ANTIBIOTIC SENSITIVITY PATTERNS OF STAPHYLOCOCCUS AUREUS TO METHILLICIN IN CLINICAL SAMPLES AT KIU-TEACHING HOSPITAL.

KAMPALA INTERNATIONAL UNIVERSITY

WESTERN CAMPUS

BY:
NALWOGA JANET
BPH/0005/113/DU

A RESEARCH REPORT SUBMITTED TO THE SCHOOL OF PHARMACY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR AN AWARD OF BACHELOR OF PHARMACY DEGREE OF KAMPALA INTERNATIONAL UNIVERSITY WESTERN CAMPUS.

SUPERVISOR
MR.MIRUKA CONRAD ONDIEKI (BSc, MSc)

FEBRUARY 2016

DECLARATION

I, Nalwoga Janet, hereby declare that this is my original work and has not been presented for the award of a degree in any other university. I declare that content of this thesis is the result of my personal handiwork, with remarkable assistance from my supervisor and others which I respectfully acknowledge.

Nalwoga Janet , BPH/0005/113/DU

Kampala International University, Western campus

Signed.....Janet.....Date.....16/03/16.....

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This research report has been presented with my full knowledge and approval as the supervisor:

Mr.Miruka Conrad Ondieki (BSc, MSc)

Kampala International University, Western campus

Signed.....Date.....16/03/2016.....

DEDICATION

To God the Lord of Lords , who is the giver of life and my everything .

To my beloved late Mother, who gave her life for me but didn't get the opportunity to witness my work.

To my excellent loving father for serving as a role model and wholeheartedly supporting me through this course.

To my beloved brothers and incomparable friends that have sacrified their time and brought an unspeakable joy to this life.

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LIST OF ABBREVIATIONS

MSSA - Methicillin sensitivite *Staphylococcus aureus*

MRSA - methicillin resistant *Staphyloccocus aureus*

S. aureus - *Staphyloccocus aureus*

E.coli - *Escherischia coli*

KIU-WC - Kampala International University –Western campus

KIU-TH - Kampala International University Teaching hospital

HA-MRSA - Hospital Acquired methicillin resistant *Stapylococus aureus*

CA-MRSA-Community acquired methicillin resistant *Staphylococcus aureus*

PBP- Penicillin Binding Protein

ABSTRACT

Back ground: *Staphylococcus aureus* is a gram positive bacteria that exists on the skin as normal flora. It is classified as Methicillin-resistant *Staphylococcus aureus* (MRSA) and Methicillin-sensitive *Staphylococcus aureus* (MSSA) where MRSA resistant to beta lactam antibiotics. MRSA has become a predominant pathogen in the health care system causing outbreaks within the communities and hospitals. The infection risk of mortality and increases morbidity.

Objective: To determine the prevalence and antibiotic sensitivity patterns of methicillin-resistant *Staphylococcus aureus* in clinical samples at KIU-teaching hospital, Ishaka

Methods: This was a cross sectional and descriptive study carried out for three months in the surgical ward . Patients admitted to the surgical ward with wound were included in the study after obtaining consent . Wound swabs were collected and taken to KIU-WC Microbiology laboratory where culturing , identification of *S. aureus*, determination of MRSA using oxacilin and antibiotics susceptibility were performed.

Results: Of 114 total isolates 75(65.8%)were *S.aureus* isolates of which 64(85.3%) were coagulase. Of the coagulase positive *S .aureus* 61(81.3%) were identified to be MRSA. All the MRSA isolates were resistant to erythromycin, and susceptible to cloxacillin, ceftriaxone and vancomycin and intermediate sensitivity was produced reaction.

Conclusion: This study showed presence of *Staphylococcus aureus* was among two thirds of the patients in the surgical ward and a high percentage was resistant. The prevalence of MRSA was56.1% among the *Staphylococcus aureus* isolates. MRSA isolates were very sensitive to vancomycin, ceftriaxone and cloxacillin

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Staphylococcus aureus is a type of gram positive, non motile round shaped cocci bacterium, often found in grape like clusters of the family staphylococcacea . *Staphylococcus aureus* is found in about forty different species with *Staphylococci aureus* as the most commonly known. Within humans, *Staphylococcus aureus* colonization is both opportunistic: causing harm when given the appropriate conditions thus referred to as a causative agent and harmless bacterium that commonly resides in the humans as normal flora located on the skin, pharynx, nose , and the intestinal tract. *Staphylococcus aureus*, is one of the most dangerous human pathogens that causes a range of infections on the skin like boils, pimples, impetigo, abscesses and wound infections (Iyada,2010).

Staphylococcus aureus is subdivided into mainly two types, that is; methicillin-sensitive *S. aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) which spread locally and globally, and persist in various environments outside of hosts (Nottasorn,2012)

Methicillin resistant *Staphylococcus aureus* has developed resistance to beta lactam antibiotics including penicillin, methicillin and other chemotherapeutic agents (Jayatilleke and Bandara, 2012). MRSA is spread by coming in contact with an infected person or by exposure to MRSA contaminated object, surface that an infected person touches. It is widely classified as hospital acquired MRSA (HA-MRSA) and community MRSA(CA-MRSA) (Sangeeta *et al.*, 2011)

MRSA resistance is due to the Staphylococcal cassette chromosome *mec* which consists of the resistance gene *mecA,* that codes for the penicillin binding protein PBP2a (Marrero *et al.*,2004). It consists of the antibiotic resistance gene mecA, which is responsible for resistance to methicillin and other ß-lactam antibiotics. mecA encodes for the penicillin-binding protein 2a (PBP2a) (Udobi *et al.*, 2013) , whose active site does not bind methicillin or other ß-lactam antibiotics. Therefore PBP2a continues to catalyze the transpeptidation reaction necessary for peptidoglycan cross-linking, which results in cell wall synthesis in the presence of cell wall sythnesis acting antibiotics. Thus the effect of the inability of PBP2a to interact with ß-lactam moieties and the acquisition of mecA confers resistance to all ß-lactam antibiotics (Jayatilleke and Bandara, 2012)

MRSA is now one of the predominant pathogens in health care associated infection especially hospitals (John, 2010) therefore a proper and accurate detection of MRSA is required for appropriate therapy and epidemiological assessment of infections caused by *Staphylococcus aureus*. Due to an increasing rise of MRSA outbreaks mostly in hospitals, control of MRSA is essential to reduce the introduction and spread of infection. Early detection of MRSA and formulation of an effective antibiotic policy, along with infection control in tertiary care hospitals is of paramount importance to reduce on the spread. (Nottasorn,2012)

Therefore this study was carried out at KIU-Teaching Hospital with the aim of determining the antibiotic sensitivity patterns of *Staphylococcus aureus* to methicillin in the clinical samples. This information obtained from the study will assist in the formulation of an antibiotic policy and appropriate control measures.

1.2 PROBLEM STATEMENT

Data on prevalence of MRSA in Uganda is limited, with reports indicating that approximately 10% of surgical procedures end up becoming septic with *S. aureus* being the most frequent pathogen isolated (Kateete *et al.*,2011).

According to the latest studies done in western Uganda, at least 38% of the patients have *Staphylococcus aureus* nosocomial infections that are non-responsive to the therapeutic regimens (Stanely *et al.*,2014).

Particularly , there is only one recent study on prevalence and antibiotic sensitivity patterns of MRSA in South Western Uganda (Stanley *et al.*,2014).

That study found high proportions of MRSA isolates that are multidrug resistant

There is therefore a need to carry out further studies in this part of Uganda to identify MRSA in hospital settings.

1.3 PURPOSE OF THE STUDY/GENERAL OBJECTIVE

To determine the prevalence and antibiotic sensitivity patterns of methicillin-resistant *Staphylococcus aureus* in clinical samples at KIU-teaching hospital, Ishaka.

1.4 SPECIFIC OBJECTIVES

- To determine the prevalence of *Staphylococcus aureus* in the surgical ward at KIU-TH
- To determine the extent of resistance of the *S. aureus* isolates to methicilin
- To determine sensitivity pattern of the MRSA strains to other commonly prescribed antibiotics

1.5 HYPOTHESIS

1.5.1 H_0 (NULL)

MRSA is not a common nosocomial infection amongst patients in the surgical ward in KIU-TH

1.5.2 H_1 (ALTERNATIVE)

MRSA is a common nosocomial infection amongst patients in the surgical ward in KIU-TH

1.6 JUSTIFICATION OF THE STUDY

- This study will bring an awareness to the KIU-TH health workers and the general public on the presence of MRSA in the facility.
- The study will assist in the formulation of an antibiotic policy and an appropriate therapeutic monitoring system for MRSA.
- The study will also promote better treatment of the patients and the attention to health workers to follow all required protocol.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 PREVALANCE OF MRSA

MRSA was discovered in 1961 shortly after the introduction of methicillin in London after which the MRSA out breaks were reported. The MRSA infections are increasingly and rapidly spreading through several regions both in community and health care settings. The highest prevalence is mainly due to the hospital acquired MRSA which is mostly found to be endemic in hospitals in most regions.

In European countries especially Belgium, Ireland , German , and the United kingdom ,the prevalence rates of MRSA range from 1% in northern Europe to greater than 40% in the south and western Europe (Madeleine *et al.*, 2011). In Africa, isolates of MRSA were first reported as early as 1978 in an outbreak that occurred in Johannesburg, South Africa and also in the early 1990s cases were identified in Zimbabwe (Matthew *et al.*,2013). Despite the limited data that is available for the developing countries especially those in Africa, a prevalence of 15% with Kenya and Nigeria classified as the highest, with prevalence of 21-30% of MRSA within the hospitals (Ojulong *et al.*, 2009) .

2.2 SPREAD OF MRSA

MRSA is commonly spread through direct contact with the individuals are inoculated with the bacteria ,in ways such as hand shaking with both the health workers and patients with the bacteria. The major routes and sites of infection include: ventilation, urinary catheters, intravenous lines, skin and soft tissue infections . These infections also occur amongst healthy people who have not recently been in hospital. MRSA infections are commonly on the skin and rarely

appear as lung infections. Several groups of people can be at risk and they include: athletes who usually share razors and towels, military personnel, children that attend daycare and public school, individuals who have gotten tattoos (Biswajit *et al.*,2012)

2.3 IMPACT OF MRSA

Several studies have established the great impact that MRSA has presented globally, evidence that MRSA infections have an unacceptably high mortality rate (Brown *et al.*,2010), increased stay of the patients,has greatly increased the costs of medical care in hospital. Patients who acquired an infection stay in hospital approximately 2.5 times longer than other patients, averaging to 11 additional days in the hospital, which puts an additional cost on diagnostic or therapeutic procedures, and prolonged antibiotic use . Patients with an infection in hospital are 7.1 times more likely than uninfected patients to die in hospital . MRSA causes a loss in productivity due to absence from work during hospitalization and a reduction in the efficiency of the health workers due to an increased patient load.(Rutare, 2013)

2.4 RISK FACTORS

The prolonged hospital stay of patients, inadequate indistinctive use of antibiotics, lack of awareness about MRSA, self medication on antibiotics before arrival to the hospital (Rajaduraipandi, 2006), over use of antibiotics, non compliance due to incomplete drug courses taken by infected persons (Iyad ,2010) are some of the predisposing factors to the MRSA prevalence.

MRSA infections are a major problem in hospitals. Normal strains of *Staphylococcus aureus* are found on the skin, nose , but some patients harbor MRSA without any harm and these patients are referred to as colonized. When

colonized patients are infected,the infection migrates to other parts of the body and it is referred to as endogenous MRSA. Patients at an increased risk of developing infection are those with skin breakage due to wounds (by either surgery ,injury or invasive procedures) ,indwelling catheters which promote entry of MRSA into the body, patients with immune deficiency disorders. Cross infection can occur through: patients who are reservoirs of MRSA, hospital staff or spread via the contaminated equipment or through the environment.

2.5 GENETIC FACTORS CONTRIBUTING TO THE REISTANCE OF *Staphylococcus aureus*

Antimicrobial resistance is a type of resistance that is genetically based mediated by the acquisition of extra chromosomal genetic elements containing resistance genes like plasmids, genetic elements, genomic islands

which are transmitted between bacteria via horizontal gene transfer. Characteristically MRSA has the ability to survive and grow favourbly in the presence of penicillin-like antibiotics, which normally prevent MRSA growth by inhibiting synthesis of cell wall synthesis. (Biswajit *et al.*,2012).

The genome of MRSA contains a heterologous mobile genetic island known , staphylococcal cassette chromosome mec (SCCmec), which conists of the mecA gene and other resistance determinants(Stanley *et al.*,2014). The mecA resistance gene, known inhibits ß-lactam antibiotics causing an inactivation of the transpeptidase enzymes that are required for cell wall synthesis.

SCCmec has six types, that is, types I-VI and they are differentiated by variation in mec complexes. The size of SCCmec element affects the number of colones horizontally transferred and is therefore responsible for the spread of MRSA infections. Types I-III SCCmec are large elements that typically contain additional

resistance genes and are characteristically hospital MRSA. (Biswajit *et al.*,2012)

Table 1: The characteristics of the genetic elements of *Stappyhococcus aureus*

Major Genetic Element	**Description**	**Examples**
Plasmid and transposons	TSST plasmid and transposons(Tn552) carry antibiotic, heavy metal and disinfectant resistance determinants,toxins, arginine metabolism	-Plasmid classes are based on physical and genetic orgarnisation and functional characteristics. -small multicopy,pSK639 family -large plasmid,conjugative pSK41
Staphylococcal cassette chromosomes mec (SCCmec)	SCCmec are large pieces of DNA that insert in the *orfX* gene in *S.aureus*. Sau 1 type 1 RM systems.	SCCmec types I-XI
Genomic islands		Three families: vSAβ, vSAα, vSAγ. Responsible for phenol-soluble modulins (PSMs), possible pro-inflammatory activity, enterotoxins and bacteriocin production

(extracted from Stefania *et al.*,2012)

2.6 CONTROL OF MRSA IN HOSPITALS

Gloving

If there is an anticipation of any contact with blood or other potentially infectious materials such as mucous membranes, non intact skin, gloves should be worn and carefully removed to prevent any hand contamination. The one use only gloves should be disposed properly after use. (Iyada,2010).

Hand hygiene

Hand hygiene should be performed after touching blood, secretions or any other contaminated items, after gloves have been removed. This practice is done every after a contact with any patient to prevent the transfer of microorganisms from one patient to another and the environment. (Stefani et al.,2012)

Gowning

Several types of gowns are worn because it is appropriate protection for the skin, eyes, nose and ears from coming into contact with any likely or contaminated substances. The eye, ear and nose protection gear such as face masks, goggles, shield and in certain cases a combination of each are available to avoid splashes, sprays of contaminated substances.(Rutare, 2013)

Appropriate handling of devices and patient care equipment

Patient care equipment should be handled in such a way that they don't contaminate the environment and bring about a transfer of microorganism especially if they are contaminated equipment that require re use, shouldn't be used again unless they have been approved and inspected for reuse (Iramoit,2014)

Antibiotic stewardship

Inappropriate or excessive antibiotic therapy to the patients within the hospital facility should be avoided . A reduction in the use of broad spectrum antibiotics should largely be discontinued. All the antibioitics should be given in their correct doses, for an appropriate duration

Screening

Active screening for MRSA carriage should be carried out for all the patients especially the high risk patients such as those known to have been infected or colonized with MRSA in the past, direct inter hospital transfer patients, those with frequent re admissions to health care facilities and also the resident of the health care facility and the nurses. The screening results obtained are reported and dealt with appropriately. (Rutare ,2013)

Decolonization

This can be skin, nasal and throat decontamination. Decolonization is done chemically and it shouldn't be excessively done to avoid any bacterial resistance . In nasal decolonization , mupirocin is used. In skin decolonization, 4% chlorhexidine body shampoo, 7.5% povidone iodine or 2% trichlosan. Its mainly used preoperatively to reduce the risk to surgical sites (Coia,2006)

Isolation and cohorting of patients with MRSA

The patients can be isolated in single rooms also known as isolation rooms. The number of patients in a facility depend on the space and the number of beds within that the facility. The rooms should have separate toilets, washing and bathing facilities.

A careful cohorting of the colonized patients should be done and a dedicated control of the infectious wards (Stanely et al.,2014)

CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY DESIGN

This study was a cross sectional and descriptive study

3.2 STUDY SETTING

The research was conducted in the surgical ward of Kampala International University-Teaching Hospital, that is located in Ishaka, Bushenyi district, western Uganda.

3.3 STUDY POPULATION

All the patients that were hospitalized at the KIU-TH surgical ward with wounds both male and female.

3.4 SAMPLE SIZE

The sample size was determined by Slovin's formula (Guilford and Frucher, 1973).

$$n = \frac{N}{1+N(e)^2}$$

Where ;n=sample size

N=population size

e=margin of error which is 4%

1=a constant

$N = 140,$

$$n = \frac{140}{(1+140(0.04)^2)}$$

$n = 114$

3.4.1 INCLUSION CRITERIA

- Patients who were hospitalized at the surgical ward of KIU-TH
- Only Patients who gave consent to participate were included in the study
- Both male and female patients in the surgical wards were included in the study

3.4.2 EXCLUSION CRITERIA

- Patients who are hospitalized in other units of KIU-TH were not included in the study.
- Patients who declined to participate in the study were not included

3.5 SAMPLING TECHNIQUE

Samples were collected randomly from patients hospitalized in the surgical ward.

Samples were collected from the patients by swabbing their wounds using sterile cotton swabs.

The swabs were transported to the microbiology laboratory of KIU for culture, in tubes containing Amies transport medium (Biolab, Budapest, Hungary)

3.6 DATA COLLECTION PROCEDURES

3.6.1 PREPARATION OF CULTURE MEDIA

Chrome agar was the media used, calculations were based on the manufacturers instructions. Basing on the sample size, 6 liters were prepared.

Culture media was dissolved in distilled water, heated to boiling and packed in the autoclave and sterilized at 121°C, 15psi 15 minutes.

Moulten agar was aseptically poured into sterile Petri dishes, left to cool and set, after which it was incubated at 37°C for 24 hours

3.6.2 CULTURE AND IDENTIFICATION OF *Staphylococcus aureus*

Swab samples were inoculated on the sterile culture media. The plates were then labeled and incubated at 37°C overnight for distinct colony growth.

The overnight culture plates were observed and *S. aureus* was identified by the blue colonies while *E.coli* species were identified by a pale brown colonies.

Organism identification was carried out by standard laboratory operating procedures of Gram staining, Slide coagulase and Tube coagulase test as described byKateete et al (2010).

Identification of MRSA was done by using oxacillin (1 µg). A zone of inhibition less than 10 mm was indicative of methicillin resistance. The *S. aureus* ATCC 25923 was used as a standard control strain.

A 10 µL of 0.5 McFarland suspension of the isolate was inoculated onto Mueller Hinton agar plate containing 2% NaCl , the oxacillin disc was placed on the

medium and the set up incubated at 37°C overnight. This was to confirm the methicilin resistance of the MRSA isolates

The susceptibility pattern of the methicillin resistant *Staphylococcus aureus* isolates to other antibiotics was determined by Kirby Bauer disc diffusion method according to the Clinical laboratory standard Institute (2012). In this procedure, the samples were incubated in medium with discs of erythromycin (15 µg) , cloxacillin(10 µg) , ciprofloxacin (5 µg) and vancomycin (30 µg), ceftriaxone (30 µg) for 18 hours at 37°C .

3.7 OUTCOME MEASURE

The diameter of the zone of inhibition was measured using a transparent ruler. The diameters obtained were reported as sensitive or resistant in accordance to CLSI guidelines (2012).

3.8 DATA ANALYSIS PROCEDURE

Data collected was analyzed using Microsoft excel. It was then presented in tables and graphs.

The degree of resistance or sensitivity was converted into percentage.

3.9 ETHICAL CONSIDERATIONS

An approval to conduct the research was sought from the University Research and Ethics Committee of School of Pharmacy KIU-WC.

Letter of permission and introduction was issued by the Dean school of Pharmacy, KIU-WC to the Head of surgical ward of KIU-Teaching Hospital

A letter of acceptance to do the research was obtained from the Head of surgical ward of KIU-Teaching Hospital.

Consent was sought from all patients before any procedure was carried out.

All information obtained from the patients was kept confidentially.

3.10 LIMITATIONS TO THE STUDY

Some patients were scared due to the procedure of picking samples from them, thinking that the swab picking was a painful cleaning procedure.

CHAPTER FOUR

4.0 RESULTS

4. 1 Growth of microrganisms

Of the one hundred fourteen isolates from the clinical samples only seventy five isolates were clearly identified as *S. aureus* with 85.3% coagulase positive and 13.3% coagulase negative. Thirty of the isolates were *E.coli*, six isolates were *Pseudonomonas spp*, *Klebsiella spp*, *Proteus spp*, *Streptococcus spp* and *Enterobacteriaceae spp* and three samples had no yield.

The prevalence of *Staphylococcus aureus* was 65.8%. The prevalence of MRSA was 56.1% .

Table 2 : Yields from the clinical samples collected

Microorganisms yielded	Number of isolates
Staphylococcus aureus	75
E .coli	30
Pseudonomonas spp,	2
Klebsiella spp	1
Proteus spp	1
Streptococcus spp	1
Enterobacteriaceae spp	1
No yield	3

4.2 Suceptibility of the isolates to the antibiotics

All MRSA isolates were resistant to erythromycin. A total of fifty seven MRSA isolates (93.4%) were susceptible to vancomycin and four (6.6%) isolates were resistant to vancomycin.

Out of the total MRSA isolates ,fifty two(85.2%) were susceptible to ceftriaxone, eight(13.1%) had an intermediate reaction and only one(1.7%) isolate was resistant to ceftriaxone.

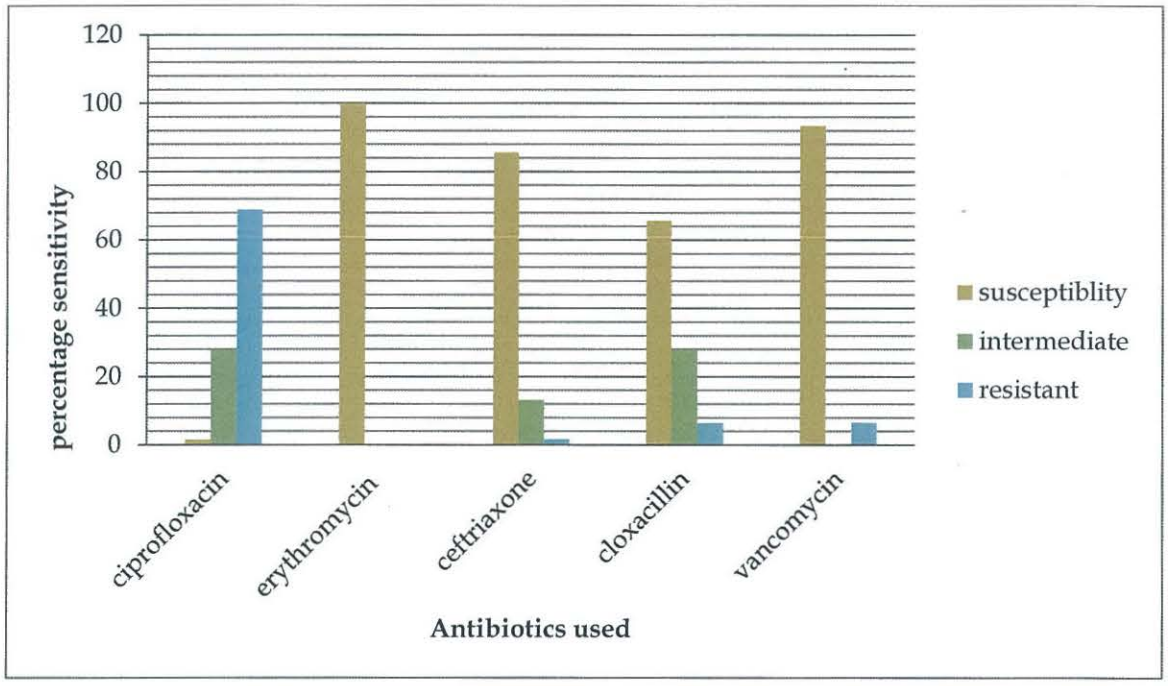
Fourty (65.6%) MRSA isolates were susceptible to cloxacillin, seventeen(27.9%) isolates had an intermediate sensitivity and four (6.5%)samples were resistant to the antibiotic.

MRSA isolates that were resistant to ciprofloxacin were fourty two (68.9%), seventeen isolates (27.9%) had an intermediate sensitivity and only one was susceptible to the antibiotic.

Table 3: Antibiotic susceptibility patterns of the MRSA isolates

Antibiotics used	Susceptible	intermediate	Resistant
Ciprofloxacin	1 (1.6%)	17 (27.9%)	42 (68.9%)
Erythromycin	60 (100%)	0	0
Ceftriaxone	52(85.2%)	8(13.1%)	1 (1.7%)
Cloxacillin	40 (65.6%)	17 (27.9%)	4 (6.5%)
vancomycin	57(93.4%)	0 (0%)	4(6.6%)

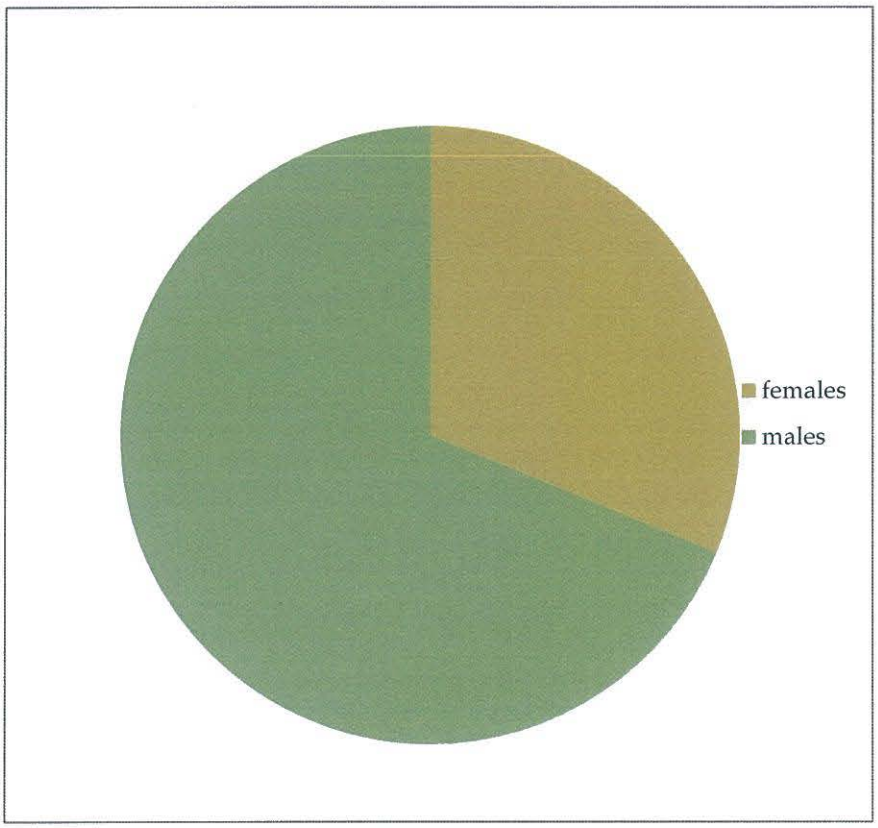
Figure 1: A graph showing the percentage of antibiotic sensitivity patterns



4.3 Distribution of MRSA amongst patients

Of the 65.8%. staphylococcus aureus samples isolated , sixty one isolates were identified as MRSA. Out of the sixty one MRSA samples isolated, 68.8 % were from males and 48.2% from females. Therefore males had a higher prevalence of MRSA than females.

Figure 2; Distribution of MRSA among patients



CHAPTER FIVE

5.1 DISCUSSION

The results obtained from this study carried at KIU-TH showed a prevalance of *Staphyloccus aureus* of 65.8% and of MRSA to be 51.6%. According to a study done by Kitara et al (2011) in Lacor Hospital Uganda, a prevalance of 48.3% was reported amongst the surgical in-patients. The prevalance obtained in this study was much higher due to the type of the samples collected which were from areas of the highest risk for nosocomial infections.

A study conducted by Udobi et al (2013) in Nigeria revealed a 75% prevalance of MRSA among the wound samples, another study done in India showed a 54.9% prevealance which is considerably high in comparission to 51.6% in this study. In a study conducted by stanely et al (2014) in Western Uganda, a prevalence of 31.3% of MRSA out of all *Staphylococcus aureus* isolates. This was lower than the 51.6% prevalence in this study. The increase could be due to the nasal carriage of the microorganisms to the site of infection, since *S. aureus* is part of the nasal normal flora.

In this study the resistance patterns of the MRSA to the commonly prescribed antibiotic were; erythromycin 100% , ciprofloxacin 68.9%, vancomycin 6.6% ,ceftriaxone 1.7% and cloxacillin 6.5%. The susceptibility patterns of the MRSA to cloxacillin , ceftriaxone , vancomycin and ciprofloxacin were 65.6%, 85.2% , 93.4% and 27.9% respevctively. A study done by Kejela and Bacha (2013) found showed a sensitivity pattern of vancomycin of 87.2% which was different from some other study by Ouko et al (2010) and Ojulong et al (2009) that showed a susceptibility pattern of above 90% for vancomycin.

The study carried out in Kenya by Rutare (2013) revealed a 35.9% resistance to ciprofloxacin which was much higher than the 68.9% in this study. Khadri and Alzohairy (2010) in their study in India,they found out that resistance to erythromycin was 83% which was lower than the 100% resistance in this study.

During this study it was found out that the ratio of male to females having MRSA is 2:1 which was similar to a study done by Nwankwo et al (2011) in Nigeria that showed that males patients had an infection rate of 62.0% which was higher than females 38.0%.

5.2 CONCLUSIONS

The prevalance of MRSA is high (56.1%) among the *S.aureus* isolates from the wound swabs of patients in the surgical ward of KIU-TH. MRSA isolates were highly susceptible to both vancomycin and ceftriaxone, followed by cloxacillin. MRSA isolates were highly resistant to erythromycin, followed by ciprofloxacin. The ratio of MRSA infection of males tom females was approximately 2:1

5.3 RECOMMENDATIONS

Vancomycin should be used as a first line treatment for MRSA infections and ceftriaxone and cloxacillin used as a second line treatment. Continuous surveillance of antimicrobial susceptibility patterns of *Staphylococcus aureus* to antibiotics should be done to reduce on the MRSA prevalence. Screening for MRSA in every surgical ward wound patient on admission and in the units should be complusary for effective wound infection control and prevention. Aspetic procedure such as hand-washing before and after contact with the patient, use of gloves, rapidly acting antibacterial alcohol solutions, thoroughly cleaning using disinfectants should be carried out. Patients that are infected with MRSA must be put in isolation from other patients

CHAPTER SIX

6.0 REFRENCES

Biswajit B , Gautam K.R. K and Shibendu B (2012). Methicillin -Resistant Staphylococcus Aureus: A Brief Review , *International Research Journal of Biological Sciences* . **1**(7): 66

Cheesbourg Monica (2011). District Laboratory practice in topical countries, second edition part 2,chapter 7: 132-143

Coia J.E, Duckworth G.J, EdwardsD.I, Farrington M, Fry C, Humphreys H, Mallaghan C, Tucker D.R (2006). Guidelines for the control and prevention of methicillin-resistant *Stapylococcus aureus*(MRSA) in health facilities, *Journal of hospital infection* **63**(5):2-6

Gorwitz J, Jernigan.D.B, Powers .J.H (2006). Strategies for the clinical management of MRSA in the community: summary of experts' meeting convened by the center for disease control and prevention. Washington, USA. Center For Disease Control And Prevention.

Iyad Kaddora (2010). Antibiotic sensitivity patterns of hospital-acquired and community-acquired methicillin- resistant *Staphylococcus aureus*(dissertation)

Jayatilleke K , Bandara P (2012). Antibiotic sensitivity pattern of *Staphylococcus aureus* in a tertiary care hospital of Sri Lanka. *Sri Lanka Journal of Infectious Diseases* **2**(2):13-17

Kateete DP, Namazzi S,Okee M, Okeng A, Baluku H, Musisi NL *et al* (2011). High prevalence of methicillin resistant Staphylococcus aureus in the surgical units of Mulago hospital in Kampala, Uganda. *BMC Research Notes* 4:326

Kejela Tekalign and Bacha Ketema (2013). Prevalence and antibiotic susceptibility pattern of methicillin-resistant Staphylococcus aureus (MRSA) among primary school children and prisoners in Jimma Town, Southwest Ethiopia, *Annals of Clinical Microbiology and Antimicrobials*12:11

Kitara LD, Anywar AD, Acullu D, Odongo-Aginya E,Aloyo J and Fendu M (2011). Antibiotic susceptiblility of Staphylococcus aureus in suppurative lesions in Lacor Hospital, *African Health Sciences*, 34-39.

Köck R, Becker K, Cookson B, van Gemert-Pijnen JE, Harbarth S, Kluytmans J,et al. (2010). Methicillin-resistant Staphylococcus aureus (MRSA): burden of disease and control challenges in Europe. *Euro Surveill* 15:19688.

Madeleine Dulon, Frank Haamann, Claudia Peters, Anja Schablon,AlbertbNienhaus (2011). MRSA prevalance in European health care settings:a review,*BMC infectious disease* 36(7):334-339

Marrero A, Mallorquí-Fernández G, García-Piquè S, García-Castellanos R, Gomis-Rüth F (2004). Staphylococcal methicillin resistance: fine focus on folds and functions. *FEMS Microbiology Letters* 235(1):1-5

Matthew E, Falagas, Drosos E, Karageorgopoulos, John Leptidis, Ioanna P. Korbila (2013). MRSA in Africa: filling the global map of antimicrobial resistance, *PLOS ONE journal research articles* 36(7):334-339

Nottasorn Plipat (2012). Methicillin-Resistant *Staphylococcus aureus* (MRSA) Exposure Assessment in Hospital Environment (PhD Dissertation)

Nwankwo Emmanuel Onwubiko, Nasiru Magaji Sadiq (2011). Antibiotic sensitivity pattern of Staphylococcus aureus from clinical isolates in a tertiary health institution in Kano, Northwestern Nigeria. *The Pan African Medical Journal*; 8:4

Ojulong J, Mwambu T, Agwu E, Bwanga F, Najjuka C, D Mulindwa K (2009). Prevalance of methicillin resistant stappylococcus aureus (MRSA) among surgical isolates in mulago hospital-kampala Uganda., *The internet jorurnal of infectious disease*,(7):2

Ouko TT, Ngeranwa JN, Orinda GO, Bii CC, Amukoye E, Lucy M, Wamae CN (2010). Oxacillin resistant Staphylococcus aureus among HIV infected and non-infected Kenyan patients. *East African Med Journal*. 87(5):179-86.

Rajaduraipandi K, Mani KR, Panneerselvam K, Mani M, Bhaskar M, Manikandan P (2006). Prevalence and antimicrobial susceptibility pattern of methicillin resistant staphylococcus aureus: a multicentre study,*Indian Journal of Medical Microbiology*, 24 (1):34-8

Sangeeta J, Pallab R, Vikas M, Jyoti B, Chitnis DS, Vikas G et al (2013). Methicillin resistant *Staphylococcus aureus* (MRSA) in India: Prevalence & susceptibility pattern *Indian J Med Res* 137:363-369

Samuel Rutare (2013). Prevalence of methicillin resistant staphylococcus aureus (MRSA) among paediatric patients admitted in intensive care unit and neonatal intensive care unit at Kenyatta National Hospital-Nairobi, Kenya (dissertation)

Stanley IJ, Bwanga F, Itabangi H, Nakaye M, Bashir M, Bazira J (2014). Prevalence and Antibiotic Susceptibility Patterns of Clinical Isolates of Methicillin- Resistant *Staphylococcus aureus* in a Tertiary Care Hospital in Western Uganda. *British Microbiology Research Journal* 4(10): 1168-1177

Stefania S,Ryeon C.D, Lindsay A.J, Henrick W, Kearns A.M, Friedrich A.W, Mackenzie F.M (2012). Methicillin resistant staphylococcus aureus(MRSA) global epidiemology and harmonization of typing methods,*International journal of antimicrobial agents*39(4):273-82

Udobi C.E, Obajuluwa A.F and Onaolapo J.A (2013). Prevalance an antibiotic resistance patterns of methicillin resistant staphylococcus aureus from orthopaedic hospital Nigeria. *BioMed Research International.* volume 2013. 1:860467

7.0APPENDICES

7.1 TABLES

Table 1 : The characteristics of the genetic elements of *Stappyhococcus aureus*

Table 2 : Yields from the clinical samples collected

Table 3: Antibiotic susceptibility patterns of the MRSA isolates.

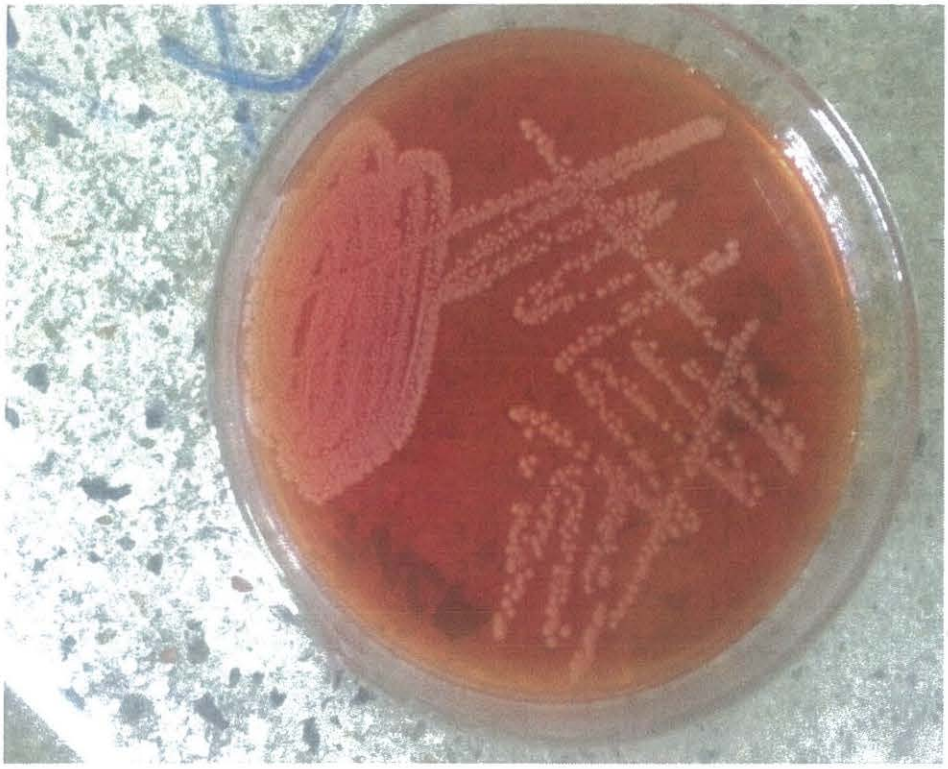
7.2 FIGURES

Figure 1: a graph showing the percentage of antibiotics sensitivity patterns

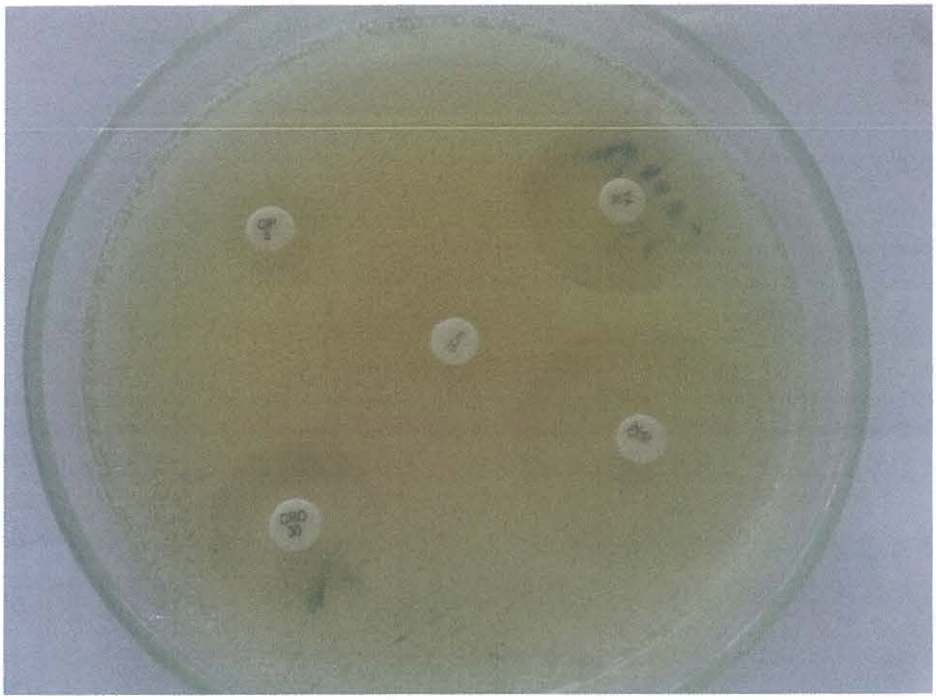
Figure 2: Distribution of MRSA among the patients.

7.3 PHOTOS

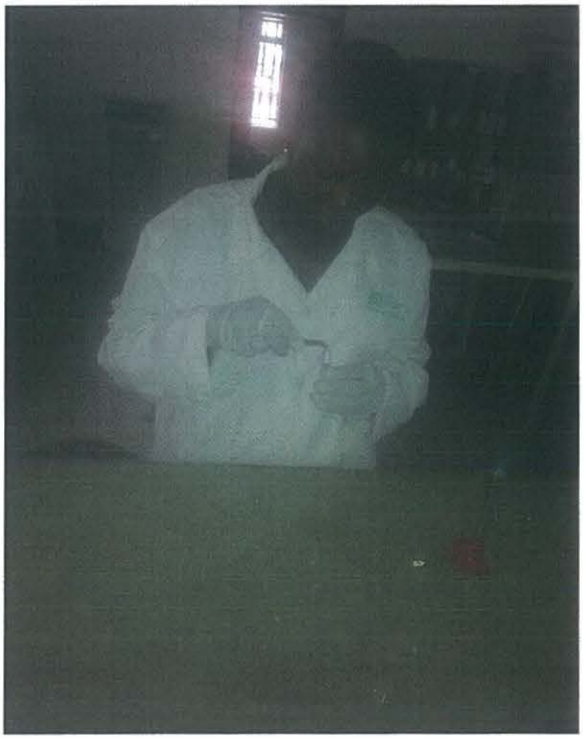
CULTURE PLATES;PLATE 1 showing growth on mckonkey agar



CULTURE PLATE : PLATE 2 showing zones of inhibition



PICTURE 3: PICKING UP ANTIBOITIC DISCS FROM THE CATRIGDE



PICTURE 4:PLATE SHOWING ZONE OF INHIBITION

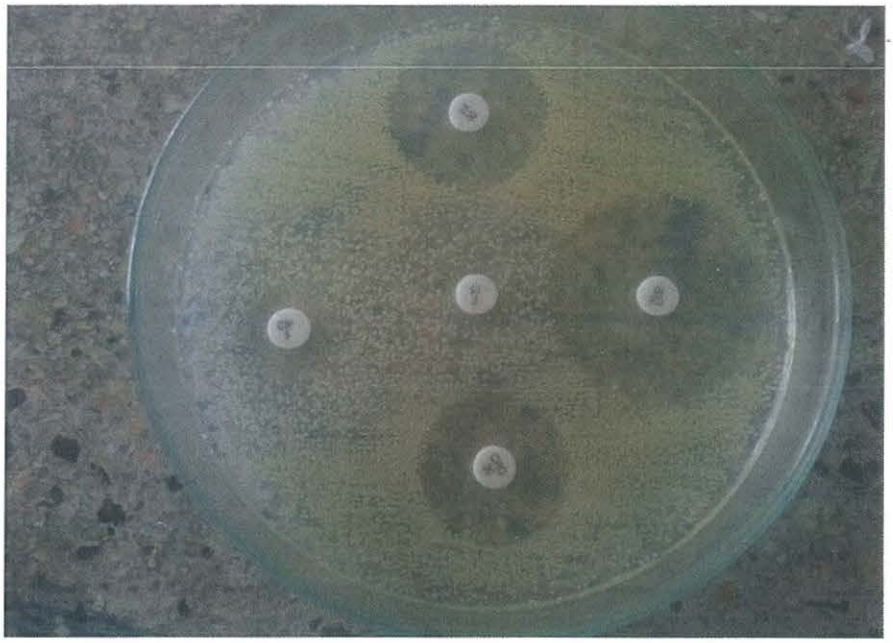
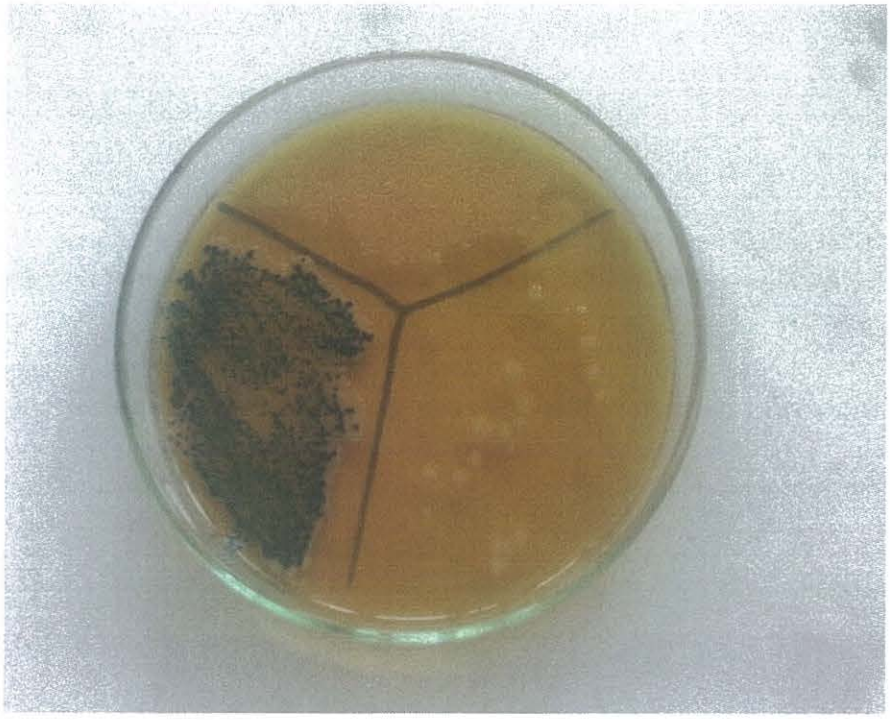


PLATE 5: PLATE SHOWING THE GROWTH OF MICROORGANISMS



PICURE 6: STERILIZING THE FORCEPS USED