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Antimicrobial Susceptibility Patterns of the Bacterial Isolates in Post-Operative Wound Infections in Murtala Muhammad Specialist Hospital Kano, Nigeria

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ABSTRACT

Bacterial post-operative wound infection has been known to be the most common complication of abdominal surgeries in both low and middle income settings with significant increased costs, morbidity and potential mortality. Documenting the agents of abdominal wound infection and prescribing the antimicrobial susceptibility pattern will go a long way in reducing this burden. This study aimed at documenting the organisms implicated in abdominal wound Infections and prescribing their antibiotic sensitivity pattern at Murtala Muhammad Specialist Hospital Kano.A prospective design was employed to conduct the study. Swabs of the clinically infected wounds detected in a population of 60 consecutively studied patients were taken, and samples were cultured on Blood and MacConkey agar media and incubated aerobically and anaerobically for 48 hours. Isolation and identification of the organism was done by standard microbiological methods. Antibiotic sensitivity pattern was also determined for the aerobic organisms cultured. 10(16.6%) of the 60 patients studied developed surgical site infections, based on clinical criteria and 8(13.3%) based on bacteriological criteria. E.Coli, Klebsiella and Staphlococcus aureus were the most frequently cultured aerobic organism in 25% (n=2) of the cultures, while Pseudomonas spp and Proteus were in 7.5% (n=1) . Over 80% of the organisms demonstrated less than 50% sensitivity to the tested antibiotics. The study showed that gram -negative bacteria are the major agents of abdominal surgical site infections and a high level of antimicrobial resistance 75-100% was observed in gram negative bacterial isolates and therefore, recommend that rational use of antibiotics and a regular monitoring of patients in post-operative wound infections are essential.

Keywords: Bacterial Isolates, Surgical Wounds, Infection, Surgery

INTRODUCTION

Surgical site infections (SSI) are have been known to be the leading cause of Hospital Acquired Infection and contribute significantly high in modern surgery [Anderson, Podgorny, Berríos-Torres, Bratzler, Dellinger, Greene, Nyquist, Saiman, Yokoe, Maragakis, Kaye 2014]. These infections could be classified based on the surface area involved [Ikeanyi, Chukwuka, Chukwuanukwu 2013]. It is one the commonly investigated infection in low-and middle income countries with incidence rates ranging from 1.2 to 23.6 per 100 surgical procedures [WHO, 2011]. The incidence of infection has been link to some indices varying from surgeon to surgeon, from hospital to hospital, from one surgical procedure to another, and most importantly from one patient to another, from time to time.[Fan, Wei, Wang ,Tan, Jiang, Tian, Cao and Nie 2017].

Infection may be defined as invasion and multiplication of microorganisms in body tissues, which maybe clinically significant to produce symptoms of infection (Joy, Eghiashe, Nwobi and Paul 2016). On the basis of degree of microbial contamination, surgical site infections can be classified into four major groups: Clean site wounds, clean contaminated wounds, contaminated wounds, dirty or infected wounds (Anaya *et al*., 2006). However, any purulent discharge from a closed surgical incision, together with signs of inflammation of the surrounding tissues should be considered as wound infection, irrespective of whether microorganisms had been cultured from it. Empirically wounds accounting to bacterial isolates that exceeds 105 colony forming unit per Gram are considered infected wounds (Heggars, 2003). Evidence have shown that Gram negative bacteria usually contaminate skin wounds of the groin and perinea areas while gastro intestinal surgeries are the intrinsic bowel flora which includes Gram-negative bacilli and Gram-positive microbes, including enterococci and anaerobic organisms. Increasing evidence has revealed that bacterial isolates colonizing surgical wounds vary in their carriage of genes encoding antibiotic resistance (Yah *et al*., 2004).

Therefore, the traditional use of antimicrobial agents in both human and veterinary medicine has resulted in wide spread antibiotic resistance genes especially within the Gram negative bacteria (Enabulele *et al.,* 2006). In the presence of antibiotic selective pressure, these organisms are capable to causing infection (Joy, Eghiashe, Nwobi and Paul 2016).

Most bacteria have developed resistance to antibiotics through various mechanisms which includes; production of enzymes that inactivate the antibiotics, efflux pumping machinery on the cell membrane, modification of drug structure, loss of porin proteins and acquisition of genes that harbor resistant plasmids (Lee *et al.*, 2000). Low prevalence of surgical site infection was inferred probably due to exclusion of cases with sub umbilical midline incision (Ezechi *et al*., 2009). Nejad *et al.,* 2011 documented higher prevalence rate of (34.4%) for *E. coli* from surgical wounds infections.

However, in other studies, Aisha, *et al.* (2013) and Dalhatu *et al.,* (2014) reported *P. aeruginosa* as the most recovered from post operative surgical wounds despite the site of infection and location of specimens due to its high survival characteristics in hospital environment. Other studies revealed strong resistance to most microbial pathogens (Masaadeh *et al.,* 2009).

METHODOLOGY

Research Design

This was a descriptive prospective study involving all subjects who have undergone abdominal surgery in surgical wards within the period of study at Murtala Muhammad Specialist Hospital Kano

Sample Collection

An informed consent form was signed before sample collection and purposive sampling method was used to select all subjects that have undergone major surgery during the study period. A total of 60 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. Wound swabs samples were collected from post operative hospitalized surgical patients Samples were only collected from patients before surgical wound dressing. A swabs sample was collected using sterile swab sticks from each patient and transported immediately in the Medical Labaratory within 1 hour for analysis. All collections were done under strict aseptic conditions.

Bacteriological Analysis

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. Antibiotics susceptibility testing was carried out on each isolates by the disc diffusion method using the Kirby-Bauer disc diffusion method to evaluate the sensitivity of the test organisms to the various antibiotics. The following antibiotics were use: Ceftazidime (Caz 30μg), Gentamycin (GN 30μg), Ofloxacin (ofl 5μg), Ciprofloxacin (Cpr 5μg), Erythromycin (Ery 10ug), Oxacillin (oxa, 1ug,), Cefuroxime (Crx 30ug), Cefixime (CXM 5ug), and Augmentin (Aug, 30ug) (Oxide), cefroxime, gentamycin, nitrofrontain etc.

After incubation, diameters of zones of inhibition were measured to the nearest millimeter using a transparent meter rule. All data obtained were analyzed in simple tabular form.

RESULTS

Table 1: Prevalence of surgical wound infection in Murtala Muhammad Specialist Hospital, Kano

Variable (n=8)	No. of infected (N=60)	No. of non infected
E.coli	2 (15%)	52 (96.6%)
Pseudomonas spp	1(7.5%)	59 (98.3%)
Klebsiella spp	2(15%)	52(96.6%)
Staphylococcus aureus	2(15%)	52 (96.6)
Proteus spp	1(7.5%)	59 (98.3%)
Clinical symptoms of SSI	2(15%)	52 (96.6%)

N= number of subjects, n= number of bacterial isolates

Table 2: Distribution of etiologic agents of post-operative wound infection

Bacteria isolates	No. of isolates/%	No.of isolates/%	No.of isolates/%	No.of isolates/%	No.of isolates/%	Total No.of isolates/%
n=8	E.coli	Klebsiella	S.aureus	Pseudomonas	Proteus Spp	Cumulative percent
n=8	2 (25%)	2(25%)	2(25%)	1(12.5%)	1(12.5%)	8 (100%)

Table 3: Prevalence of multi-drug resistance

Bacterial Isolates; number	S. n(%)	R_1.n(%)	Rm.n(%)
E.coli	5(29.4)	3(17.6)	13(76.4)
Klebsiella Spp	2(13.3%)	1(6.6)	6(40)
Staphylococcus aureus	1(6.6%)	14(93.3%)	14(93.3)
Pseudomonas Spp	0(0%)	100 (100%)	100 (100%)
Proteus	0(0%)	100 (100%)	100(100%)
Ceftazidime (Caz 30µg), Gentamycin (GN 30µg), Ofloxacin (ofl 5µg), Ciprofloxacin (Cpr 5µg), Erythromycin (Ery 10ug), Oxacillin (oxa, 1ug,), Cefuroxime (Crx 30ug), Cefixime (CXM 5ug), Augmentin (Aug, 30ug) (Oxide), cefroxime, gentamycin, nitrofrontain, etc			

n = number of bacterial isolates, S = sensitive to all antibiotic tested,R_1= resistance to one class of antibiotic, R_m = resistance to 2 or more class of antibiotic i.e multidrug resistance

Sensitivity of the isolates to different antibiotics varied and most isolates were multidrug resistant. Generally resistance to cephalosporin is above 75% except for Nitrofrontain which showed nearly more than 50% sensitivity. Surprisingly, the staphylococcal pathogens were 75-

100% resistance to all the tested antibiotic except Gentamycin which is 35% resistance.

RESULTS AND DISCUSSION

The study examined the causative organisms of post operative wound infection and prescribed their sensitivity profiles. The Results showed higher rate of gram negative bacteria with E.coli, Klebsiella and Staphylocoocus aureus for gram positive bacteria being the predominant pathogens implicated in post operative wound infection. This findings relatively differs with the reports documented by Akinkunmi, Adesunkanmi, and Lamikanra 2014, Mohammad ,Chanter and Ranashar 2013, Shuaibu, Ibrahim, Olayinka and Atata 2017, which showed Staphylococcus aureus being the most predominant pathogen implicated in post operative wound infection. Other studies documented around the world reported showed Pseudomonas spp and Klebsiella being the commonest pathogens implicated in post-operative wound infection (Dalhatu, *et al.,* 2014, Ezebialu, Chukwura, Ezebialu 2010,Joy,Eghiaghe,Nwobu,and Paul 2016) . Most antimicrobial agents tested in this study showed higher resistance except for Nitrifrontain which showed higher sensitivity rate. This finding is somewhat similar to the report documented by (Mohammad,Chanter and Ranashar 2013). The study concluded that there is high rate of gram negative pathogens being implicated in surgical site infection and higher rate of antibiotic resistance 75-100% in all pathogens isolated was observed.

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