Research Article

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Prevalence of bacterial nosocomial infections in matibabu foundation hospital and ukwala sub county referral hospital in Siaya County

Abstract

Nosocomial infection is an infection that is contracted from the environment or staff of a healthcare facility. This infection can transmitted to a susceptible patient in a clinical setting by a number of medium including contaminated equipment, bed linens, or air droplets. This cross sectional study was carried out from March 2015 to August 2015 in Ukwala Sub County Hospital and Matibabu Foundation Hospital in Ugenya Sub county to determine prevalence of Bacterial nosocomial infections in the two Hospitals. A sample size of 108 was used for collection of data. The overall percentage prevalence of nosocomial infection in the two hospitals was found to be twelve point zero three percent (12.03%) with USCH recording five point six percent (5.6%) while MFK had six point five percent (6.5%). The most common nosocomial infection was urinary tract infection at nine point zero percent (9.0%), followed by Blood stream infection at four percent (4%). To determine the susceptibility pattern, Modified NCCLS Kirby-Bauer disc diffusion technique was used and the interpretation of zones done by use of NCCLS chart (Monica Cheesbrough page 141). It is recommended that another study incorporating bacterial, fungal and viral Nosocomial infection be carried out in order to establish the actual prevalence of nosocomial infection in the two hospitals.

Keywords: bacterial nosocomial infection, urinary tract infection, primary bacteremia, catheter-related infection

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Abbreviations: WHO, world health organization; UTI, urinary tract infection; CDC, centre for disease control

Introduction

Infection control and health care associated infections prevalence reports from developing countries are often not well established because of lack of enough staffs and resources. In the United States, the number of HCAI rose from 72 to 98 per cent from 1975 to 1995.[1,2] The Centre for disease control (CDC) estimates that nearly 2million patients around the same time in USA were infected with HCAI and the cost of treatment was estimated at 4.5million dollars per year (WHO, 2002). According to WHO publication, in developing countries the prevalence of HCAI in 2009 varied from 3.8% to 18.6%. In Kenya, a study conducted in Kenyatta National Hospital on the incidence of catheter associated urinary tract infection (UTI) in the intensive care unit (ICU), established the incidence rate to be 18% (WHO, 2009). Epidemiological characteristics of nosocomial infections show variations in different hospitals of the same countries.[3–5] Many of the infections are associated with microorganisms that are resistant to multiple antibiotics and can easily spread on hands of personnel.[6] Nowadays, over 1.4million people worldwide and more so in resource limited nations, suffer from infectious complications acquired in hospital.[7,8] These infections are associated with overstay in hospital, multiple complication, stress to relatives and even loss of lives.[9–11]

Objective

This study aimed at determining the prevalence rates of nosocomial infections in Matibabu Foundation Hospital (MFK) and Ukwala Sub county Hospital (USCH) in Kenya.[12,13]

Methods

This was a cross sectional study which was carried out in the two hospitals from May 2015 to August2015. The study was conducted in Siaya County which is one of the counties in the former Nyanza Province in the southwest part of Kenya. It is bordered by Busia County to the north, Kakamega County and Vihiga County's to the northeast and Kisumu County to the southeast. It had a population of 108,934 with ukwala having a population of 49,802 and the urban population in ukwala town where the two hospitals are located being 671(National, 2009). The study was carried out in ukwala town. The focus areas were the two hospitals located in ukwala i.e. Matibabu foundation hospital and Ukwala Sub county Referral hospital. The Inclusion criteria involved: Patients who developed signs of urinary tract infection (UTI), primary bacteremia, catheter-related infection, or wound infection (i.e. at least 48h to 72h after admission) were eligible and were included in study. Those who qualify were asked for consent to be formally included in the study. Ethical clearance was sought from relevant regulatory bodies.

Data collection procedures

Data was collected using a predesigned tool which captured both the independent and dependent variables.

Urine specimens culture procedures

Urine samples were collected for bacteriological examination by the midstream method or catheterization into sterilized container after using catheter. Then the following procedures were carried out;

Biochemical tests: Biochemical tests used in identification of

Prevalence of bacterial nosocomial infections in matibabu foundation hospital and ukwala sub county referral hospital in Siaya County

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the isolates were Catalase test, coagulase test, indole production, Hydrogen gas production, motility test, urease test, oxidase test.

Microbiological susceptibility testing and preparation of turbidity standard

The antimicrobial susceptibility test was performed using the Kirby Bauer disk diffusion technique. Mueller Hinton agar was prepared and sterilized as instructed by the manufacturer and then poured into 90ml diameter sterile petri dish to a depth of 4mm and kept at 2-8°C in sealed plastic bags. For use, the plates were dried at 37°C for about 30 minutes. Before inoculation into the Mueller Hinton agar, 3-5 well isolated colonies were removed from a pure culture to make a suspension of the test organism. The turbidity of the test suspension was checked against the turbidity of a chemical standard. A swab was used to collect inoculum by careful rotation against the side of the tube and then the surface of the plate was swabbed by rotating followed by application of disc on the inoculated plate. This was then incubated at 37°C.

Preparation of turbidity standard

I. Add 99ml of water to 1ml concentrated sulphuric acid (1%v/v conc. H_2SO_4(aq)).

II. For 1% solution of barium chloride, dissolve 0.5g of dehydrate barium chloride in 50ml distilled water.

III. Add 0.6ml of barium chloride solution to 99.4ml of sulphuric acid solution and mix.

IV. Store in a well-sealed container in a dark bottle at 20 -28°C.

The drugs for disk diffusion testing were in the following concentrations:

Patterns of nosocomial infections

Among 108 patients, 13 (12.04%) were confirmed to have nosocomial infection. Of the 13 patients 8 (61.54%) were males and 5 (38.46%) females. The overall distributions of the nosocomial infections in both hospitals were UTIs 9 (8.3%), and BSIs 4(3.7%).[14]

Antibiotic usage

All of the patients included in the study had received antibiotic(s), in the form of either prophylactic or therapeutic (Tables 1-7).

Gram positive bacteria

Table 8: Percentage susceptibility patterns of S. aureus

Table 1 Summary of blood culture procedures

Day 1	
Collect blood and inoculate culture media	Using aseptic technique dispense:
	10-12ml blood into Columbia agar diphasic medium and mix incubate up to 7 days
	When aerobic infection is suspected, dispense 5ml blood into thioglycollate broth and mix. Incubate up to 14 days
	Dispense 2ml blood into EDTA and mix
	Prepare buffy coat smears from EDTA blood ;
Examine microscopically	Gram smear
	Gram stain
Day 2	
Examine and report cultures	After overnight incubation:
	1. Examine diphasic culture: subculture (even when no growth is seen); in Blood agar and macConkey agar, incubate aerobically, in chocolate agar, incubate in CO2
	Perform antimicrobial susceptibility tests

Table 2 Summary of urine culture procedures

Day 1		
Describe appearance	Describe color whether clear or cloudy	
Examine microscopically	Wet preparation and report: WBCs, RBCs, Casts, Cells etc	Gram smear : when Bacteria or WBCs (pus cells) are seen in wet preparation
Tests Biochemically	Tests to help diagnose UTI	Glucose ,ketones, bilirubin urobilinogen
Culture specimen	CLED agar; inoculate CLED medium and incubate aerobically	
Day 2		
Examine and report cultures	CLED culture Look particularly for; *E coli, Proteus, p. aeruginosa, S. aureus, S. saprophyticus*	Carry out susceptibility testing as indicated

Prevalence of bacterial nosocomial infections in matibabu foundation hospital and ukwala sub county referral hospital in Siaya County

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Table 3 Summary of pus culture procedures

Day 1		
Cleanse skin around wound with alcohol and aspirate or tissue is best	Inoculate on blood and mac conkey agar, Gram stain	Incubate up to 48hours in carbon dioxide
Day 2 Onwards		
Identify and perform susceptibility on growths	When two or more pathogens present report as mixed flora	

Table 4 Himedia discs used on Gram negative bacteria

Antibiotic	Symbol	Concentration
Ampicillin	AMP	25mcg
Tetracycline	TE	25mcg
Co-trimoxazole	COT	25mcg
Streptomycin	S	10mcg
Kanamycin	K	30mcg
Gentamycin	GEN	10mcg
Sulphamethoxazole	SX	200mcg
Chloramphenicol	C	30mcg
Nalidixic acid	NA	30mcg

Table 5 Himedia sensitivity Octodiscs KGL ¼ used on Gram positive bacteria

Antibiotic	Symbol	Concentration
Penicillin-G	P	1IU
Minocycline	MI	30mcg
Erythromycin	E	15 mcg
Methicillin	MET	5mcg
Co-trimoxazole	COT	25mcg
Chloramphenicol	C	30mcg
Ampicillin	AMP	10mcg
Lincomycin	L	2mcg

Table 6 Age and sex distribution of patients investigated for bacterial nosocomial infections

Age group	Female no %	Male no %	Total no %
< 25	12 (11.11%)	12(11.11%)	24 (22.22%)
26-35	10 (9.2%)	19 (17.59%)	29(26.85%)
36-45	14 (12.96%)	7 (7.0%)	21(19.44%)
46-55	3(2.78%)	7(7.0%)	10 (9.26%)
56-65	4(3.7%)	10(9.26%)	14(12.96%)
>66	4(3.7%)	6(5.56%)	10(9.26%)
TOTAL	47 (43.52%)	61(56.48%)	108 (100%)

Table 7 Distribution of nosocomial infections in the two facilities

Infection	UTIs	BSIs	Prevalence %
MFK	3.70%	2.80%	6.48%
USCH	4.60%	0.93%	5.56%
TOTAL	8.30%	3.73%	12.04%

Gram positive bacteria

Table 8 Percentage susceptibility patterns of *S. aureus*

Bacterial isolate	Percentage response to drugs of*S. aureus* isolates n=12		
Drugs	**Sensitive**	**Intermediate**	**Resistant**
P	8(66.7%)	2 (25%)	2 (25%)
MI	6 (75%)	1 (12.5%)	5 (65.5%)
E	5 (65.5%)	5(65.5%)	2(25%)
MET	7(87.5%)	1(12.5%)	4(50%)
COT	2(66.7%)	7(87.5%)	3(37.5%)
C	7(87.5%)	4(50%)	1(12.5%
AMP	6(75%)	2(25%)	4(50%)
L	5(65.5%)	3(37.5%)	4(50%)
TE	8(66.7%)	3(37.5%)	1(12.5%)
NA	5(65.5%)	4 (50%)	3(37.5%)

Gram positive bacteria

Discussion

From the results obtained, the overall prevalence of nosocomial infections in both hospitals was 12.037%, this was slightly lower than what was expected (5.1-11.6%) but within the range of WHO in 2009 (3.8-18.6%) of HCAIs in developing countries. This slight decrease in prevalence in both hospitals may be because of improvement in infection prevention practices, lower infection rate, and availability of high number of health personnel and set up of hospital.[15,16] This study found lower prevalence of nosocomial infection as compared to[17] which reported 13%. This lower prevalence may be due to the method of sample analysis, which was dependent mainly on bacteriological agents. Viral and fungal agents were not assessed due to unavailability of technology and laboratory facilities in this study, even though they can cause nosocomial infections. In this study UTI, was the most common nosocomial infection found. Since all of the patients infected had urinary catheters, this then suggests that there is a direct link between catheter use and UTI. The most probable reason could be

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not observing sanitary precautions when inserting the catheter.[18] The other type infection identified was the blood stream infection which accounted for 3.04%. Two of the cases were for children less the 10 days old. Their infection could have been brought about by lack of proper hygiene especially taking good care of the umbilical stump. Pus swabs cultured did not grow and the reason could have been daily dressings done on the wounds by the nurses. The other could have been keeping the wounds covered at all times and thus not exposed to microorganisms.[19]

Currently many microorganisms have become resistant to different antimicrobial agents which causes a problem in health care facilities.[1]

The antibiotic susceptibility of this study confirmed the scenario of resistance by pathogens to common antibiotics in use. In this particular study, both gram positive and gram negative bacterial isolates showed high resistance level to Cotrimoxazole, Chloramphenicol, and Gentamicin, those still outstanding were Ampicillin and Lincomycin where all the *S. aureus* isolates were susceptible. The reason as to why some of the antibiotics perform poorly could be because of intense use of these drugs outside the hospital, and many antibiotics are available over the counter for self-medication.[18,20–24] These problems coupled with the increased chance of cross infection among inpatients, are known to account for circulating resistance strains (Tables 9 & 10) (Figure 1).

Table 9 Susceptibility patterns of *Proteus* species n=1.

Drugs	AMP	TE	COT	S	K	GEN	SX	C	NA
Susceptibility	S	R	R	I	S	S	R	I	S

Gram Negative bacteria

Table 10 Gram negative *S. aureus* susceptibility patterns n=1

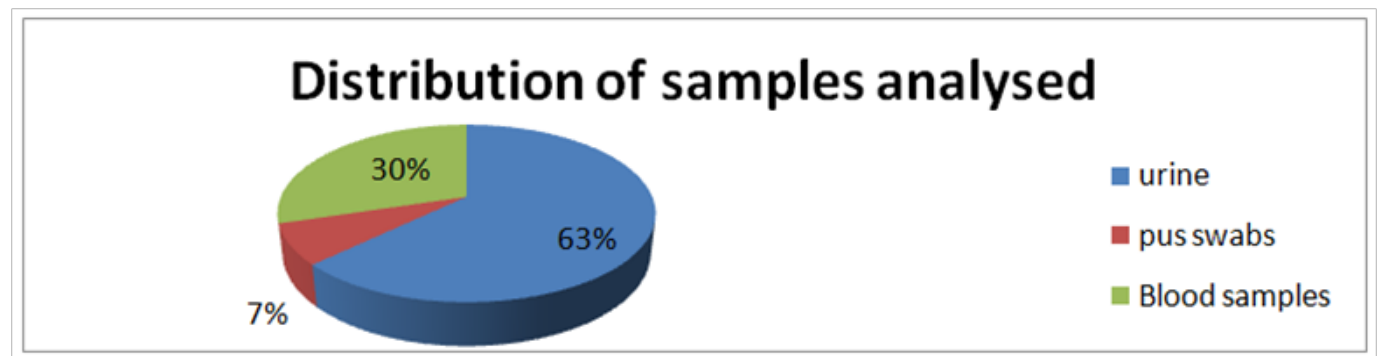| Drugs	AMP	TE	COT	S	K	GEN	SX	C	NA
Susceptibility	S	S	I	S	S	S	I	R	S

NB/S, sensitive; II intermediate; R, resistant

Figure 1 Distribution of total samples analyzed.

Conclusion

It was also evident that the isolates showed resistance to more than one type of antibiotics with the leading ones being those commonly bought over the counter.

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None.

Conflict of interest

The author declares no conflict of interest.

References

1. Bouza E, San Juan R, Munoz P, Voss A, Kluytmans J, et al. A European perspective on nosocomial urinary tract infections II. Report on incidence, clinical characteristics and outcome (ESGNI–004 study). European Study Group on Nosocomial Infection. *Clin Microbiol Infect.* 2001;7(10):532–542.

2. Mesaros N, Nordmann P, Plésiat P, et al. *Pseudomonas aeruginosa*: resistance and therapeutic options at the turn of the new millennium. *Clin Microbiol Infect.* 2007;13(6):560–578.

3. Riddle DJ, Dubberke ER. *Clostridium difficile* infection in the intensive care unit. *Infect Dis Clin North Am.* 2009;23(3):727–743.

4. Zilberberg MD, Shorr AF. Preventing *clostridium difficile* infection in the intensive care unit. *Crit Care Clin.* 2013;29(1):11–18.

5. Gefand B, Popov T, Kabarak V. *Epidemiology and etiology of nosocomial infections in surgical intensive care units.* 2005.

6. Durmaz B, Durmaz R, Sonmez E. Nosocomial infections in a New Medical center, Turkey. *Infect Control Hosp Epidemiol.* 2000;241(8):534–536.

7. Furtado GH, Azevedo PA, Santos AF, et al. Intravenous polymyxin B for the treatment of nosocomial pneumonia caused by multidrug–resistant *Pseudomonas aeruginosa*. *Int J Antimicrob Agents.* 2007;30(4):315–319.

8. Jack H. *Prevalence of hospital acquired infections in Canadian hospital.* 2010.

9. Herzig SJ, Howell MD, Ngo LH, et al. Acid–suppressive medication use and the risk for hospital–acquired pneumonia. *JAMA.* 2009;301(20):2120–2128.

10. Cunha BA. *Pneumonia Essentials.* 3rd ed. USA: Physicians Press; 2010.

11. Jroundi I, Khoudri I, Azzouzi A, et al. Prevalence of hospital acquired infections in a Moroccan university hospital. *Am J Infect Control.* 2007;35(6):412–416.

Prevalence of bacterial nosocomial infections in matibabu foundation hospital and ukwala sub county referral hospital in Siaya County

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12. MOH. *Kenya National Infection prevention guidelines*. 2010.

13. Chan RK, Lye WC, Lee EJ, et al. Nosocomial urinary tract infection: a microbiological study. *Ann Acad Med Singapore*. 1993;22(6):873–877.

14. Agodi A, Barchitta M, Cipresso R, Giaquinta L, Romeo MA, et al. *Pseudomonas aeruginosa* carriage, colonization, and infection in ICU patients. *Intensive Care Med*. 2007;33(7):1155–1161.

15. Wang S, Kwok M, McNamara JK, et al. Colistin for Multi–Drug Resistant (MDR) Gram–Negative Bacillary Infections. *Antibiotics for Clinicians*. 2007;11:389–396.

16. Dridi E, Chetoui A, Zaoui A. Investigation of the prevalence of nosocomial infections in a Tunisian regional hospital. *Sante Publique*. 2006;18(2):187–194.

17. Ferrara AM. Potentially multidrug–resistant non–fermentative Gram–negative pathogens causing nosocomial pneumonia. *Int J Antimicrob Agents*. 2006;27(3):183–195.

18. Jones RN. Microbial etiologies of hospital–acquired bacterial pneumonia and ventilator–associated bacterial pneumonia. *Clin Infect Dis*. 2010;51(Suppl 1):S81–S87.

19. Cunha BA. Multi–drug Resistant (MDR) *Klebsiella, Acinetobacter*, and *Pseudomonas aeruginosa. Antibiotics for Clinicians*. 2006;10:354–355.

20. Cheebrough M. *Medical Laboratory Manual for Tropical Countries*. UK: Cambridg press; 2002.

21. Nguyen Q. *Hospital acquired infections, medicine from WEBMD medicine*. 2004.

22. Shaikh JM, Devrajani BR, Shah SZ, et al. Frequency, pattern and etiology of nosocomial infection in intensive care unit:an experience at a tertiary care hospital. *J Ayub Med Coll Abbottabad*. 2008;20(4):37–40.

23. Barbut F, Corthier G, Charpak Y, et al. Prevalence and pathogenicity of *Clostridium difficile* in hospitalized patients. A French multicenter study. *Arch Intern Med*. 1996;156(13):1449–1454.

24. Bouza E, Torres MV, Radice C, et al. Direct E–test (AB Biodisk) of respiratory samples improves antimicrobial use in ventilator–associated pneumonia. *Clin Infect Dis*. 2007;44(3):382–387.