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EC MICROBIOLOGY
Research Article

Detection of MRSA from Selected Hospital in Dutse Metropolis Jigawa State, Nigeria

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Abstract

This study was carried out in Dutse, Jigawa state in five hospitals involving equipments used in hospital settings at the selected hospitals which include stethoscopes, thermometers intravenous drip tubes, catheters, etc. The aim of the study was to detect Methicillin Resistant *Staphylococcus aureus* (MRSA) from equipment's in some selected Hospitals of Dutse metropolis. A total of 350 hospital instrument were surface-swabbed from the hospitals and samples were analyzed. Isolation and identification of *S. aureus* was carried out. Isolates that were Gram positive cocci, catalase positive and coagulase positive were characterized as *S. aureus* and used to carry out further analysis. Results revealed that out of the 350 samples collected, 104 (29.7%) were *S. aureus*. The highest number of 33 (31.68%) were from Dutse General Hospital, while Dr. Bashir Hospital has the lowest number of 13 (12.48%) isolates. It revealed that 18 (17.28%) out of the 104 *S. aureus* were MRSA isolates. Samples from Dutse General Hospital were found to harbor the highest number of MRSA isolates of 7 (38.85%) while samples from Dr. Bashir Hospital, had the least 1 (5.55%). Antibiotic susceptibility test revealed that gentamicin and ciprofloxacin has the greatest activity on the isolates. It is eminent to note that the secondary healthcare hospital has high no of *S. aureus* isolates and MRSA. It's followed by primary health care centers having 45 *S. aureus* and 6 MRSA isolates. This is followed by tertiary health care hospital having 15 *S. aureus* isolates and 5 MRSA isolates.

Keywords: *Antimicrobial; Healthcare; Susceptibility; Resistant; Methicillin*

Introduction

Staphylococcus aureus, a coagulase-positive, gram-positive bacterium, is among the most successful human pathogens. Both methicillin-sensitive *S. aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) can cause mild to fatal diseases, spread locally and globally, colonize numerous human body parts, and persist in various environments outside of hosts. MRSA is a bacterium labeled a "superbug" because of its acquired resistance to a multitude of antibiotics. MRSA is resistant to antibiotics in the class beta-lactams (B-lactams), which include, but are not limited to, methicillin, penicillin, and amoxicillin. B-lactams work by inhibiting bacterial cell wall synthesis and are among the most widely used antibiotics globally [1]. *S. aureus* is perhaps the greatest concern of human pathogens because of its intrinsic virulence due to its ability to create a diverse array of life-threatening infections and its capacity to adapt to different environmental conditions [2].

With increase in contamination and infection, obviously there is going to be an increase in prolong hospital stay, long term disability, increase antimicrobial resistant, rise in socio-economic disturbance, and increased mortality rate. These infections can be apparently observed only when they become epidemic and there is no any institutions or a country that can claim to have resolved this endemic menace [3,4]. Colonized or infected patients are a major reservoir for patient-to-patient transmission of methicillin-resistant *Staphylococcus aureus* (MRSA) in hospitals. Despite attempted adherence to recommended infection, prevention and control procedures, a general medicine unit in our hospital continued to experience ongoing transmission of MRSA [5]. Patients who are critically ill are more prone to infections most especially through contaminated equipment and often require antimicrobial sensitivity assay practices. However, the heavier use of antimicrobial agents in these patients can worsen the problem by selecting for antimicrobial resistant microorganisms [6]. MRSA infections have become widespread both in advance and under-resourced countries [2,7].

Materials and Methods

Sampling site

This study was carried out in five hospitals which include Dutse General Hospital, Federal University Dutse Clinic, Dr Sambo Hospital, Dr Bashir Hospital and finally Rasheed Shekoni Teaching Hospital Federal University Dutse in Dutse metropolis.

Study equipments

This study involves equipment used in hospital settings at the selected hospitals. These includes: stethoscopes, Thermometers Intravenous drip tubes, catheters, forceps, sphygmomanometer syringes, disposable gloves, microscope, electrophoresis machine, colorimeter, burette ventilator, stop watch weighing scale and also equipment used in general surgery such as scalpels, scissors, forceps which serve as possible routes to pass pathogens between patients.

Sample collection

A total of 350 hospital equipment surface swabbed samples were randomly collected from five selected hospitals. A sterile cotton swabs was moistened in sterile water and was firmly applied and slowly rotated, thoroughly covering the surface of the hospital equipment. These were then dropped in a cooler containing ice pack and were taken to the laboratory aseptically as described by Ayokunmi., *et al.* [8].

Isolation, identification and confirmation of MRSA

MRSA was isolated by direct plating of swabs onto Mannitol Salt Agar (MSA) containing 2 mg/L oxacillin (Oxoid), followed by incubation for 48h at 35°C. Suspected individual colonies were selected from each MSA plate. After incubation, isolates that produces colonies exhibiting characteristic deep golden yellow coloration were confirmed as *S. aureus* using Grams staining and biochemical tests according to Cheesbrough [9]. The confirmed colonies were streaked on nutrient agar slants and incubated at 37°C for 24 hours and later stored in the refrigerator until required for further analysis.

Biochemical characterization

All the isolated organisms were gram-stained and biochemical test was carried on the bases of their gram reaction standard biochemical reactions, including catalase, indole, citrate, oxidase, urease and motility.

Antibiotic susceptibility testing

Antibiotic susceptibility tests was performed using the disk diffusion technique for each of the identified isolates using Mueller Hinton agar (MHA) as described by Clinical Laboratory Standard Institute [10]. The inoculated plates were allowed to dry for 10 minutes and the commercially obtained antibiotic disc were applied aseptically to the surface of the agar and after 30 minutes, the plates were inverted, and incubated at 35°C for 24 hours.

Result

Table 1 revealed that, out of 350 samples collected, 104 (29.7%) were *S. aureus.* The table further revealed that the highest number of 33 (31.68%) were from Dutse General Hospital, while Dr. Bashir Hospital has the lowest number of 13 (12.48%) isolates. It further revealed that 18 (17.28%) out of the 104 *S. aureus* were MRSA isolates. Similarly, samples from Dutse General Hospital were found to harbor the highest number of MRSA isolates of 7 (38.85%) while sample from Dr. Bashir Hospital, had the least 1 (5.55%) respectively.

Sampling sites	No. of samples collected	Samples positive	No. of MRSA isolated
DGH Hospital	100	33 (31.68%)	7 (38.85%)
FUD Clinic	50	18 (17.28%)	2 (11.10%)
RSTH Hospital	80	25 (24.16%)	5 (27.80%)
DSH	50	15 (14.40%)	3 (16.70%)
DBH	70	13 (12.48%)	1 (5.55%)
Total	350	104 (29.7%)	18(17.28%)

Table 1: *Distribution of S. aureus and MRSA isolates identified among five hospitals in Dutse.*
Key: DGH: Dutse General Hospital, FUDC: Federal University Dutse Clinic, RSTH: Rasheed Shekoni Teaching Hospital, DSH: Dr. Sambo Hospital, DBH: Dr. Bashir Hospital.

Study site		No of *S. aureus*	No of MRSA (%)
Primary health care	Site A: FUDC	18	2 (11.11%)
	Site B = DBH	13	1 (5.55%)
Secondary health care	Site A = DGH	33	7 (38.89%)
	Site B = DSH	15	3 (16.67%)
Tertiary health care	Site A = RSTH	25	5 (27.78%)
	Total	104	18 (100%)

Table 2: *Number of S. aureus and MRSA isolated from each class of hospitals in Dutse Metropolis.*
Key: DGH: Dutse General Hospital, FUDC: Federal University Dutse Clinic, RSTH: Rasheed Shekoni Teaching Hospital, DSH: Dr. Sambo Hospital, DBH: Dr. Bashir Hospital.

Table 3 showed that hospital instrument (needle, tourniquette, test tube rack, ring stand, drip stand, etc. has the highest number of *S. aureus* while other equipment used for analysis of patient body and equipments used for analyzing samples from patient body had the least.

Antibiotic susceptibility test was carried out for the 104 *S. aureus* isolates and the zones of inhibition were classified based on clinical laboratory standards institute [10] interpretive chart for antimicrobial sensitivity testing and the antibiogram of the *S. aureus* isolates from the various hospitals is presented in table 4. The samples examined were from Rasheed Shekoni Teaching Hospital, Federal University Dutse Clinic, Dutse General Hospital, Dr. Bashir Hospital, and Dr. Sambo Hospital. It's worthy to note that in all the hospitals, the greatest level of resistance was found with Ceftazidime 67.27% from Dutse General Hospital, followed by Ceftriaxone 61.50%, Erythromycin 39.40%, Cefuroxime 32.67%, Chloramphenicol 23.60% (Table 4).

Type of hospital instrument	No of *S. aureus*	No of MRSA
Critical	10	3 (16.67%)
Semi critical	15	4 (22.22%)
Non critical	26	11 (61.11%)
Total	51	18 (100%)

Table 3: *Distribution of S. aureus based on the type of instrument.*

Note: Critical instrument include: razor blade, scissors, tonsil clamp, ear syringe, nasal speculum, needle.

Non critical instruments include: Pulse oximeter, microscope, autoclave, hand glove, colonial loop etc.

The level of susceptibility of the *S. aureus* isolates to the antibiotics tested include; ciprofloxacin 80.72%, amoxicillin 73.04%, gentamicin 38.44% respectively, ofloxacin 19.22%, chloramphenicol 76.88%, cefuroxime 67.27%, erythromycin 60.54%, ceftriaxone 38.44% and ceftazidime 32.67% (Table 4).

Comparing the sample sites, gentamicin, and ciprofloxacin has the greatest activity on the isolates followed by ofloxacin. However, the greatest level of resistance was observed with Chloramphenicol by *S. aureus* isolated from Rasheed Shekoni Teaching Hospital, Federal University Dutse Clinic, Dutse General Hospital, Dr. Bashir Hospital, and Dr. Sambo Hospital followed by Ceftazidime, Ceftriaxone and Erythromycin (Table 4).

		N = 104		
Antibiotics	**Susceptible**		**Resistant**	
	No	**Percentage**	**No**	**Percentage**
Chloramphenicol	24	23.06%	80	76.88%
Cefoxitin	86	82.65%	18	17.29%
Ciprofloxacin	35	33.64%	69	66.31%
Amoxicillin	28	26.91%	76	73.04%
Gentamicin	40	38.44%	64	61.50%
Ofloxacin	84	80.72%	20	19.22%
Erythromycin	63	60.54%	41	39.40%
Cefuroxime	70	67.27%	34	32.67%
Ceftriaxone	40	38.44%	64	61.50%
Ceftriaxone	34	32.67%	70	67.27%

Table 4: *Antibiotic susceptibility profile of S. aureus isolated from Hospital equipments.*

Discussion

This study reveals a high contamination rate of hospital equipments with *S. aureus* and MRSA Most importantly. A total of 350 samples from 5 main hospitals were screened for MRSA with specimens collected from different locations within the hospitals. Isolates from 104 of the 350 samples (29.7%) were confirmed as *S. aureus* and 18 (17.28%) were confirmed to be MRSA by Cefoxitin Disc Diffusion assay;

this is in conformity with a research conducted in A Thai study from Srinakharinwirot University in 2013 which demonstrated that 29.7% of healthy, third-year, preclinical medical students carried *S. aureus*, but there was no MRSA carriage [11] this is also in conformity with a research conducted which reported 'e screening of environmental samples revealed that the carriage rate of *S. aureus* was 17.5% and of MRSA 19% [12], the majority (33/104) (31.68%) were from Dutse General Hospital.

Table 2 indicates high prevalence of MRSA in secondary health care center/hospital which translates to high rate of MRSA. The secondary hospital has high no of *S. aureus* isolates and MRSA indicating high contamination of hospital equipment's in secondary hospital. The variations in isolates can be attributed to the level of hygiene and the level of compliance to work ethics exhibited by the different hospitals. Also, the influx rate of patient can also influence the prevalence of *S. aureus* from hospital equipment. The number of patients, staffs and human-facility ratio can be a determinant of the carriage/transmission rate of *S. aureus* and MRSA within a department and the hospital at large.

The results provide evidence that hospital equipment's could serve as MRSA carriers and also in the dissemination of MRSA to the public and other workers.

High levels of MRSA were found from samples collected from the Dutse general hospital 7 (38.85%), followed by RSTH 5 (27.80%) This hospital (RSTH) is the main and biggest hospital in Dutse and Jigawa state in general followed by Dutse General Hospital (in Dutse) and therefore had a much larger sample size than the other 3 hospitals.

The private (DBH, and DSH) hospitals deal with specific clinical conditions and therefore the overall numbers of patients and visitors were less than those in the much larger general hospital. Both hospital size and other factors, such as antibiotic therapy, and hospital management are likely to be of importance in the dissemination and development of MRSA infections.

Out of 350 samples collected, 104 (29.7%) were *S. aureus.* The table (Table 1) further revealed that the highest number of 33 (31.68%) were from Dutse General Hospital, while Dr. Bashir Hospital has the lowest number of 13 (12.48%) isolates. This can be compared to other studies for example, A study by Obianju., *et al*. [13] at Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), showed that 30 (73.2%) methicillin-resistant *S. aureus* isolates were obtained from inpatients while 11 (26.8%) was from outpatients. Other studies revealed that health-care workers accounted for 93% of personnel to patient transmission of MRSA [14].

This is also comparable to a study as reported by Aishatu., *et al.* [15] that reported the prevalence of phenotypic methicillin resistance of 48.5% (16/33) and also comparable to a prevalence rate of 37.5% from clinical specimens at University of Calabar Teaching Hospital and 34.7% from Ilorin [16]. Similarly, in a study carried out by Atif Asghar [2014] reported that A total of 206 *S. aureus* clinical isolates were analysed using standard microbiological methods. Multiplex PCR was performed on genomic DNA from MRSA isolates in order to identify the types of SCCmec.

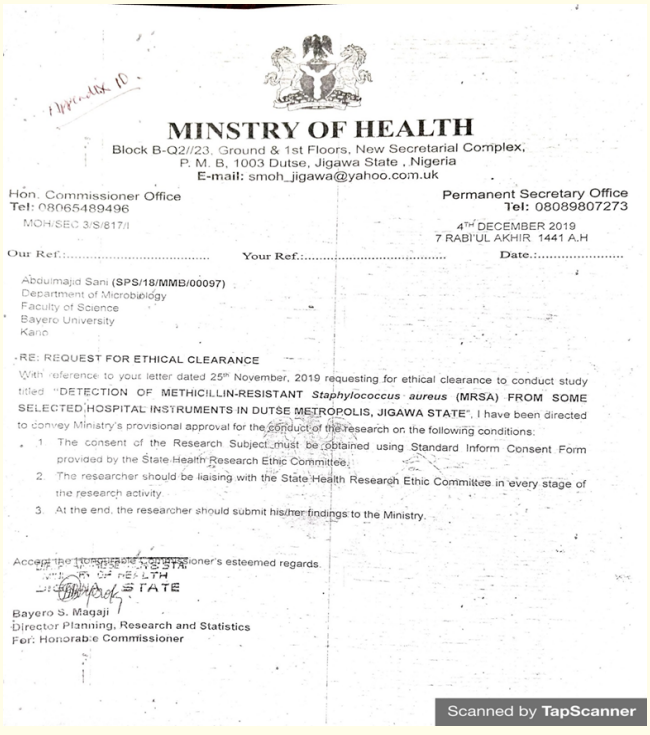
The study also revealed a high contamination rate of hospital equipment's with *S. aureus* and MRSA. Most importantly, invasive hospital instrument as compared to equipments used for assessing and analyzing samples for patients. This implies a serious concern as the possibility of biofilm formation on these equipments has been documented to cause serious illness and failure of medical devices [17].

Conclusion

This study revealed high contamination of hospital equipment, out of 350 samples collected, 104 (29.7%) was *S. aureus.* It further revealed that the highest number of 33 (31.68%) were from Dutse General Hospital, while Dr. Bashir Hospital has the lowest number of 13 (12.48%) isolates. The study further revealed that 18 (17.28%) out of the 104 *S. aureus* were MRSA isolates. Similarly, samples from Dutse General Hospital were found to harbor the highest number of MRSA isolates of 7 (38.85%) while sample from Dr. Bashir Hospital, had the least 1 (5.55%) respectively.

Antibiotic susceptibility test revealed that gentamicin and ciprofloxacin had the greatest activity on the isolates.

Appendix



MINSTRY OF HEALTH

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MOH/SEC 3/S/817/I

4TH DECEMBER 2019
7 RABI'UL AKHIR 1441 A.H

Our Ref.:..... Your Ref.:..... Date.:.....

Abdulmajid Sani (SPS/18/MMB/00097)
Department of Microbiology
Faculty of Science
Bayero University
Kano

RE: REQUEST FOR ETHICAL CLEARANCE

With reference to your letter dated 25th November, 2019 requesting for ethical clearance to conduct study titled "DETECTION OF METHICILLIN-RESISTANT *Staphylococcus aureus* (MRSA) FROM SOME SELECTED HOSPITAL INSTRUMENTS IN DUTSE METROPOLIS, JIGAWA STATE", I have been directed to convey Ministry's provisional approval for the conduct of the research on the following conditions:

1. The consent of the Research Subject must be obtained using Standard Inform Consent Form provided by the State Health Research Ethic Committee.
2. The researcher should be liaising with the State Health Research Ethic Committee in every stage of the research activity.
3. At the end, the researcher should submit his/her findings to the Ministry.

Accept the Honourable Commissioner's esteemed regards.

Bayero S. Magaji
Director Planning, Research and Statistics
For: Honorable Commissioner

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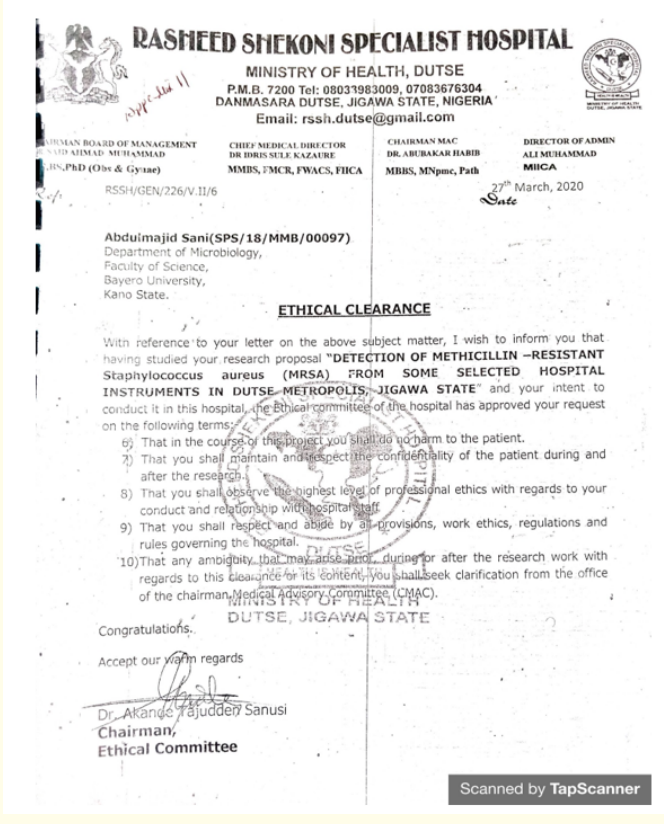

RASHEED SHEKONI SPECIALIST HOSPITAL

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RSSH/GEN/226/V.II/6

27th March, 2020

Abdulmajid Sani(SPS/18/MMB/00097)
Department of Microbiology,
Faculty of Science,
Bayero University,
Kano State.

ETHICAL CLEARANCE

With reference to your letter on the above subject matter, I wish to inform you that having studied your research proposal **"DETECTION OF METHICILLIN –RESISTANT Staphylococcus aureus (MRSA) FROM SOME SELECTED HOSPITAL INSTRUMENTS IN DUTSE METROPOLIS, JIGAWA STATE"** and your intent to conduct it in this hospital, the Ethical committee of the hospital has approved your request on the following terms:

6) That in the course of this project you shall do no harm to the patient.
7) That you shall maintain and respect the confidentiality of the patient during and after the research.
8) That you shall observe the highest level of professional ethics with regards to your conduct and relationship with hospital staff.
9) That you shall respect and abide by all provisions, work ethics, regulations and rules governing the hospital.
10) That any ambiguity that may arise prior, during or after the research work with regards to this clearance or its content, you shall seek clarification from the office of the chairman, Medical Advisory Committee (CMAC).

MINISTRY OF HEALTH
DUTSE, JIGAWA STATE

Congratulations.

Accept our warm regards

Dr. Akande Tajudden Sanusi
Chairman,
Ethical Committee

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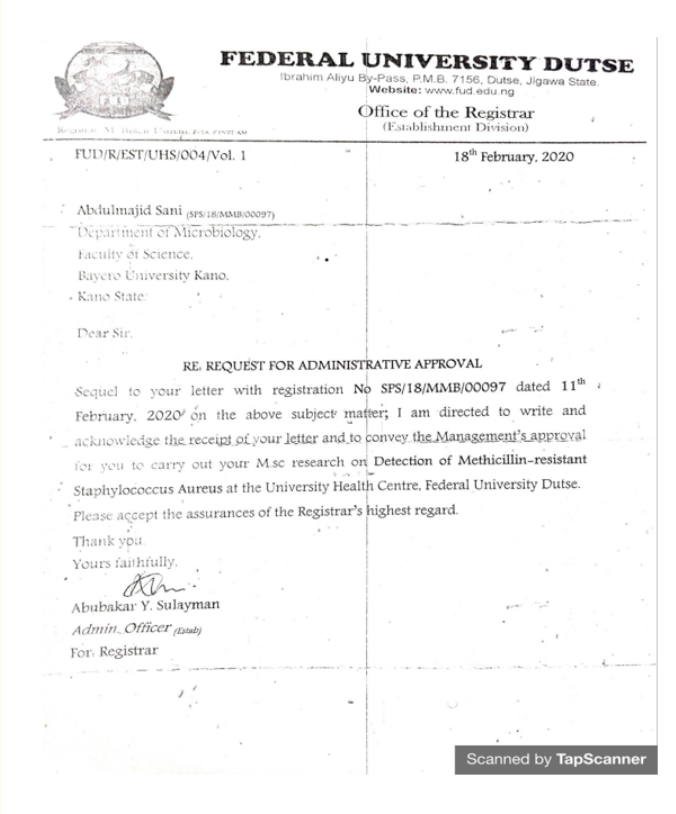

FEDERAL UNIVERSITY DUTSE
Ibrahim Aliyu By-Pass, P.M.B. 7156, Dutse, Jigawa State.
Website: www.fud.edu.ng
Office of the Registrar
(Establishment Division)

FUD/R/EST/UHS/004/Vol. 1 — 18th February, 2020

Abdulmajid Sani (SPS/18/MMB/00097)
Department of Microbiology,
Faculty of Science,
Bayero University Kano,
Kano State.

Dear Sir,

RE: REQUEST FOR ADMINISTRATIVE APPROVAL

Sequel to your letter with registration No SPS/18/MMB/00097 dated 11th February, 2020 on the above subject matter; I am directed to write and acknowledge the receipt of your letter and to convey the Management's approval for you to carry out your M.sc research on Detection of Methicillin-resistant Staphylococcus Aureus at the University Health Centre, Federal University Dutse.

Please accept the assurances of the Registrar's highest regard.

Thank you.

Yours faithfully,

Abubakar Y. Sulayman
Admin. Officer (Estab)
For: Registrar

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