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Bacterial Agents of Abdominal Surgical Site Infections in General Hospital Funtua, Katsina State, North-Western Nigeria.

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Abstract:
Background: *Infection continues to be a major complication of abdominal surgeries with significant increased costs, morbidity and potential mortality. Identifying the agents of abdominal wound infection and instituting appropriate measures will go a long way in reducing this problem.*
Objective: *This study was conducted to identify the organisms involved in abdominal wound Infections and document their antibiotic sensitivity pattern at the General Hospital Funtua.*
Methods*: A prospective design was used to conduct the study. Swabs of the clinically infected wounds detected in a population of 127consecutively studied patients were taken and cultured for aerobic bacteria using standard microbiologic methods. Antibiotic sensitivity pattern was also determined for the aerobic organisms cultured.*
Results: *28(22.05%) of the 127 patients studied developed surgical site infections, based on clinical criteria and 25(19.6%) based on bacteriological criteria. Pseudomonas spp. was the most frequently cultured aerobic organism in 39% (n=11) of the cultures, while Klebsiella in 21% (n=6) and Staphylococcus in 17% (n=5). Over 80% of the organisms demonstrated less than 50% sensitivity to the tested antibiotics.*
Conclusion*: The study showed that gram -negative bacteria are the major agents of abdominal surgical site infections in General Hospital Funtua, Katsina State,Nigeria. It is therefore recommended that there is need for further investigations in the field to confirm the source and microbial resistance pathogen.*
Keywords: *bacterial agents, abdominal surgical wounds, infection, surgery*

I. Introduction

Though the aim of asepsis and antisepsis in surgery is the prevention of infection, sepsis still complicates between 2 to 7% of all surgical procedures (Mohammed & Priscilla 1989). The development of wound sepsis following surgery usually results in significant strain on the surgeon, burden the nursing staff and increasing morbidity and health care cost to the patient if not fatal (Mofikoya, Neimogha, Ogunsola, & Atoyebi, 2009). Surgical operations aim to utilize controlled morbidity to repair and restore normal anatomy and function. The trauma of access however disrupts the normal biologic barrier to infection and increases the risk of sepsis. Reports on microbes responsible for wound infection vary and depends on the surgical site, study population and pattern of local antimicrobial use (Ronald &Nicholes 2001).

The life threatening nature of severe surgical site infection is well known. For the less severe varieties the associated morbidity of SSI related complications and increased financial burden on the patients who survive is highly significant. The patient with SSI is two to eleven times more likely to die than their non infected cohorts (Engerman, Carmeli &Cosgrove,2003). More than 75% of all deaths in patients with SSI are attributable to the SSI (Mangram, Horan, Pearson & Silver 1999). This is in addition to the over a week of additional post operative hospital stay incurred (Cruse & Ford 1980). Repeat admissions following discharge is commoner in patients who developed SSI than non infected cohorts (Horan et al.,1992). For many of our patients who have to make out of pocket expenses for their health care expenses will benefit from a shorter hospital stay. This can be achieved through a better knowledge of the etiologic agents of SSI and appropriate antimicrobial use.

Health-care associated infection (HAI) is a major global safety concern for both patients and health-care professional (World Health Organization WHO, 2002). HAI is defined as an infection occurring in a patient during the process of care in a hospital or other health-care facilities that was not manifest or incubating at the time of admission (Nejad,Allegranzi,Syed,Ellis,&Pitted, 2011). These include infections acquired in the hospital and any other settings where patients receive health care and may appear even after discharge (Nejad et al.2011). HAI also includes occupational infections among facility staffs (WHO, 2002). These infections often caused by multiresistant pathogens, take a heavy toll on patients and their families causing illness, excess costs

and sometimes death (Pittet, & Donaldson, 2005; Archibald & Jarvis, 2007; Allegranzi & Pittet, 2008). The burden of HAI is already substantial in developed countries, where it attains 5% to 15% of hospitalized patients in regular wards and as many as 50% or more of patients in Intensive Care Units ICUs (WHO, 2009; Vincet, Rello, Marshall, Silva, Anzueto & Martin, 2009.)

In 2005, WHO launched the First Global Patient Safety challenge "Clean Care is Safe Care" to create a global momentum and Commitment to reduce Hospital Acquired Infection(Nejad, 2011). Surgical Wound Infection is a good index of Hospital Acquired Infection (Oni, Ewete ,Gbaja ,Kolade, Mutiu, Adeyemo & Bakare. 2006). In developing countries, the magnitude of the problem remains underestimated or even unknown largely because HAI diagnosis is complex and surveillance activities to guide interventions require expertise and resources (Allegranzi & Pittet,2008). Surveillance systems exist in some developed countries and provide regular reports on national trends of endemic HAI, such as the National Health Care Safety Network of United State of America or the German Hospital Infection Surveillance System (Nejad, et al.2011). This is not the case in most developing countries because of social and health care system deficiencies that are aggravated by economic problems (WHO,2010).Moreover, in developing countries where resources are limited, even even basic life-saving operations, such as appendectomies and caesarean sections, are associated with high infection rates and mortality (Gaynes,Culvar,Edwards,Richards&Telson,2007). Additionally, overcrowding and understaffing in hospitals results in inadequate infection control practices and a lack of infection control policies, guidelines and trained professional also adds to the extent of the problem (Nejad, et al. 2011).

Five studies reported microbiology data on surgical site infection (Nejad, Allegranzi, Syed, Ellis & Pittet, 2011). In three, S.aureus and E. coli were the leading pathogens recovered from infected wounds. Other reported isolates included Klebsiella Spp, Enterococcus Spp, Pseullumonas Spp, and other enterrobacteriaceae. A Nigeria study reported E. Coli as the most common pathogen (34.4%), followed by Klebsiella Spp, and E. Coli and proteus Spp 6.3% (Nejad, et al.,2011). In a study from the Central African Republic, S. aureous and proteus mirabilis were the most common pathogens isolated from the infected surgical sites (Bercion, Gaudeuille, Mapouka, Behoude & Guetahoun, 2007). In surgical site infections, the ratio of Gram positive to Gram Negative organisms was 1.2.3 this is similar to the pattern of the previous review when it was 1.3% (Oni, Bakare, Okesola, Ogunlowo & Ewete, 1997) but quite different from the findings of Odugbemi & Coker who obtained ration of 4:1 in the Lagos University Teaching Hospital (LUTH), Lagos, in the same in the same Geographical Location (Odugbemi & Coker). The difference may be due to the difference in antibiotic policies in the hospitals as well as differences in the composition of microbial population in the two hospitals (Oni et al., 2006). The incidence of infection varies from surgeon, from hospital to hospital from one surgical procedure to another and most importantly from one patient to another (Nichols, 2001).

Surgical site infections depend on the host susceptibility, condition of the wound and the amount and type of microbial contamination of wound (Oni et al., 2006). There is less information or baseline data in the study setting regarding bacteriological pathogens implicated in abdominal surgeries and microbial resistance antibiotics, hence the need for the study.

II. Methodology

Research Design

This was a descriptive prospective study involving all subjects who have undergone major surgery in surgical wards within the period of study at General Hospital Funtua Kastina state.

Study Setting

General Hospital Funtua of Katsina state is in the North-West part of geopolitical zone of Nigeria. The hospital was established in 1975 with an average bed capacity of one hundred and eighty six (186) as a secondary centre for healthcare delivery. The hospital has eight (8) wards each of which has a surgical unit. The hospital has about eighty four nurses (84) with an average of about four hundred and twenty surgical patients outflow annually. The hospital has two operating theatres and various surgeries are performed to include appendectomy, prostatectomy, herniotomy, caesarean section, hysterectomy, myomectomy, laparotomy, excision biopsy among others.

Sampling techniques and sample size

Non probability purposive sampling method was used to select all subjects that have undergone major surgery during the study period. A total of 127 respondents were used for the study. Therefore all patients of all ages and gender undergoing major surgical procedures with visible incision were serially recruited right from the time when surgical intervention was announced until the sample size was attained.

Ethical Consideration

Ethical consent was obtained from the ethical review board of the hospital and informed consent was obtained from each subject or subjects care giver before being enrolled in to the study.

Instrument for data collection

A questionnaire was developed using the CDC/WHO Criteria for determining SSIs. The instrument was tested for validity and reliability through pilot study. Also two full-time nurses' assistants were trained on the use of the instrument

Data Collection and Laboratory Procedures

Surgical wounds were inspected 48hours postoperatively and at the time of first dressing (5th day postoperatively), and wound swabs were collected from a clinically infected wound for bacteriological examination. Swabs of the clinically infected wounds detected in a population of studied patients were taken and cultured for aerobic bacteria. The sample specimen were inoculated on blood agar, chocolate and mac Conkey agar and incubated at 37^{0c}, while the choc were incubated in a Candle jar for 24hrs, a gram stained smear was also examined under microscope using x100 Objective lens with immersion oil. The colonial morphologies of the organism grown were recorded. A presumptive identification of all isolates were made base on morphology, hemolysis, pigments as well as primary and secondary gram stain appearance. Confirmatory biochemical tests were carried out according to standard microbiological procedures (Cowan, 1974).

Antibiotic sensitivity was done using standardized disc agar diffusion technique (Kirby Bauer method) Buaer,Kirby,Sherris &Tunrer 1966) and interpreted according to NCCLS standard 1990 . All data obtained were analyzed in simple tabular form. All patients had preoperative antibiotics as needed in the course of their treatment.

Data analysis

Data were entered into a computer using SPSS software version 16 and analysed using STATA software 12 according to the objectives of the study. Descriptive statistics using frequency table with percentages were used in the analysis.

III. Results

As reflected on table 1, the mininum age of the subjects ranged from 11years to 65years with mean age of 38years .Over 39% were in the age group (11-20), over 77% of the subjects were females and 74.8% were married. On the educational level, 59.8% hold senior secondary while 14.96% hold no formal education. In the area of occupation, 59.8% were not working while only 5.51% were professionals.

Table 1 Socio-demographic Data

Frequency distribution of respondents by demographic characteristics

Variable	Frequency	Percent
Age (grouped)		
11-20	50	39.40
21-30	35	27.60
31-40	24	18.90
>40	18	14.20
Total	**127**	**100.0**
Sex		
Male	29	22.80
Female	98	77.20
Total	**127**	**100.0**
Marital Status:		
Single	32	25.20
Married	95	74.80
Total	**127**	**100.0**
Highest Education Level:		
No Education	19	14.96
Primary	17	13.38
Junior Secondary	12	9.45
Senior Secondary	76	59.84
Higher Education	3	2.37
Total	**127**	**100.0**
Patients' Occupation:		
Not working	76	59.84
Unskilled manual	7	5.51
Skilled manual	4	3.16
Services	12	9.45

Sales	14	11.02
Clerical	7	5.51
Professionals	7	5.51
Total	**127**	**100.0**

Table 2. Bacterial Isolates from General Hospital Funtua, North-Western Nigeria

Table 2: Organisms Isolated		
Organism	**Percent**	**Frequency**
Pseudomonas spp.	39.28	11
Klebsiella spp.	21.43	6
Staphylococcus spp.	17.85	5
Streptococcus spp.	7.14	2
Staphylococcus and Coliform	3.60	1
Purulent Drainage	10.70	3
Total	**100.0**	**28**

Table 2 shows the distribution of bacteria implicated in SSI .Out of the twenty eight (28) subjects diagnosed of surgical site infections and whose specimens were collected for microbiological investigations, 25(89.3%) specimens from different patients had positive bacterial growth within 48 hours of incubation. Only one out of the 25 of the cultured specimens (3.6%) had mixed growth, while 3 (10.70%) showed no evidence of bacterial growth after 48hours of incubation..

Common bacteria isolated were Pseudomonas spp. 11(39.28%), Klebsiella spp. 6(21.43%), Staphylococcus spp 5 (17.85%), Streptococcus spp 2 (7.14%),Staphylococcus and Coliform 1 (3.60%)

Table3 Organism and Culture Sensitivity from General Hospital Funtua, North-Western Nigeria

Organism	**Number**	**Percentage(%)**	**% Sensitivity**					
			Aug	**Cipr**	**Nob**	**Gen**	**Amx**	**Nal**
Pseudomonas spp	**11**	**39.28**	**50**	**40.5**	**12.5**	**12.5**	**R**	**R**
Klebsiella spp	**6**	**21.43**	**50**	**30**	**R**	**12.5**	**12.5**	**30.5**
Staphylococcus sp	**5**	**17.85**	**33.3**	**R**	**50**	**33.3**	**R**	**12.5**
Streptococcus	**2**	**7.14**	**12.5**	**12.5**	**33.3**	**50**	**R**	**33.3**
Staphylococcus and Coliform	**1**	**3.60**	**R**	**33.3**	**R**	**R**	**R**	**12.5**
No growth	**3**	**10.7**						
Total	**28.0**	**100.0**						

Aug=augumentin,Cipr=Cipr=Ciproflaxacin,Nob=nobactin=Amx=amoxicillin,Nal=nalidixic acid

IV. Discussion

Our findings of a predominance of gram-negative bacilli are similar to those of other workers (Masaaddeh & Joran 2009). In most cases of SSI the organism is usually patients' endogenous flora. In abdominal surgeries the opening of the gastrointestinal tract increases the likelihood of coliforms, gram negative bacilli as agents of wound infection which was the finding in this study. These group of organisms tend to be endemic in hospital environment by being easily transferred from object to object, they also tend to be resistant to common antiseptics and are difficult to eradicate in the long term (Zerahn, Stogaard & Arendrup 1997 cited by Mofikoya et al 2009).These group of organisms are increasingly playing a greater role in the many hospital acquired infections. The study showed that virtually all of the pathogens were resistant to the commonly prescribed antibiotics such as ,amoxycilline, septrin,gentamycine and tetracycline. The cultured aerobes also demonstrated less than 50% sensitivity to the tested antibiotics (nobactin,gentamycin and nalidixin acid), in over 80% of the infected patients. This finding further supports the well known high prevalence of multiple antibiotic resistant nosocomial pathogens in our environment and may reflect the widespread abuse of antibiotics in the general population(Okonkwo,Soleye,Amusan&Ogun 2009;Okeke,Aboderin,Byarugaba,Ojo &Opintan 2007).Though limited by the influence of perioperative antimicrobial use and narrow range of antimicrobial sensitivity tested, the high resistance to most antimicrobials found is cause of significant concern, making choice of empiric antibiotic use more difficult.

V. Conclusion

The study showed that Pseudomonas, Klebsiella and Staphylococcus are the predominant organisms causing SSI in patients having abdominal surgeries. Majority of the aerobic agents appear to be resistant to Bacterial Agents of Abdominal Surgical Site Infections in General Hospital Funtua. There is a definite need for

more investigations to be done at our health care center in this Field, to accurately confirm the source of identified pathogens and study the pattern of multidrug Resistant pathogens in greater detail.

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