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Prevalence of hospital acquired (nosocomial) infections in surgical wounds among patients attending Murtala Muhammad Specialist Hospital, Kano, Nigeria

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ABSTRACT: The study was carried out among sixty (60) subjects suspected with Nosocomial infections of surgical wounds at Murtala Mohammed Specialist Hospital, Kano, Nigeria between April and August, 2005. Out of which 32 (53.3%) were positive while 28 (46.7%) were negative. Observations have shown that among the positive patients, female 18 (30%) have the highest prevalence than males 14 (23.3%). In addition to that, patients at the age range of 0-29 (35%) have the highest prevalence followed by 60 and above (10%) but low at the age range of 30-59 (8.3%). *Staphylococcus aureus* was the most dominant organism isolated accounting for 20%, *Pseudomonas aeruginosa* 13.3%, *Escherichia coli* 6.7%, *Klebsiella* spp 5%, *Proteus* spp 3% and *Staphylococcus saprophyticus* 5%. Statistical analysis using Chi-square test have shown that there is a significant difference ($p > 0.05$). All the isolated bacteria were sensitive to gentamycin, all the gram negative bacteria were resistant to taravid and peflacin and all the gram positive bacteria were resistant to Norbactin.

Key Words: Nosocomial infections; Surgical wounds; Prevalence study.

Introduction

Hospitals and clinics are places where sick people go with the expectation that they will get better, unfortunately there is a risk that clients may become infected because of their visits to these places (Heritage, 2001).

Nosocomial infections are infections that develop within a hospital or are produced by microorganisms acquired during hospitalization. Nosocomial infections may involve only patients but also anyone else who has contact with a hospital including members of staff, volunteers, visitors, workers, sales person, and delivery personnel. The majority of Nosocomial infections become clinically apparent while the patients are still hospitalized. However, the onset of disease can occur after a patient has been discharged. As many as 25% of post-operative wound infections for example become symptomatic after the patient has been discharged. Infections incubating at the time of patient's admission to the hospital are not Nosocomial infections, they are community – acquired, unless of course they result from a previous hospitalization (Brachman, 1992).

An infection that is acquired during hospitalization is called Nosocomial infection. Nosocomial infection can result from diagnostic and therapeutic procedure, for example bacteria may be inadvertently introduced into the blood by catheterization of the bladder or blood vessel; or during surgery. The organisms may come from the hospital environment, from contact from medical personnel or from the patient's normal flora (Nester *et al.*, (1995).

Nosocomial infections encompass almost all clinically evident infections that do not originate from the patients original admitting diagnosis. Within hours after admission, a patient's flora begins to acquire characteristics of the surrounding bacteria pool. Most infections that become clinically evident after 48 hours of hospitalization are considered as hospital acquired. Infections that occur after the patient's discharge from the hospital can be considered to have a Nosocomial origin if the organisms were acquired during hospitalization (Andreoli *et al.*, 1997).

Nosocomial infections are among the major causes of morbidity and mortality in institutionalized patients (Anyiwo *et al.*, 1980). These unfortunate complications often prolong hospitalization, add appreciably to cost of treatment and also create new health hazards for the community. The includes those undergoing surgery, being treated with broad spectrum antibiotics or on immunosuppressive or antineoplastic therapy (Anyiwo *et al.*, 1980).

The prevention, surveillance and control of hospital associated infections has become a major subject of interest among clinicians, microbiologist, epidemiologists, environmental scientists, hospital administrators, and more recently, economists. Consequently, the problem is still with us, many countries are seeking a national approach to its solution based on rational surveillance programmes (Anyiwo *et al.*, 1980).

The aims and objectives of this study are (1) to isolate all possible bacteria that are acquired by patients during and after surgery, (2) To test the potency of various antibiotics to the bacteria isolated, and (3) To recommend to physicians, surgeons and nurses that are in charge of such operations of the possible implication and danger the patient tends to face if the wounds are not properly managed.

Materials and Methods

Study Area

The research was conducted between May and August, 2005 at Murtala Mohammed Specialist Hospital (MMSH), Kano, Nigeria.

Sample Size

Sixty (60) samples were collected from in-patients in 5 surgical wards of the hospital.

Media

The media were used according to manufacturers guide line: Blood agar, Mc Conkey agar, (**Antec Diagnostic Laboratory, UK**). Nutrient agar(**Antec Diagnostic Lab. Ltd**) and Simmon Citrate agar.

Sample Collection Methods

Samples were collected from sixty patients in the different surgical wards in the hospital with the help of sterile swab sticks. The swabs were taken from the wounds that were discharging purulent materials

The demographic data of the patients were written in spaces provided on the swab sticks and transported immediately to medical microbiology laboratory for analysis. The specimens were collected at 6:00am before the dressings were done.

Bacteriological Analysis

Bacterial analysis was carried out using the method of Baker and Silvertown (1985). All works were carried out using aseptic techniques in the laboratory.

Inoculation Procedure

After collecting the swabs from post-operative wounds, the lid of the already prepared Mac Conkey agar was opened gently and a pool of inoculum was made at the top edge of the plate followed by primary, secondary and tertiary streak was made using sterilized wire loop at each interval to obtain the discrete

colonies (Plate 1). The same method was adopted for the blood agar plates. The blood agar plates were incubated microaerophilically while the Mac Conkey agar plates were incubated aerobically at 37°C for 18 – 24 hours after which the plates were identified microscopically using Gram's staining techniques and biochemical tests.

Gram's Staining Procedure

A colony was picked from the incubated media with the help of a sterile wire loop and placed onto a slide which had a drop of distilled water on it, a smear of about 3mm was done on the slide, the slide was fixed by passing it three times over a flame.

The slide was placed on an iron rack and the surface of the entire slide was flooded with crystal violet, which was allowed to stand for about 60 seconds, after which it was rinsed with water.

The slide was then flooded with Lugol's iodine and was allowed to stand for 30 seconds, after which the slide was rinsed with water.

The slide was decolourised using acetone, after which it was rinsed with water. The slide was then counterstained with Safranin which was allowed to stand for about 60 seconds, after which the slide was rinsed with water. The slide was allowed to air dry, after which a drop of oil immersion was placed on the stained smear and it was viewed under the microscope to observe if the stained organism was Gram-positive or negative.

Biochemical Analysis

All the biochemical tests procedures carried out were used as outlined by Baker and Silverton (1985). The following biochemical tests were carried out:

-Catalase Test, Coagulase Test, Citrate Test, Indole Test, Oxidase Test, Motility Test

Antibiotic Sensitivity Test

A colony was picked from the inoculated plates and streaked on the already prepared nutrient agar plate using a quadrant streak pattern with the help of a sterile wire loop.

Using the Kirby – Bauer technique, filter paper discs impregnated with various concentrations of antibiotics were placed on the streaked nutrient agar plate, the antibiotics diffused into the surrounding medium. Following incubation, clear zones of inhibition appeared which indicated the degree of sensitivity of the test organism to the antibiotics tested. The inhibition zones were grouped as follows:

6 – 8 mm were weakly sensitive
8 – 12mm were moderately sensitive
12mm – above were highly sensitive.
Below 6mm – resistant

Plating control

Negative Control

For every batch of culture media prepared, a control was setup by incubating a non seeded plate of each medium at 37°C for 24 hours.

Positive Control

Preserved strains of microorganisms with a known sensitivity pattern obtained from Murtala Mohammed Specialist Hospital Laboratory were used in controlling all tests carried out in this study.

Results

A total number of sixty (60) samples were collected from different surgical wards at Murtala Mohammed Specialist Hospital, Kano, Nigeria within a four month study period. The results of the study showed that bacteria were isolated in 32 (53.3%) of the surgical wounds, while 28 (46.7%) of the surgical wounds examined had no growth. Table 1 shows the percentage occurrence of bacteria isolated from

surgical wounds. Table 2 shows the percentage distribution of bacteria in surgical wounds at different types of operation. Table 3 shows the percentage occurrence of bacteria isolated from surgical wounds in relation to age groups. The age group were categorized into three 0-29, 30-59 and 60 and above. The result showed that the occurrence of bacteria was higher in the age group 0-29 (35%) and 60 and above (10%), than in the age group 30-57 years (8.3%). Table 4 shows the percentage occurrence of bacteria isolated in relation to sex. The result showed that the rate of infection was higher in females 18 (30%) than in males 14 (28.3%). Table 5 shows the sensitivity pattern of the different bacteria isolated to commercially prepared antibiotic discs.

Table 1: Percentage occurrence of bacteria isolated in surgical wounds

Bacteria isolated	Total No. isolated	Percentage (%)
<i>Staphylococcus aureus</i>	12	20
<i>Pseudomonas aeruginosa</i>	8	13.3
<i>Escherichia coli</i>	4	6.7
<i>Klebsiella</i> spp	3	5
<i>Proteus</i> spp	2	3.3
<i>Staphylococcus saprophyticus</i>	3	5
No growth	28	46.7
	60	100

Table 2: Percentage distribution of bacteria isolated in surgical wounds at different types of operation

Types of operation	Number of cases sampled	Number of bacteria isolated	Percentage (%)
Lapratomy	7	3	5
Appendicectomy	12	9	15
Typhoid perforation	8	2	3.3
Cystostomy	4	1	1.7
Protastectomy	6	3	5
Urethroplasty	3	2	3.3
Thyriodectomy	2	0	-
Ceaserian section	18	12	20
Total	60	32	53.3

Table 3: Percentage occurrence of bacteria isolated from surgical wounds in relation to age groups.

Age	Number of samples	Number of bacteria isolated	Percentage (%)
0 - 29	41	21	35
30 – 59	12	5	8.3
60 and above	7	6	10
Total	60	32	53.3

Table 4: Percentage occurrence of bacteria isolated from surgical wounds in relation to sex.

Sex	Number of samples	Number of bacteria isolated	Percentage (%)
Male	38	14	23.3
Female	22	18	30
Total	60	32	53.3

Table 5

Table 6: A comparative analysis of the X^2 test among infected and non-infecting patients in relation to sex ($P > 0.05$).

Sex	Infected	Non-infected	Total
Males	14(a)	24 (b)	38 (a+b)
Females	18 (c)	4 (d)	22 (c +d)
Total	32 (a+c)	28 (b+d)	60 (N)

Where N = is the sum of a, b, c, and d

$$X^2 = \frac{N(ad - bc)^2}{(a + b) (a +c) (b+d) (c+d)}$$

degree of freedom (d.f) = 1.

$$X^2 = \frac{60[(14 \times 4) - (24 \times 18)]^2}{(14 + 24) (14 +18) (24+4) (18+4)}$$

$$X^2 = \frac{60(56 - 432)^2}{(38 \times 32 \times 28 \times 20)}$$

$$X^2 = 11.32$$

The calculated value of X^2 is 11.32 while the table value is 3.81 at degree of freedom (d.f) at 5% percent level of significance. Since the calculated value is greater than the table value of X^2 distribution, therefore, on the basis of significant difference, we reject the null hypothesis.

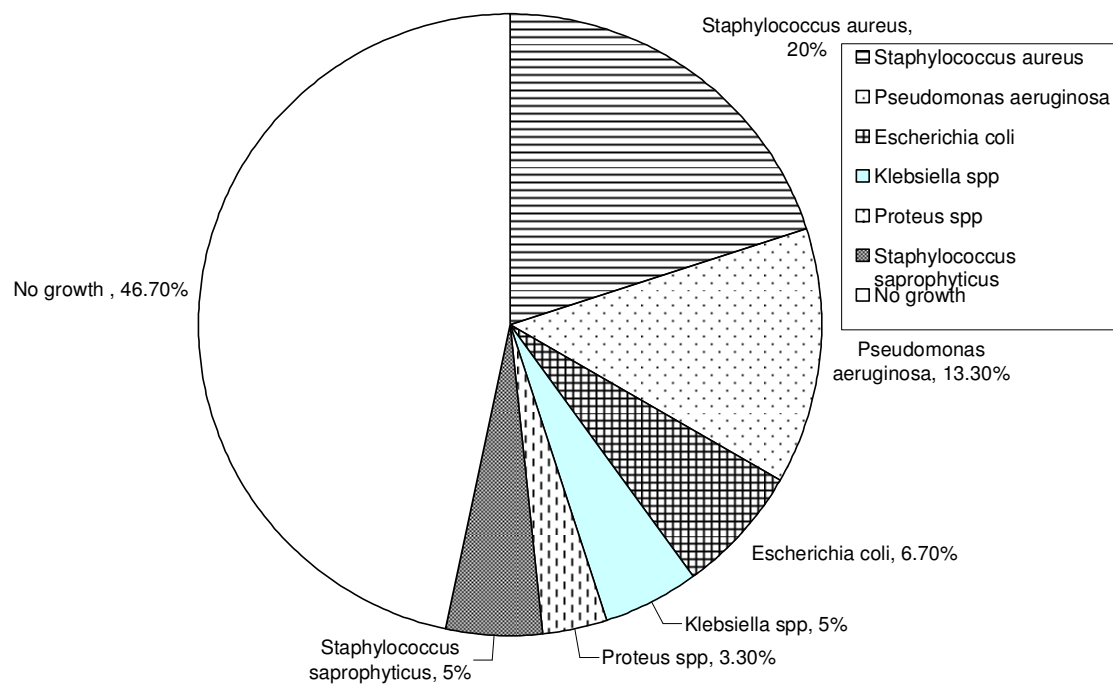


Fig. 1: Pie chart showing the prevalence of nosocomial infections in surgical wounds.

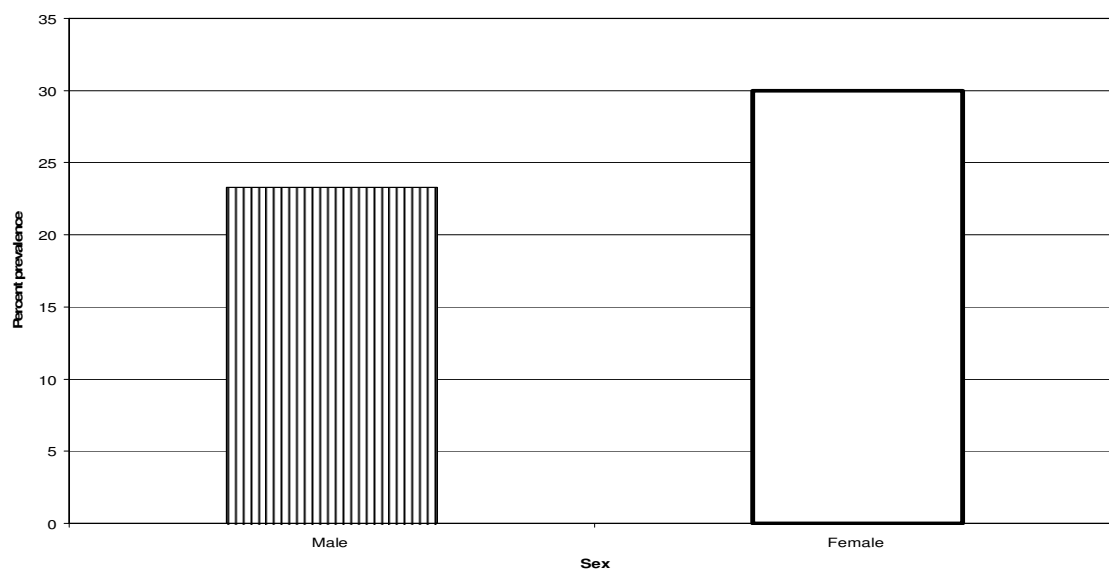


Figure 2: The occurrence of nosocomial bacteria isolated in relation to sex.

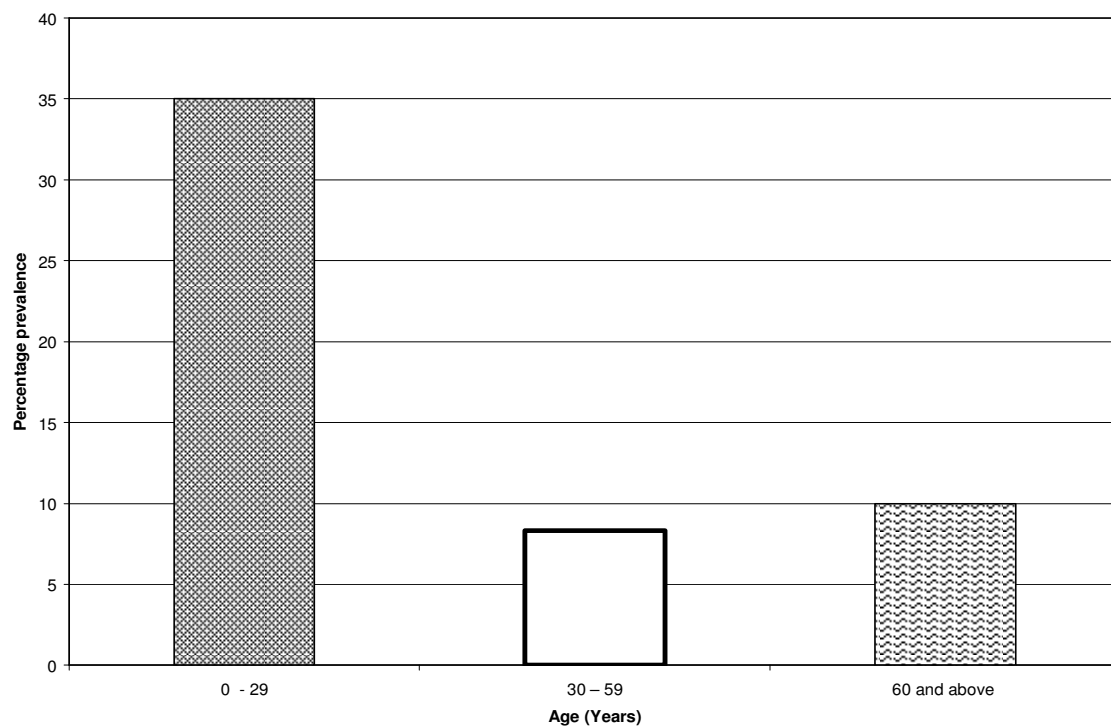


Fig. 3: The occurrence of nosocomial bacteria isolated in relation to age

Discussion

The nosocomial surgical wound infection is considered one of the major health problems in the world today (Frankart *et al.*, 1973). The results obtained showed a high prevalence of *Staphylococcus aureus* (20%), *P. aeruginosa* (13.3%), *Proteus* spp (3.3%) and *S. saprophyticus* (5%). Anyiwo *et al.* (1980) at Lagos State Teaching Hospital, Lagos reported a prevalence rate of 14.5% for *Staphylococcus aureus*, 21% for *E. coli*, 25% for *Klebsiella*, 13.2% for *Proteus* spp. The result of this study was lower than that of Anyiwo *et al.* (1980), this could be attributed to differences in geographical location and hygienic measures.

NNIS system (CDC, 1996) recorded a prevalence rate of 20% for *Staphylococcus aureus*, 8% for *E. coli*, 8% for *P. aeruginosa*, 3% for *Proteus* spp, and 3% for *Klebsiella* spp, which is almost in line with what was found out in this study. Sawjer *et al.* (1994) recorded a prevalence rate of 28.2% for *S. aureus*, 25.2% for *P. aeruginosa*, 7.8% for *E. coli*.

Furthermore, this work indicates that the occurrence of bacteria in surgical wound infections is dependent on age and sex. From this study, age group 0-29 had a prevalence of 35% bacteria isolated, age group 30 – 59 had a prevalence of 8.3% while age group 60 and above had a prevalence of 10%. Joshi *et al.* (1984) recorded a prevalence of 15% for age group 0-29, 8.3% for age group 30-59 and 10% for age groups 60 and above. This is almost in line with what was obtained from the research carried out. Out of the 12 *S. aureus* isolated 8 (66.7%) were sensitive to gentamycin, 4 (33.3%) were sensitive to ciprofloxacin, 6 (50%) were sensitive to streptomycin, 6 (50%) were sensitive to erythromycin, 11 (91.7%) were sensitive to rifampin and 7 (58.3%) were sensitive to chloramphenicol.

All the isolated bacteria were sensitive to gentamycin and ciprofloxacin. This is also in line with what was reported by Holvey and Talboth (1972) that most of the organisms are sensitive to gentamycin, polymyxin B and Colistin.

The incidence of hospital – acquired infections in developing countries (such as Nigeria) is difficult to assess on a national basis. This may be partly due to the fact that clinicians are less interested in nosocomial infections as both endemic and epidemic forms are among the major causes of morbidity and mortality (Anyiwo *et al.*, 1980).

Conclusion

This study shows that there is an increased rate of prevalence of bacteria isolated in post-operative wound infections. This is in agreement with surveys carried out in various hospitals both nationally and internationally (Joshi *et al.*, 1984). The infection appears to be common in hospitals with relaxed hygienic measures and is dependent on age, sex and duration of stay in the hospitals.

Recommendations

The high prevalence of bacteria isolated could be attributed to the use of unsterilized surgical equipments. These equipments should be adequately sterilized before being used to perform any operation. Wounds should not be exposed for prolonged period unduly during the course of dressing. All personnel handling post-operative wounds should be taught the principle and practice of aseptic techniques. Samples of disinfectants and antiseptics used should be sent to the laboratory regularly for evaluation of its efficacy.

There should be good communication between the infection control unit and the hospital authorities. All patients and visitors to the hospitals should always employ the techniques of hand washing with antiseptics always. Finally, patients with nosocomial infections should be separated from other patients to avoid cross infection.

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