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage:www.elsevier.com/locate/apjtd



Document heading doi:

Pattern of hospital associated infections in a teaching hospital in Nigeria

*Olajubu, Festus Abiose[1], Osinupebi, Olubunmi Adetokunbo[2], Lawal Ismail[3], Obadina Bosede[4], Deji-Agboola, Anota Mopelola[2]

[1]*Department of Microbiology, Adekunle Ajasin University, Akungba-Akoko*
[2]*Department of Microbiology and Parasitology, Obafemi Awolowo College, of Health Sciences, Olabisi Onabanjo University, Sagamu*
[3]*Department of Medical Microbiology and Parasitology, Olabisi Onabanjo University Teaching Hospital, Sagamu*
[4]*Infection Control Unit, Olabisi Onabanjo University Teaching Hospital, Sagamu*

ARTICLE INFO

Article history:
Received 5 September 2012
Received in revised from 27 October 2012
Accepted 28 November 2012
Available online 28 December 2012

Keywords:
Hospital associated infection
Teaching hospital
Antibiogram
Surveillance
Klesiella pneumonia

ABSTRACT

Objective: This study aimed at investigating the distribution and antibiogram of possible hospital associated pathogens, providing baseline information for the hospital. **Methods:** Patients with hospital associated infections in the various wards of OOUTH, Sagamu, between January 2007 and October 2010 were analyzed with respect to their age, sex, ward and duration of admission, site of infection, pathogens isolated and their antibiotic susceptibility pattern. **Results:** There were 12,109 discharges during the study period, out of which 217 had hospital associated infections giving an incidence rate of 1.8%. Surgical sites were the most infected (31.3%) while burns were the least infected (4.1%). *Klebsiella pneumoniae* was the most frequently isolated pathogen (37.3%) closely followed by *Staphylococcus aureus* (36.4%). Male surgical specialty and Neonatal wards had the highest hospital associated infections; each recorded 54 cases while the intensive care unit had only 4 cases during the period under study. Most of the isolates were sensitive to Ofloxacin and Ceftriazone while resistance was demonstrated against Azithromycin and Tetracycline by most isolates. **Conclusion:** The infection rate in this hospital is relatively low, however, regular surveillance remains a good control measure to either maintain the current infection rate or further reduce it.

1. Introduction

It has not been possible to create an environment that is absolutely free of microorganisms which have the potential for causing diseases in our health care facilities. This explains why some patients develop infections which were neither present nor incubating in them at their time of being admitted. This type of infection is called Nosocomial or Hospital-associated/ Acquired infection.[1,2] Nosocomial infections include infections acquired in the hospital but appearing after discharge and also occupational infections among staff of the facility.

Hospital-associated infection which has a world wide distribution remains a major cause of deaths among hospitalised patients. It has been estimated that over 1.4 million people world wide suffer from infectious complications acquired in the hospital.[3,4,5]

The prevalent rate of nosocomial infections in European and Western pacific regions were 7.7% and 9.0% respectively. In 1998, Ogunsola *et al*[6]reported a monthly prevalence range of 0.11-8.1% among patients in Lagos University Teaching Hospital, while the prevalence rate was 4.2% at the University of Ilorin Teaching Hospital.[2,6,7] Some organisms can survive for a longer period of time in the hospital environment and can also survive disinfectant solutions thereby becoming potential pathogens for hospital infections.[1]These microorganisms could be bacteria, fungi, viruses or parasites.

Commonly isolated hospital associated pathogens are *Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Escherichia coli, Bacillus cereus, Proteus sp, Legionella* and *Clostridium sp*. Hepatitis B,C, D, HIV, *Aspergillus sp*., *Candida albicans* and *Cryptosporidium*

*Corresponding author: Department of Microbiology, Adekunle Ajasin University, Akungba-Akoko
E-mail: olajubufa@yahoo.com
Phone: +234802 393 1914

had also been incriminated as pathogens in nosocomial infections. [7,8,9]

Device-associated infection was reported to have been the major cause of morbidity and mortality of patients in intensive care unit of a Korean hospital. These device-associated infections include Catheter-associated urinary tract infection (CAUTI), central-line associated blood stream infection (CABSI) and ventilator-associated pneumonia (VAP). [10,11]

The most common sites of Nosocomial infections are surgical wounds, burns, urinary tract, respiratory system, skin, blood and the gastrointestinal tract. *Pseudomonas aeruginosa* is commonly associated with wound and burns infections while *Escherichia coli* is predominantly isolated in urinary tract infections.[12,13,14,15]

The role of a microbiology laboratory in the establishment of Nosocomial infection cannot be overemphasized. Gastmeier *et al*,[12]reported that there were remarkable differences in infection rates between hospitals with and those without an on-site Microbiology laboratory.

Many control measures which include setting up of infection control unit and use of checklist by infection control practitioners have been adopted in many health facilities, yet nosocomial infections still remain a burden. Since the establishment of the infection control unit in Olabisi Onabanjo University Teaching Hospital (OOUTH) Sagamu, Nigeria, there had not been any assessment of their activities nor making their achievements known to either the local or international communities. The publication of the contribution of this unit to reduction in hospital infections becomes imperative.

This study, therefore, aimed at investigating the rate, distribution and antibiogram of possible pathogens and establishing a reference which will be useful in monitoring the activity of the infection control unit of the hospital.

2.Materials and Methods

This retrospective study was carried out between January 2007 and October 2010 at the various wards/ units of Olabisi Onabanjo University Teaching Hospital, Sagamu in Ogun state, Nigeria. Samples were taken from infected post operative wounds, umbilical cords and eye of neonates, burn sites, catheter tips, Steiman's pin site and blood for culture. Information about the age, sex, ward and date of admission, site of infection and sample type were extracted from the patients' laboratory forms.

The samples were streaked out on Blood agar and MacConkey agar. The plates were then incubated aerobically at 37℃ for 24hrs. Presumptive identification of the colonies was done by observing their colonial morphology on the culture media. Further identification of purified isolates were done through biochemical tests which include, Catalase, Coagulase, Indole production, Citrate utilization, Urea agar and Sucrose Indole Motility (SIM) agar. Modified Kirby-Bauer's[16]method was used for the susceptibility testing of the isolates. Meuller-Hinton agar and Abteky multiple antibiotic discs for both Gram positive and Gram negative isolates were used. Control strain, *Staphylococcus aureus* (ATCC 25923) and *Escherichia coli* (ATCC 25922) were tested along with Gram positive and Gram negative isolates respectively.

3.Results

A total of 217 patients had hospital associated infections during the 41 months of the study. During the same period 12,109 patients were discharged from the hospital putting the infection rate at 1.8%. Of the total hospital associated infection, 32.7% was for 2007 while the months of May, June,

Table 1

Monthly distribution of Nosocomial infections.

Year	Jan	Feb	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Total
2007	3	4	4	2	10	10	12	10	–	2	9	5	71
2008	7	8	5	1	2	5	2	9	4	4	6	2	55
2009	4	5	8	16	4	4	3	1	4	4	8	5	66
2010	7	4	4	2	8	–	–	–	–	–	–	–	25

Table 2

Sites of nosocomial infections by each year under review.

Period	Number of pathogens isolated from infection sites.									
(Years)	Soft tissues	UTI	Surgical sites	Steiman's pin sites	RTA wounds	Eyes	Cords	Burns	Blood	Total (%)
2007	12	8	15	2	8	4	5	5	1	60 (27.6)
2008	2	10	14	4	3	8	2	3	5	51 (23.5)
2009	4	7	22	1	10	5	4	–	7	62(28.6)
2010	1	7	17	3	10	4	–	1	1	44 (20.3)
Total (%)	19 (8.8)	34 (15.7)	68 (31.3)	10 (4.6)	31 (14.3)	21 (9.7)	11 (5.1)	9 (4.1)	14 (6.4)	217 (100)

Legend:

UTI- Urinary Tract Infections

RTA- Road Traffic Accidents

Table 5

Antibiogram of bacteria isolates associated with nosocomial infections.

Antibiotics	Susceptibility of isolates (%)							
	S. aureus n=79	Klebsiella pneumonia n=81	Proteu sp n=24	Coag.-Staph n=5	E. coli n=10	Atipical. coliform n=4	Pseudomonas sp n=12	Serratiamerscenses n=2
Ofloxacin	72	52	21	65	8	2	11	2
Ceftriazone	70	49	21	4	8	1	2	2
Gentamycin	75	35	18	4	4	0	2	1
Ceftazidine	62	61	15	5	5	0	11	1
Azithromycin	65	–	–	3	–	–	–	–
Erythromycin	65	–	–	3	–	–	–	–
TetraTetracycline	15	–	–	2	–	–	–	–
Augmentin	47	64	12	3	8	1	6	1
Cotrimoxazole	17	53	06	2	6	0	0	0
Nitrofurantoin	54	21	06	1	6	2	1	0
Nalidixic acid	12	15	07	1	2	2	2	0

July and August of the same year recorded an average of 10.5 infections as shown in Table 1. The month of April, 2009 recorded the highest number of infections. Table 2 showed that there were 127 (58.5%) males and 85 (41.5%) females, giving a male to female ratio of 1.5:1. 31.3% of infections were from surgical wounds, 15.7% were from urinary tracts while burns contributed 4.1%.

Table 3

Ward distribution of nosocomial infections.

Years	Wards									
	MSS	PSW	MSG	GYN	NNW	ICU	MMW	FMW	FSW	Total
2007	28	9	10	2	–	4	–	–	13	66
2008	15	2	13	9	14	–	–	5	2	60
2009	4	4	–	30	24	–	–	4	–	66
2010	7	–	–	–	16	–	–	2	–	25
Total	54	15	23	41	54	4	–	11	15	

Legend:

MSS- male surgical specialty; PSW-paediatrics surgical ward; MSG-male surgical general;

GYN- gynaecology ward; NNW- neonatal ward; ICU- intensive care unit; MMW- male

Medical ward; FMW- female medical ward; FSW- female surgical ward.

Table 4

Frequency of isolation of nosocomial pathogens

Clinical isolates	Number isolated			
	2007	2008	2009	2010
S. aureus	26	10	32	11
Klebsiella pneumonia.	38	23	16	4
Proteus sp.	4	3	11	6
Coagulase -ve Staph .	–	1	–	4
Escherichia coli	2	7	1	–
Atypical coliform	1	1	2	–
Pseudomonas sp	–	10	2	–
Serratia merscences	–	–	2	–

The ward distribution of hospital associated infections as shown in Table 3 had 54 infection cases in male surgical specialty (MSS) and neonatal wards (NNW) while only four cases were reported in intensive care unit (ICU) of the hospital during the study period. *Staphylococcus aureus* (36.4%) and *Klebsiella pneumoniae* (37.3%) were the most frequently isolated bacteria. However, *Serratia marscenses* was isolated in two cases (0.9%) in 2009 as shown in Table 4. The ratio of Gram-positive to Gram-negative stood at 1:3. The susceptibility of the isolates was highest with Ofloxacin. Tetracycline and Nalidixic acids performance were poor. *Staphylococcus aureus* was sensitive to a greater number of antibiotics while the atypical coliforms were resistant to many of the antibiotic used in this study as demonstrated in Table 5.

4.DISCUSSION

Hospital associated infections remain the major cause of death among hospitalised patients worldwide. The infection rate of 1.8% in this study is relatively low when compared with other reports from different parts of the same country (Nigeria) namely Ilorin (4.2%), Ife (2.7%), Lagos (3.8%) and other nations of the world like Germany (3.5%), Senegal (11%), Norway (7.3%), Korea (7.5%) and Ankara (2.4%).[17,18,19,20]

The most likely reasons for this low infection rate might be associated with the type of cases received during the study period, the types of interventions employed and the zeal of the infection-control nurses in the despatch of their duty and the willingness on the part of the care givers to embrace the then new programme in controlling hospital associated infections.

The infection rate of 28.9% recorded in the neonatal unit and surgical ward were of great concern when compared with total infection rate of 1.8%. Though, similar pattern was observed in Lagos (15.1%) Korea (20%) and other centres.[17,18,21]The contribution of the immature immune system of these neonates might be a major factor together with the stress of delivery processes especially in prolonged labour cases since these are cases often referred to tertiary health

facilities as last result. Many factors can really contribute to the high rate of infection (31.3%) in post operative wound infections which could include the surgical procedures employed, fitness of the patient before surgery, post operative nursing care and the ward environment. But not likely from the operating theatre since the air of the operating theatre of this hospital has been studied and found to contain no potential pathogen for Nosocomial infection.[21,23,24]

Though critical cases are managed in the Intensive Care Unit (ICU) of the Hospital, the very low infection rate (1.8%) might be due to the consciousness of the health care givers; holistic cleaning arrangements regularly employed in this units and restriction of movements to and fro this unit, which is not observed in many other wards of the hospital. However, an average device-associated infection rate of 6.8% has been reported by the International Nosocomial Infection Control Consortium (INICC) in 36 countries of the world.[14,25]

In a German hospital, Urinary Tract Infection (UTI) was responsible for 42.1% of nosocomial infections, in Lagos 22% but 15.7% in this study. This is relatively comparable to observation from Lagos hospital but lower than the study in Germany. In- dwelling catheter, types of ailments (e.g diabetes and AIDS), patients toilet hygiene and duration of stay in the hospital are known to predispose a patient to hospital associated UTI.[12,21,26]The most frequently isolated Gram negative bacterium is *Klebsiella pneumoniae* (37.3%). This agrees with the work of Odimayo *et al*.[7]and Edinc *et al*.[22]*Klebsiella pneumoniae* is a non-motile capsulated bacterium that can survive adverse conditions. It is often associated with infections such as bronchopneumonia, wound sepsis, bacteremia, meningitis and urinary tract infections.[13,27,28]Hence, its isolation is of clinical importance. *Staphylococcus aureus* (36.4%) was the most frequently isolated Gram-positive bacterium. This has also been reported by other researchers. *Staphylococcus aureus* is equally hardy and can survive in adverse environment for a very long period. It has been isolated from skin and nasal samples of hospital personnel, hospital formites and air.[1,9] This explains why *Staphylococcus aureus* is readily isolated in the hospital environment.[8,9,23,29]Proteus sp., Coagulase-negative *Staphylococcus; Escherichia coli, Pseudomonas sp*., which were isolated in this study has equally been reported in other related works.[6,7,10,13]

Ofloxacin has the best activity across all the isolates and this is closely followed by Ceftriazone and Gentamycin. This agrees with the work of Odimayo *et al*.[7]and shows that these antibiotics can still be effectively employed for the treatment of nosocomial infections even presumptively. This study has produced a baseline data for the assessment of the activity of the infection control department. It is also suggested that checklist of items be prepared for daily surveillance as this might further reduce the infection rate in this hospital.

Conflict of interest statement

We declare that we have no conflict of interest.

ACKNOWLEDGEMENT

We are grateful to the Management of Olabisi Onabanjo University Teaching Hospital for provision of materials and space for this study. We also appreciate the contributions of Mrs. Otaru-Bello and all the staff of Microbiology Department toward the success of this work.

References

[1] Rajesh B, Rattan LI. Essentials of Medical Microbiology. Jaypee Brothers Medical Publishers. 4th Edition ;2008, p. 448-451.

[2] Cheesbrough M. Medical Laboratory for Tropical Countries, 2nd Edition, University Press, Cambridge; 1991, p. 508-511.

[3] World Health Organization (WHO). Prevention of hospital-acquired infections- A practical guide. 2nd Ed. Edited by Ducel G, Fabry J, Nicolle L. 2002, p. 5-72.

[4] Gerberding JL. Hospital- Onset infections: A patient safety issue. *An International Med* 2002, **137**: 665-670.

[5] Arias CA, Murray BE. Antibiotic-Resistant Bugs in the 21st century. A clinical super challenge. The New England Journal of *Medicine* 2009, **360**: 439-443.

[6] Ogunsola FT, Oduyebo O, Iregbu KC, Coker AO., Adetuyi A. A review of Nosocomial infection at the Lagos University Teaching Hospital: Problems and strategies for improvement. *Journal of the Nigerian Infection Control Association* 1998, **1**(1): 11-13.

[7] Odimayo MS, Nwabuisi C, Adegboro B. Hospital-acquired infections in Ilorin, Nigeria. The Tropical Journal of *Health Sciences* 2008; **15**(1): 49-54.

[8] Sanaa OY, Armani EA. Isolation of Potential Pathogenic bacteria from the air of hospital-delivery and Nursing Rooms. *Journal of Applied Science* 2010; **10**(11): 1011-1014.

[9] Chikere CB, Omoni VT, Chikere BO. Distribution of potential Nosocomial pathogens in a hospital environment. *African Journal of Biotechnology* 2008, **7**(20): 3535-3539.

[10] Kwak YG, Lee SO, Kim HY Risk factors for device-associated infections related to organisational characteristics of intensive care unit: Findings from the Korean Nosocomial Infections Surveillance System. *Journal of Hospital infection* 2010, **75**(3): 195-199.

[11] Yinnon AM, Wiener-Well Y, Jerassy Z. Improving implementation of infection control guidelines to reduce Nosocomial infection rate: pioneering the report card .Journal of hospital infection. In Press, Corrected Proof. Available online 23rd May 2012.

[12] Gastmeier P, Kampf G, Wischnewski N. Prevalence of Nosocomial infections in representative German hospital. *Journal of Hospital infection* 2004, **38**(1): 37-49.

[13] Victor DR, Hu B, Dennis,GM. International Nosocomial Infection

Control Consortium (INICC) report, Data summary of 36 countries, for 2004-2009. *American Journal of Infection Control* 2012, **40**(5): 396-407.

[14] Victor DR, Dennis GM, Silom A. International Nosocomial Infection Control Consortium (INICC) report, Data summary for 2003-2008. *American Journal of Infection Control* 2010, **38**(2): 95-104.

[15] Rosello J, Olona M, Campins M. Investigation of an outbreak of Nosocomial infection due to a multiply drug-resistant strain of *Pseudomonas aeruginosa*. *Journal of Hospital infection* 1992, **20**(2): 87-96.

[16] Bauer AW, Kirby MM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disc method. *Am. J. Clin. Pathol* 1966, **45**: 493-496.

[17] Onipede AO, Oluyede CO, Aboderin AO, Zailami SB, Adedosu AM, Oyelese AO A survey of Hospital Acquired infection in Obafemi Awolowo University Teaching Hospital, Ile-Ife. *Afr. J. Clin. Exp. Microbial* 2004, **5**: 108-118.

[18] Kesah CN, Egri-Okwaji MTC, Iroha EO, Odugbemi T. Experience with hospital-acquired infections in paediatric wards of Lagos University Teaching Hospital. Journal of *Infection Control Association* 1998, **1**: 14-20.

[19] Ka AS, Peigne V, Bougere J, Seye MN, Imbert P. Efficacy of an infection control programme in reducing Nosocomial blood stream infections in a Senegalese neonatal unit. *Journal of hospital infection* 2011, **79**(2): 161-165c.

[20] Eriksen HM, Iversen BG, Aaritsland P. Prevalence of Nosocomial infections and use of antibiotics in long-term care facilities in Norway, 2002 and 2003. *Journal of Hospital infection* 2004, **57**(4): 316-320.

[21] Kesah CN, Egri-Okwaji MTC, Iroha EO, Odugbemi TO. .Bacteria associated with Nosocomial infection and their antimicrobial resistance pattern in paediatric patients in a tertiary health institution. Journal of *Medicine and Medical Science* 1999, **1**:6-13

[22] Erdinc FS, Yetkin MA, Hatipoglu M, Yucel AE, Karakoc MA, Cevik N. Five-year surveillance of nosocomial infections in Ankara Training and Research Hospital. *Journal of Hospital infection* 2007, **67**(2): 205-206

[23] Awosika SA, Olajubu FA, Amusa NA. Microbiological assessment of indoor air of a teaching hospital in Nigeria. *Asian Pacific journal of Tropical Biomedicine* 2012, 465-468.

[24] Ishida TK, Nakano H, Nakatani A. Bacteriology evaluation of cardiac surgery environment accompanying hospital relocation. *Surgery Today* 2006, **36**: 504-507.

[25] Abad C, Fearday A, Safdar N. Adverse effect of isolation in hospitalised patient: a systemic review. *Journal of Infection Control* 2010, **76**: 97-102.

[26] Oni AA, Mba GA, Ogunkunle MO, Shittu OB, Bakare RA. Nosocomial infections: Urinary tract infection in patients with indwelling urinary catheter. *Afr. J. Clin. Exp. Microbial* 2003, **4**: 63-71.

[27] Zhanel GG, Decorby M, Laing N. Antimicrobial-resistant pathogens in intensive care units in Canada: results of the Canadian National Intensive Care Unit (CAN-ICU) study, 2005-2006. *Antimicrob Agents Chemotheter* 2008, **52**: 1430-1437.

[28] Benet T, Vanhems, P. Correlation of Nosocomial bloodstream infection incidences: An Ecological study. *Journal of Hospital infection* 2009, **73**(3): 217-224.

[29] Ekhaise, FO, Isitor EE, Idehen O, Emoghene AO. Airborne microflora in the Atmosphere of an Hospital Environment of University of Benin Teaching Hospital (UBTH) Benin City, Nigeria. *World Journal of Agricultural Sciences* 2010, **6**(2): 166-170.