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# Antibiotic Susceptibility Pattern of Bacteria Isolated From Surgical Wounds of Patients Attending Federal Medical Center and Christiana Specialist Hospital, Owerri

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**Abstracts**
This study was aimed at investigating and determining the performance levels of different antibiotics used in the treatment of surgical wound infections at Federal Medical Centre (FMC) and Christiana specialist hospital (CSH) Owerri. 100 post surgical wound specimens containing purulent materials were aseptically collected from postsurgical wound and cultured on MacConkey, blood and Mannitol salt agars. Bacteria growths were subjected to standard methods of identification. Isolated organisms were tested for their antibiotic susceptibility. Data generated were analyzed using t-test and ANOVA at 95% confidence limit. A total of 146 bacterial isolates were obtained (81 from FMC and 65 from CSH). Most of the specimens yielded poly microbial growth (more than 60%). *Staphylococcus* species was significantly ($p< 0.05$) the most predominant bacteria isolated (70% and 58%) and the least significantly occurring ($p< 0.05$) was *Proteus vulgaris* (10% and 4%) on specimens from FMC and CSH Owerri respectively. At FMC, age group 20-29 yrs had the highest number of isolates (12) and ages 0-9 yrs recorded significantly ($p< 0.05$) the least number of isolates (03). Bacteria isolated from males (96) were significantly higher ($p< 0.05$) than in the females (45). Based on occupation, most bacteria ($p< 0.05$) were isolated from drivers (51) while the isolates from Igbos (106) were significantly the highest ($p< 0.05$) amongst the other tribes. The results of the antibiotic susceptibility revealed that *Pseudomonas aeruginosa* was more sensitive to NIT (62.9%), and most resistant to AMX (100%) on samples obtained from FMC. *P. vulgaris* was most sensitive to AMX (50%) and NAL (50%) on samples obtained from CSH. Therefore, usage of COT, GEN, and AUG in treatment of surgical wound infections were most likely not to yield any positive results.

## Introduction

Hospital-acquired infections remain a cause of morbidity, extended hospital stay and death for patients (Holzheimer*et al*., 1990). The burn and wound represent a susceptible site for opportunistic colonization by organisms of endogenous and exogenous origin (Pruitt *et al*., 1998). Burns, wounds, trauma, multi-organ failure and use of invasive devices for surgery, and exposure of microorganisms in the environment of hospital to a number of antimicrobial agents leading to selective resistance are all some of the factors facilitating colonization, transmission and susceptibility to infection (Poh and Yeo, 1993).The infection of burns andwounds with multiple organisms, as a result of superadded problem of drug resistance, illustrates the need for a drug policy by the hospitals for burn patients. Isolated bacteria from studies have exhibited multiple resistances to antibiotics (Roberts *et al*., 2008).

Burns provide a suitable site for bacterial multiplication and are more persistent richer sources of infection than surgical wounds, mainly because of the larger area involved and longer duration of patient stay in the hospital (Agnihotri*et al*., 2004). Bacterial infections in burn and wound patients are common and are difficult to control.The knowledge of the causative agents of wound infection has proved to be helpful in the selection of empiric antimicrobial therapy and on infection control measures in hospitals (Shittu*et al*., 2004) are also useful in formulating rational antibiotic policy. The Pseudomonads are a diverse bacterial group of established and emergent pathogens. Members of the genus are major agents of nosocomial and community acquired infections, being widely distributed in the hospital environment where they are particularly difficult to eradicate.

## Materials and Methods

### *Specimen Collection*

A total of 100 post operative wounds and burns swabs were collected aseptically from patients attending Federal Medical Centre and Christiana Specialist Hospital, Owerri and transported to Microbiology laboratory of Madonna University Elele for the investigation. The specimens were collected according to the sample plan which was 10 specimens per week (5 from each hospital) from the two hospitals. The specimens were collected for a total of 10 weeks Ethical approval for this study was obtained from both hospitals in Owerri. Only the conventional antibiotics prescribed for frequent use by patients in the area were considered for this study.

***Cultivation of Organisms***

All media used were prepared according to the instructions of the manufacturer. Swabs were taken from all septic wounds. Swabs were transported to the lab immediately after collection and cultured by streaking on MacConkey's agar, Mannitol salt agar, Blood agar; the plates were incubated at 37 °C for 24–48 hours. Bacterial growths were identified by cultural and colony characteristics, blood hemolysis, microscopic examination of Gram stained preparations and biochemical techniques from pure cultures. Primary cultures were sub cultured using the streaking techniques on nutrient agar plates to obtain pure cultures (Cowan, 2000).

***Identification of Bacterial Pathogens***

Pure cultures on secondary plates were characterized using physical appearances on selective and differential media. Gram reactions were observed and recorded after the slides had been Gram stained to assist in the identification process. Biochemical tests such as catalase, coagulase, oxidase, Hydrogen Sulfide test, urease, methyl red, indole, citrate and sugar utilization tests were carried out as confirmatory tests as described by (Agwung-Fobellah and Kemajou, 2007).

***Microscopic identification***

Gram stain is a differential staining procedure that divides bacteria into Gram positive and Gram negative groups based on their ability to retain the crystal violet dye when decolourized with an organic solvent like ethanol. Gram stain also reveals the morphology of the organism. *Staphylococcus aureus* (Ochei and Kolhatkar, 2008). A drop of distilled water was placed on a grease free slide. A smear was then made by emulsifying a colony from the 24 hours culture on the slide and allowed to air dry. The smear was heat fixed by passing it through a Bunsen flame for three times. A drop of crystal violet (primary stain) was added allowed to stay for 60 seconds and rinsed. Lugol's iodine (mordant) was added, allowed to stay for 60 seconds and rinsed The slides were then flooded with 70 % ethanoll for 10-20 seconds and rinsed immediately to avoid over decolourization. The secondary stain (saffranin) was added, allowed to stay for 2 minutes and rinsed. The slides were then allowed to dry and later observed microscopically using x100 objectives with oil immersion (Alfred, 2007).

***Biochemical Tests***

Confirmatory were performed to assist in the naming of the isolates. Biochemical activities including oxidase test, glucose, lactose, arabinose, sucrose, maltose and mannitol fermentation, indole production, catalase activity, urease production, citrate test, $H_2S$ production, coagulase test and pigment productions were performed and results observed to confirm the identification of each isolate according to the methods of Manual of Methods for General Bacteriology (1981).

***a) Catalase test:*** Two to three drops of hydrogen peroxide was disposed on clean, grease free slides. The isolates were inoculated in the hydrogen peroxide using sterile applicator sticks to emulsify. Organisms that produced the enzyme catalase oxidized the hydrogen peroxide to water and oxygen. This was observed by the rapid appearance of gas bubbles (Cheesbrough, 2003).

***b) Coagulase test:*** This test was carried out to identify *Staphylococcus* species that produced the enzymes coagulase (*Staphylococcus aureus*). Human plasma was used after being allowed to warm at room temperature. A drop of distilled water was placed at both ends of the grease free slides and a colony of each test organism emulsified at both ends on each slide. A drop of plasma was added to one of the sides while the other served as control. The slide was then rocked for 10 seconds. In the positive tests, the fibrinogen was converted directly to fibrin. The positive test shows clumping while no clumping shows a negative test (Cheesbrough, 2003).

***c) Oxidase test:*** This test was used to assist in the identification of bacterial species that produced oxidase enzymes. It was carried out using oxidase reagent, which is a solution containing phenylenediamine. Two to three drops of the oxidase reagent were placed on filter papers with the aid of sterile wire loop. Colonies were then collected from pure cultures and smeared on the filter papers containing the drops of reagent. A development of blue-purple colour from oxidation of phenylenediamine within 10 seconds confirmed oxidase-producing organisms and no colour change signified negative result (Cheesbrough, 2003).

***d) Motility test:*** This was done to detect motile organisms. 24 hours cultures of the test organisms in peptone water were used. A drop of the bacterial suspension was placed on the cover slip and the edge sealed with petroleum jelly to prevent it from spilling. The slide was gently placed on it avoiding contact with the suspension, it was then quickly inverted. The slides were examined microscopically with the x10 and x40

objectives. The organisms with motile organelles were seen moving to one or different directions (Cheesbrough, 2003).

***e) Urease test:*** This differential test for Enterobacteria was used to support a more vigorous growth of many Gram negative bacteria capable of splitting urea. The test organisms were cultured in a medium which contains urea and the indicator phenol red and incubated for 48 hours. When the strain was urease producing, the enzymes broke down the urea (by hydrolysis) to give ammonia and carbon dioxide. With the release of ammonia, the media turned alkaline and this was shown by a change in colour of the indicator to pink-red and a yellow-orange color indicated negative results (Cheesbrough, 2003).

***f) Citrate utilization test:*** This test was carried out using the simmon's citrate agar. This test is based on the ability of the isolates to use citrate as the only source of carbon. The test organisms were cultured on the slopes of the agar media in bijou bottles and incubated for 48 hours. A bright blue colour indicated a positive citrate test while no change in colour was a negative citrate test (Cheesbrough, 2003).

***g) Indole test:*** This test was used to detect organisms that produce indole. About 3mls of Sterile peptone water was used and the organism inoculated and incubated for about 48 hours at 37ºC. Kovac's reagent was then added and shook gently. Positive indole test showed a red surface layer within 10 minutes (Cheesbrough, 2003).

***h) Sugar utilization tests:*** The sugars used were the lactose, glucose, maltose, arabinose, sucrose and mannitol. These were prepared and the isolates aseptically cultured in each of them to test their abilities to ferment sugars. The sugars were observed for positive results indicated by a change in colour to yellow after about 48 hours. The results were recorded and later used for identification (Cheesbrough, 2003).

**Antibiotic Susceptibility Test**

The identified isolates were tested using some antibiotics, such as the test was performed according to the Kirby-Bauer technique (Anguzu and Olila, 2007). The diffusion technique was employed to determine the antibiotic susceptibility pattern of the isolates to the selected antibiotics such as Cotrimoxazole (25ug), cloxacillin (5ug), erythromycin (5ug), gentamycin (10ug), augmentin (30ug), streptomycin (10ug), tetracycline (10ug), chloramphenicol (10ug), ofloxacin (5ug), nalidixic acid (30ug), nitrofurantoin (200ug), and amoxicillin (25ug). A total of twelve antibiotics commonly used in the hospitals were used for this study.

***Standardization of inoculums***

Mac Farland 0.5 turbidity standard was prepared by mixing 99.4ml of 1% dilute Sulfuric acid solution and 0.6ml of 1% Barium chloride to give a standard turbidity (Cheesbrough, 2003). A peptone water culture of the test organism was used to obtain a solution equal to the Mac Farland standard. One milliliter (1ml) of the culture dilution (bacteria suspension) was transferred into a well dried surface of the sensitivity test agar medium (Mueller Hinton agar) and tilted to spread evenly over the entire surface of the agar plate. The excess fluid was drained off and dried for about 15 minutes. Multi-antibiotic discs were then placed on the surface of the inoculated plates.

The Antibiotic discs were placed on the Agar using sterile forceps. Each disc was placed far from each other to avoid their zones of inhibition from coalescing into the other. These procedure used have been previously reported by other authors (Sani*et al.,* 2012). The different zone sizes were measured and recorded in millimeters (mm). The result of each antimicrobial agent tested was reported as susceptible or resistant when the test organism was compared with the control and manufacturer's manuals for interpretation. The zone sizes were interpreted using the criteria of the National Committee on Clinical Laboratory Standards as described by (Bach, 2002).

**Statistical Analysis**

The results obtained were edited, coded, and subjected to different statistical investigations. Mean occurrence was determined for the various specimens. Analysis of variance (ANOVA) was also used to determine the significance at 95% interval to investigate on the antibiotic that was most resistant and most potent to the bacteria. Percentage susceptibilities and resistance were also investigated (Agwung, 2007).

**Results**

The patients at FMC Owerri and Christiana hospital Owerri had records ranging from acute postsurgical wound sepsis to septicemia after surgery. A total of 50 patients from each location were investigated. They were made up of 62 males (34 from FMC and 28 from Christiana's hospital) and 38 females (16 from FMC and 22 from

Christiana). The ages ranged from a month old baby to 62 years. Positive bacterial growths were observed in 82 patients while 18 had no bacterial growth. *Staphylococcus* species was significantly ($p < 0.05$) the most frequently isolated organism (70% and 58% respectively from the two locations) followed by *Pseudomonas aeruginosa* (54% and 44% respectively), *Klebsiella pneumonia* (28% and 24% respectively). *Proteus vulgaris* (10% and 4%) was significantly ($p < 0.05$) the least frequently isolated organism (Table 1).

Table 2 shows that at FMC Owerri, the occurrence of *Pseudomonas* species was more within age group of 30-39 with 7 isolates. This was higher but not significantly different ($p< 0.05$). Age group 0-9 years with 01 isolate was the least. A total of 21 bacterial isolates were recorded for age interval 30-39 yrs. This was significantly higher than the number of isolates recorded for any other interval. Age group 20-29 yrs recorded significantly the highest number of isolates (12), followed by group 60-69 yrs (11), 10-19 yrs (10) and the least number of isolates in age group 0-9 yrs (03). For Christiana hospital, age group 40-49 yrs with 13 isolates was the highest but not significantly different ($p> 0.05$) from age group 30-39 yrs with 12 isolates. Age group 60-69 recorded least cases with 06 isolates and this was not significantly different ($p> 0.05$) from age group 0-9 yrs with 07 isolates.

Table 3 shows that bacteria isolated from males (96) were significantly higher ($p < 0.05$) than females (45). This trend was evident in the number observed within each of the hospitals.

Based on occupation, most ($p < 0.05$) bacteria were isolated from drivers (51) followed by students (28) while least ($p> 0.05$) isolates came from infants (04), civil servants (02) and house wives (02) as shown in Table 4. Based on tribe, bacteria isolated among Igbos (106) were significantly higher ($p< 0.05$) than the number obtained from other tribes combined. Least number of isolates was notice on specimens collected from Ikwerre (00) and Ifik (03), and Urhobo (05) as shown in Table 5.

The antibiotic susceptibility pattern of the isolates revealed that the Gram positive isolates (*Staphylococcus aureus* and coagulase negative *Staphylococcus*) were more susceptible to Gentamycin, Erythromycin, Streptomycin and Tetracycline with percentages ranging from 60%-80%. Majority of the Gram negative isolates were moderately susceptible to Gentamycin, Nitrofurantoin and Tetracycline with results ranging from 40-65% (Tables 6 and 7).

**Table 1:**Occurrenceof bacterial isolates from surgical wounds at each location

| **Location** | **Total specimens** | ***P. aeruginosa*** | ***K. pneumoniae*** | ***Staphylococcus* species** | ***P vulgaris*** |
|---|---|---|---|---|---|
| FMC Owerri | 50 | 27 (54%) | 14 (28%) | 35 (70%) | 5 (10%) |
| Christiana Hospital | 50 | 22 (44%) | 12 (24%) | 29 (58%) | 2 (4%) |

**Table 2:**Distribution bacteria isolated from surgical wounds by age and location of patients

| | **FMC Owerri** | | | | | **Christiana hospital** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Age range** | N | I | II | III | IV | N | I | II | III | IV |
| 0-9 | 8 | 1(12.5) | 0(0) | 2(25) | 0(0) | 6 | 3(50) | 0(0) | 4(66.7) | 0(0) |
| 10-19 | 6 | 3(50) | 3(50) | 4(66.7) | 0(0) | 9 | 4(44.4) | 1(11.1) | 6(66.7) | 0(0) |
| 20-29 | 7 | 5(71.4) | 0(0) | 6(85.7) | 1(14.3) | 9 | 3(33.3) | 2(22.2) | 4(44.4) | 0(0) |
| 30-39 | 12 | 7 (58.3) | 4 33.3) | 8 (66.7) | 2 (16.7) | 10 | 3 (30) | 3 (30) | 5 (50) | 1 (10) |
| 40-49 | 5 | 3 (60) | 3 (60) | 3 (60) | 1 (20) | 8 | 5 (62.5) | 3 (37.5) | 4 ( 50) | 1 (12.5) |
| 50-59 | 6 | 5 (83.3) | 2(33.3) | 6 (100) | 1 (16.7) | 5 | 2 (40) | 2 (40) | 3 (60) | 0 (0) |
| 60-69 | 6 | 3 (50) | 2(33.3) | 6 (100) | 0 (0) | 3 | 2 (66.7) | 1 (33.3) | 3 (100) | 0 (0) |
| TOTAL | 50 | | | | | 50 | | | | |

Key : N (number of isolates), I (*Pseudomonas aeruginosa*), II (*Klebsiellapneumoniae*), III (*Staphylococcus species*), IV ( *Proteus vulgaris*)

**Table 3:**Distribution of bacterial isolates from surgical wounds of patients by sex and hospital

| | FMC Owerri | | | | | Christiana Hospital | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sex | N | I | II | III | IV | N | I | II | III | IV |
| Males | 34 | 16 (47.1) | 10 (29.4) | 21 (61.8) | 4 (11.8) | 28 | 15 ( 53.6) | 9 (32.1) | 19 (67.9) | 2 (7.1) |
| Female | 16 | 11 (68.7) | 4 (25) | 14 (87.5) | 1 (6.2) | 22 | 7 (31.8) | 3 (13.6) | 10 (45.5) | 0 (0) |

Key : N (number of isolates); I (*Pseudomonas aeruginosa*), II (*Klebsiella pneumoniae*), III (*Staphylococcusspecies*), IV ( *Proteus vulga*ris)

**Table 4:** Occupational distribution of bacteria isolates from surgical wounds of patients.

| | FMC Owerri | | | | | Christiana Hospital | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Occupation** | **N** | I | II | III | IV | N | I | II | III | IV |
| Students | 9 | 5(55.6) | 4(44.4) | 6(66.7) | 1(11.1) | 7 | 6(85.7) | 3 (42.9) | 3 (42.9) | 0 (0) |
| Petty traders | 6 | 4(66.7) | 3 (50) | 6 (100) | 1(16.7) | 12 | 3 (25) | 3 (25) | 5 (41.7) | 0 (0) |
| Drivers | 14 | 7 (50) | 4(28.6) | 12(85.7) | 3 (21.4) | 11 | 10 (90.9) | 4 (36.4) | 9 (75) | 2 (18.2) |
| Infants | 4 | 0 (0) | 0 (0) | 3 (75) | 0 (0) | 2 | 0 (0) | 0 (0) | 1 (50) | 0 (0) |
| Housewives | 2 | 0 (0) | 0 (0) | 1 (50) | 0 (0) | 1 | 0 (0) | 0 (0) | 1 (100) | 0 (0) |
| Civil servants | 2 | 1 (50) | 0 (0) | 0 (0) | 0 (0) | 4 | 0 (0) | 0 (0) | 1 (25) | 0 (0) |
| Educationists | 5 | 4 (80) | 1 (20) | 1 (20) | 0 (0) | 4 | 0 (0) | 0 (0) | 3 (75) | 0 (0) |
| Businessmen | 4 | 4 (100) | 2(50) | 4 (100) | 0 (0) | 7 | 3(42.9) | 1 (14.3) | 5 (71. 4) | 0 (0) |
| Forces | 4 | 2 (50) | 0 (0) | 2 (50) | 0 (0) | 2 | 0 (0) | 2 (100) | 2 (100) | 0 (0) |
| Total | 50 | | | | | 50 | | | | |

Key : N (number of isolates), I (*Pseudomonas aeruginosa*), II (*Klebsiella pneumoniae*), III (*Staphylococcus species*), IV ( *Proteus vulgaris*)

**Table 5:** Distribution of the isolates from surgical wounds of patients by their tribes

| | **FMC** | | | | | **CSH** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Tribe** | **N** | **I** | **II** | **III** | **IV** | **N** | **I** | **II** | **III** | **IV** |
| Igbo | 28 | 19 (67.8) | 8 (28.6) | 27 (96.4) | 3 (10.7) | 35 | 18 (51.4) | 10 (28.6) | 20 (65.7) | 2 (5.7) |
| Yoruba | 5 | 1 (20) | 0 (0) | 0 (0) | 0 (0) | 3 | 0 (0) | 0 (0) | 1 (33.3) | 0 (0) |
| Hausa | 4 | 2 (50) | 1 (25) | 2 (50) | 1 (25) | 3 | 1 (33.3) | 0 (0) | 2 (66.7) | 0 (0) |
| Edo | 6 | 3 (50) | 2 (66.7) | 3 (50) | 1 (16.7) | 4 | 2 (50) | 2 (50) | 4 (100) | 0 (0) |
| Efik | 3 | 1 (33.3) | 0 (0) | 1 (33.3) | 0 (0) | 2 | 0 (0) | 0 (0) | 1 (50) | 0 (0) |
| Urhobo | 2 | 1 (50) | 1 (50) | 2 (100) | 0 (0) | 3 | 0 (0) | 0 (0) | 1 (33.3) | 0 (0) |
| Ikwere | 2 | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 | 0 (0) | 0 (0) | 0 (0) | 0 (0) |

Key : N (number of isolates), I (*Pseudomonas aeruginosa*), II (*Klebsiella pneumoniae*), III (*Staphylococcus species*), IV ( *Proteus vulgaris*)

**Table 6:** Percentage antibiotic resistance of Gram positive isolates from surgical wounds of patients at FMC Owerri and Christiana specialist hospital

| Antibiotics | FMC | | | | CSH | | | |
|---|---|---|---|---|---|---|---|---|
| | *S. aureus* N = 25 | | Coagulase negative *Staphylococcus* N = 10 | | *S. aureus* (N=17) | | Coagulase negative *Staphylococcus* (N=12) | |
| | NS | NR | NS | NR | NS | NR | NS | NR |
| COT | 4 (16) | 21 (84) | 1 (10) | 9 (90) | 2 (11,8) | 15 (88.2) | 0 (0) | 12 (100) |
| CXC | 2 (8) | 23 (92) | 0 (0) | 10 (100) | 5 (29.4) | 12 (70.6) | 2 (16.7) | 10 (83.3) |
| ERY | 7 (28) | 18 (72) | 8 (80) | 2 (20) | 7 (41.2) | 10 (58.8) | 8 (66.7) | 4 (33.3) |
| GEN | 11 (44) | 14 (56) | 6 (60) | 4 (40) | 7 (41.2) | 10 (58.8) | 7 (58.3) | 5 (41.7) |
| AUG | 0 (0) | 25 (100) | 1 (10) | 9 (90) | 2 (11.8) | 15 (88.2) | 3 (25) | 9 (75) |
| STR | 9 (36) | 16 (64) | 7 (70) | 3 (30) | 6 (35.3) | 11 (64.7) | 6 (50) | 6 (50) |
| TET | 3 (12) | 22 (88) | 8 (80) | 2 (20) | 5 (29.4) | 12 (70.6) | 8 (66.7) | 4 (33.3) |
| CHL | 5 (20) | 20 (80) | 3 (30) | 7 (70) | 3 (17.6) | 14 (82.4) | 3 (25) | 9 (75) |

KEY: N (Number of specimens isolated), NS (Number of sensitive isolates), NR (Number of resistant isolates)
COT (Cotrimoxazole25ug), CXC (Cloxacillin5ug), ERY (Erythromycin 5ug), GEN (Gentamycin10ug),
AUG (Augmentin30ug), STR (Streptomycin 10ug), TET (Tetracycline10ug), CHL (Chloramphenicol 10 ug)

**Discussion**

*S. aureus* found as the most prevalent organism (70% from FMC and 58% from CSH hospital) is a commensal of the skin and nasal passages and this is in agreement with the report of (Adegoke and Komolafe, 2008). They also stated that poor wound management allows the organisms to invade the inner tissue and bring about chronic systemic infections. Most of theinvasion of microorganisms in wound is a clear case of poor hospital hygiene, just like other implicated organisms are frequent agents of nosocomial infection (Samuel *et al.,* 2010). *P. aeruginosa* was observed as the second most prevalent organism (54% and 44% in both hospitals respectively) and this does not correspond with the report of (Lilani *et al.,* 2005) where the organism occurs 4 out of 17 times (23.5%). When the observed bacteria rate was categorized with respect to location, age, sex, occupation and tribe of the patients, it was discovered that deeply infected wound related surgeries could be attributed to young men (Table 2). This is attributable to the fact that the age range of the more prevalent groups were made of leisurely active men.

Largest number of bacterial pathogens isolated from the same age range might also be due to their agility as it was observed (during sample collection) that many of them hardly stayed on their beds. This observation was peculiar to male patients and might explain the reason for the higher prevalence in them than their female counterparts.

A study of *in vitro* antimicrobial susceptibility profile of the aetiological agents of surgical site infection has revealed that there is a growing emergence of multi-drug resistant microbes. 92% and 70.6% from both hospitals respectively of *S. aureus* isolated were resistant to cloxacillin which is a drug often used for initial and empirical treatment of Staphylococcal infections. This high level of resistance to cloxacillin may pose problems in the treatment of surgical wound infections and SSI. The increasing percentage resistance of *S. aureus* to cloxacillin observed in this study is extremely high as against the 40% resistance documented by (Angyo *et al.,* 2001) in SSI septicaemia. This may be due to the widespread abuse of the drug which is usually available in combinations with ampicillin for the treatment of infections in our society and can be obtained over the counter without a prescription. About sixty to hundred percent (60 – 100% resistance) of *S. aureus* to other commonly used antibiotics like cotrimoxazole, erythromycin, augmentin, streptomycin, tetracyline and chloramphenicol were observed. The consequences of using an ineffective drug in severe bacterial infections could be disastrous as this can complicate management and increase morbidity and mortality. In adults of all ages, SSI is associated with increase in mortality, longer days of hospitalization (Kirkland *et al*., 1999) and adverse impact on clinical outcomes.

A general overview of the anti bio gram of all the bacterial isolates indicated that both the Gram positive bacteria and Gram negative bacteria had very high resistance levels. This situation raises serious concern. This suggests a very high resistance gene pool due perhaps to gross misuse and inappropriate usage of the antibacterial agents. The upsurge in the antibiotic resistance noticed in this study is in agreement with an earlier report by (Obaseki-Ebor *et al.,* (1987) where antibiotic abuse and high prevalence of self medication with antibiotics were identified as being responsible for the selection of antibiotic resistant bacterial strains.

**Conclusion**

The findings of this study suggest that bacterial resistance in surgical wound infections is becoming serious menace in all the study area. *Staphylococcus aureus* is still the most frequently involved pathogen, showing high resistance rates of bacteria isolated from surgical wounds followed by *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, and the least occurring *Proteus vulgaris* (notably agents of nosocomial infections) Erythromycin and Gentamycin are the best therapeutic options from the results (Table 6) to treat Staphylococcal infections because of the lesser resistance caused by these organisms and or the Gram negative isolates Gentamycin, Nitrofurantoin and Tetracycline can be used but they must be combined with other antibiotics for a more effective treatment.

Infections of the surgical wound by these bacteria are one of the most common and important cause of morbidity and mortality in developing countries.The delay in recovery and subsequent increased length of hospital stay also has economic consequences. It has been estimated that each patient with a surgical site infection will require an additional six to seven (6-7) days in the hospital, which results in the doubling of hospital costs.

**Recommendations**

This piece of work has demonstrated vividly the urgent need for management strategies designed for specific groups of patients with infections in order to maximize therapeutic benefits, cost reduction and possible reduction in the incidence of adverse drug reactions. There is therefore need for usage policy that would be made applicable to the different tiers of our health care providers at the primary, secondary and tertiary levels.

This should be done concurrently with sustained enlightenment and media publicity focusing attention on the dangers of high incidence of bacterial resistance to antibacterial agents in general and the ultimate consequences. Early treatment when antibacterial therapy is indeed necessary should be promptly initiated; inadequate use of antibacterial (doses that are too low, therapy ended prematurely) is a major factor for the selection of resistant strains.

The surgical team must also take perioperative measures to prevent microbial contamination of the wound. Contamination from the surgical team may result from direct contact, usually with hands or from shedding from skin or mucous membranes. Transfer of microorganisms from hands to the wound should be reduced by scrubbing the hands and wearing sterile gloves. The surgical scrub is designed to kill or remove as many bacteria as possible, including resident bacteria.

Since most infections are acquired in the operating room and good surgical practices are crucial to their prevention, most prevention measures should be directed at influencing the practices of the surgical team. Measures aimed at preventing microbial contamination of the wound begin before the operation. One important preoperative and postoperative measure is the treatment of active infections.

A patient, who has an active bacterial infection, even if it is at a site remote from the surgical wound, has a greater risk of wound infection than does an uninfected patient. Treating a "remote" infection that is present before or after an operation is believed toreducethe risk of wound infection.

Other preoperative measures involving the patient are keeping the preoperative hospital stay short, avoiding hair removal or, if necessary, removing hair with clippers or depilatories rather than a razor, and preparing the operative site with an antiseptic. A short preoperative stay has been associated with low wound infection rates. Bathing by the patient with antimicrobial-containing products has been suggested as an effective preoperative prevention measure, because it reduces colonization with typical wound pathogens such as *S. aureus*. Although such bathing is relatively easy, safe, and inexpensive, it has not been proven to reduce colonization with *S. aureus* in the host's natural reservoir; the anterior nares or toreduce infection rates. Hair adjacent to the operative site is often removed to prevent the wound from becoming contaminated with hair during the operation.

The skin at the operative site is thoroughly cleaned to remove superficial flora, soil, and debris before the operation to reduce the risk of contaminating the wound with a patient's skin flora. Immediately before the operation, a preoperative skin preparation is applied to the patient's skin to kill or inhibit more adherent, deep, resident flora. The surgical team must also take perioperative measures to prevent microbial contamination of the wound.

Personnel taking care of wounds can reduce the risk of contamination by washing their hands and using instruments to handle dressings and tissues (the no-touch technique) or, if touching the wound is necessary, sterile gloves should be put on. In the postoperative period, the risk of wound infection can be reduced by adequate wound drainage. If not allowed to drain freely, blood, body fluids, pus, and necrotic material collected in a wound could provide a growth medium for microorganisms. If all these measures are applied, there would be a significant reduction in the occurrence of surgical wound infections amongst patients in hospitals and also an increased effectiveness of improved antibiotics and resistance will be greatly minimized.

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