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BACTERIAL ISOLATES AND ANTIBIOTIC SENSITIVITY PATTERN FROM LAPAROTOMY WOUNDS IN A NIGERIAN TERTIARY HOSPITAL

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Abstract

Background: The burden of managing surgical site infection (SSI) is enormous and coupled with the changing pattern that has been observed by other researchers with respect to causative agents of SSI, it therefore becomes imperative to study the bacteriology of the common aetiological agents responsible for post-operative wound infection in the study centre. Therefore the aim was to determine the bacterial isolates responsible for causing SSI as well as the antibiotic sensitivity pattern.

Methodology: This is a prospective cross-sectional study in patients who had elective and emergency laparotomies. The wounds were inspected on post-operative days 3, 5 and 7 and swabs obtained for microscopy, culture and sensitivity tests in infected cases. The presence of infection was defined using standardized criteria stipulated by the Centres for Disease Control and Prevention.

Results: There were 291 patients who had laparotomy during the study period, 223 met the inclusion criteria; consisting of 157 (70.4%) males and 66 (29.6%) females (M: F = 2.4: 1). Their ages ranged between 18 and 80 years with a mean age of 33.89 ± 12.57 years. Incisional SSI was clinically diagnosed in 85 patients; 77 (91%) had positive culture results. Single bacterial isolate was seen in 56 (65.9%) patients. Bacteria isolates demonstrated good sensitivity to the cephalosporins (> 85%), quinolones (>75%) and gentamicin (100%). The duration of hospital stay for these patients ranged between five to ninety days (Mean = 16.69 ± 8.50 days).

Conclusion: Gram negative organisms were the predominant aetiological agents with an attending sensitivity pattern in favour of cephalosporins, quinolones and aminoglycoside. Antibiotics regimen for patients undergoing laparotomies either for prophylaxis or therapeutic purposes should be based on the antibiogram.

Introduction

Surgical site infection (SSI) otherwise called post-operative wound infection occurs at or near the operative site after a surgical procedure[1]. This may range in spectrum from a spontaneous wound discharge to a life-threatening postoperative complication such as septicaemia, multiple organ dysfunction syndrome[1]. It is the second most common hospital acquired infection (HAI) after urinary tract infection (UTI) and has been found to be responsible for about 3% of post-operative complications worldwide [2]. SSI not only affects the quality of life of the patient; it is also a major reason for extended hospital stay and financial burden both to the healthcare providers and the patient [3-7].

SSI denotes the presence and multiplication of bacteria in a surgical wound with associated host (immunological) reaction [5,8]. This host reaction could be detected locally at the wound site or may be manifested by the changes in the patient's physiological events. At the wound site, the presence of erythema, tissue swelling, undue pain, discharge of purulent exudates depict the presence of wound infection while alterations in the vital signs like tachycardia, tachypnoea and the presence of fever represent systemic involvement [9].

Aetiological agents of SSI include bacteria, viruses, fungi and parasites but to a large extent, majority of SSIs are bacterial in origin [4, 10]. These organisms could be Gram positive or negative in nature and they could either be aerobic or anaerobic. Many researchers have identified Gram positive organisms as a common cause of SSI. However, a drift from Gram positive to Gram negative organisms has recently been reported by different authors [11-14]. These organisms could be acquired endogenously (from the patient's own body flora) or exogenously (from another patient or within the hospital facility) [2, 15].

The knowledge of the predominant aetiological agent will be of great clinical significance with respect to the choice of antibiotics either for prophylactic or therapeutic use in order to prevent the emergence of resistance strains and also avoid injudicious use of antimicrobial agents. This study therefore, looked into the bacteriology of infected wounds in adult patients that underwent laparotomies in a tertiary health care centre in Gombe, Northeast Nigeria.

Methods

This is a prospective cross-sectional study conducted among patients who had elective and emergency laparotomies. The wounds were inspected on post-operative days 3, 5 and 7 for the presence of infection. The diagnostic criteria used for clinical diagnosis of incisional SSI were extrapolations from the Centres for Disease Control and Prevention (CDC) criteria and include the presence of at least two of the following: erythema (in light complexioned patients),swelling/oedema at the wound margins, discharge of pus/serous effluent from the wound, presence of abnormal odour, presence of tender, inflamed skin and subcutaneous tissue (cellulitis) around the operative wound, presence of systemic response like fever, tachycardia or tachypnoea [16].

Wound swabs were obtained under aseptic conditions using sterile cotton-tipped applicators and sent to microbiology laboratory within 15 minutes of collection; inoculated on blood, chocolate and MacConkey agar plates and incubated aerobically at 37◦C for 24 hours. Characterization of bacterial isolates was based on standard microbiological methods [17,18].

Patients excluded include those that were operated outside the study centre and referred on account of complications, paediatrics patients, and those with associated co-morbidities. Patients' demographic data and wound outcomes were entered into a proforma designed for the study.

Result

A total of 85 patients out of 223 who met the inclusion criteria for the study had clinical evidence of wound infection and had swabs taken and processed; out of which 77 (91%) were culture positive. Sixty three (74.1%) of SSI were superficial SSI while 22 (25.9%) were deep. Single bacterial isolates were seen in 56 (65.9%) patients while mixed infection was seen in 21(24.7%) patients. *Klebsiella pneumoniae* (a Gram negative organism) was the most common single isolate (34%) followed by *Staphylococcus aureus* (30.4%), *Proteus mirabilis* (19.6%), *Providencia* (12.5%) and *Escherichia coli* (3.6%). Isolated organisms (both as single and mixed isolates) demonstrated good sensitivity to the cephalosporins (> 85%), quinolones (>75%) and gentamicin (100%). The duration of hospital stay for these patients ranged between five to ninety days (Mean = 16.69 ± 8.50 days).

Figure 1: Distribution of isolates in the study

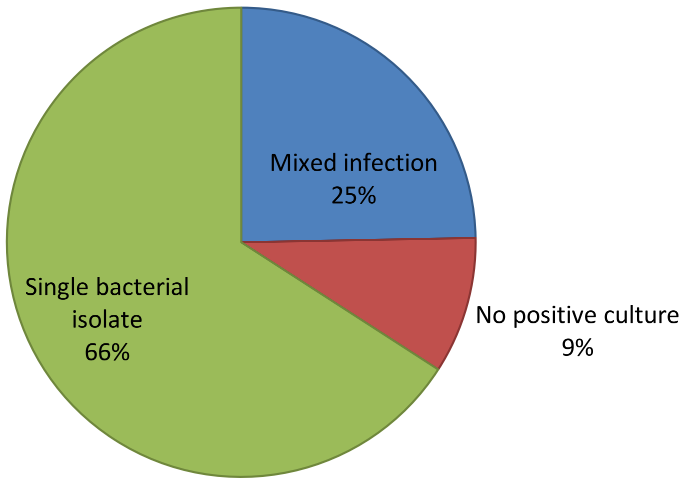

Figure 2: Single bacterial isolates in the study by percentage distribution.

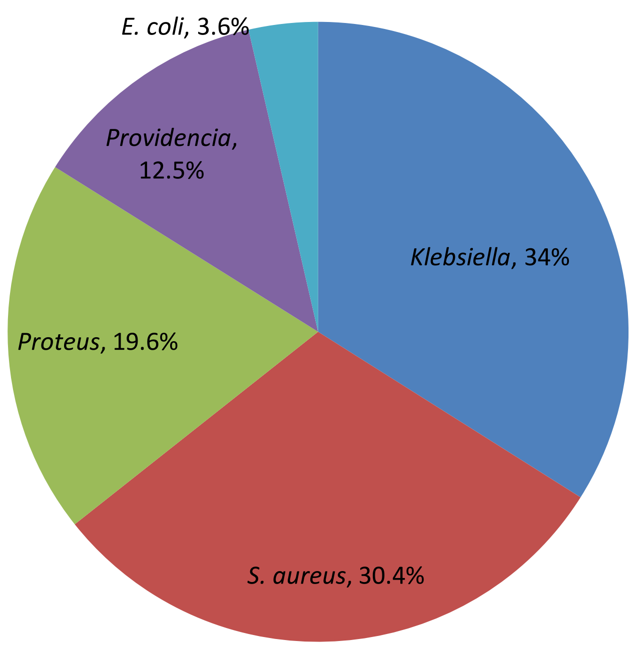

Figure 3: Percentage distribution of mixed isolates in 21 patients

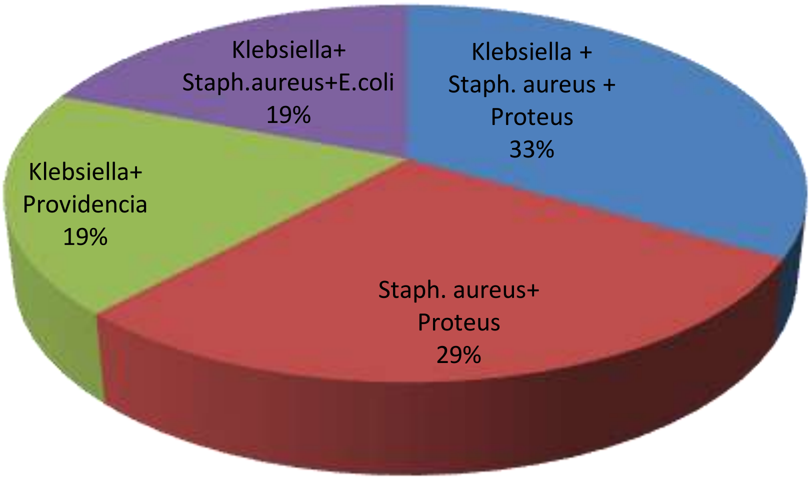

Table 1: Antibiotic sensitivity patterns of single bacterial isolates.

	Klebsiella (n=19) T_i [S_i] (% S)	*S. aureus (n=17)* T_i [Si] (% S)	*Proteus (n=11)* T_i [S_i] (% S)	*Providencia (n=7)* T_i [S_i] (% S)	*E. coli (n=2)* T_i[S_i] (% S)
Gentamicin	19 [19] (100.0)	17 [2] (11.8)	11 [11] (100.0)	7 [7] (100.0)	2 [2] (100.0)
Ceftriaxone	19 [19] (100.0)	17 [15] (88.2)	11 [11] (100.0)	7 [7] (100.0)	2 [2] (100.0)
Amoxicillin/ Clavulanic acid	19 [5] (26.3)	17 [17] (100.0)	11 [8] (72.7)	7 [3] (42.9)	2 [0] (0.0)
Penicillin	19 [2] (10.5)	17 [14] (82.4)	11 [4] (36.4)	7 [3] (42.9)	2 [0] (0.0)
Cefuroxime	19 [16] (84.2)	17 [17] (100.0)	11 [11] (100.0)	7 [7] (100.0)	2 [1] (50.0)
Ciprofloxacin	19 [15] (78.9)	17 [16] (94.1)	11 [9] (81.8)	7 [4] (57.1)	2 [2] (0.0)
Ceftazidime	19 [19] (100.0)	17 [3] (17.7)	11 [11] (100.0)	7 [7] (100.0)	2 [2] (100.0)
Sparfloxacin	19 [14] (73.7)	17 [17] (100.0)	11 [11] (100.0)	7 [7] (100.0)	2 [2] (100.0)
Cotrimoxazole	19 [15] (78.9)	17[14] (82.4)	11 [4] (36.4)	7 [3] (42.9)	2 [2] (100.0)
Ampicillin	19 [7] (36.8)	17 [11] (64.7)	11 [1] (9.1)	7 [2] (28.6)	2 [0] (0.0)

KEY: T_i-number of isolate tested. S_i-number of isolate sensitive to tested antibiotic agent. % S- Percentage sensitivity

Table 2: Antibiotic sensitivity patterns of mixed isolates (n=21)

Antibiotics	Number Tested	Number Sensitive	% Sensitivity
Ciprofloxacin	21	17	81.0
Sparfloxacin	21	14	66.7
Ceftriaxone	21	21	100.0
Cefuroxime	21	21	100.0
Ceftazidime	21	19	90.0
Amoxicillin/clavulanic acid	21	11	52.4
Gentamicin	21	21	100.0
Cloxacillin	21	0	0.0
Cotrimoxazole	21	3	14.3
Penicillin	21	2	9.5
Ampicillin	21	7	33.3

Discussion

In our study, the most common single bacterial isolate was *Klebsiella pneumoniae* (a gram negative organism). Gram negative (aerobic) organisms accounted for the majority (69.7%) of both the monomicrobial and polymicrobial isolates in this study. This was typified by *Klebsiella pneumoniae* (34%) being the most single aerobic bacterial isolate followed by *Staphylococcus aureus* (30.4%). The reason for the predominance of *Klebsiella* among the single bacterial isolates in this study may be due to the predominance of patients with already established intra-abdominal infection (peritonitis) from gut perforation at presentation. Other isolated organisms were *Proteus spp* (19.6%), *Providencia* (12.5%) and *Escherichia coli* (3.6%).

Our findings agrees with that of previous local studies done in Lagos[10], Bida[11] and Ilorin[13] in which Gram negative organisms were responsible for 69.2%, 52.5% and 49.3% of the total isolates respectively. Reports from India[14] and Pakistan[20] are in agreement with the observations from our study and that of other authors from Nigeria on the predominance of Gram negative organisms as the aetiological agents for SSI.

The preponderance and drift towards Gram negative organisms as common aetiological agents for SSI is not only limited to our environment as similar reports have emanated from other parts of the globe [10,13,14,20,21]. This drift has been attributed to injudicious use of antimicrobial agents to which most of the organisms have developed resistance over time[11,13].

Staphylococcus aureus (a Gram positive organism) is the second predominant (30.4%) aetiological agents for SSI observed in this study. This organism which is a normal commensal of the anterior nares of some individuals and the pubis has been reported in some studies to be the most common cause of SSI [22-24]. The predominance of this organism as the second most common organism responsible for SSI in this study may be due to contamination from the environment, surgical instruments or contaminated hands of health professionals especially when there is a break in aseptic protocols. Other isolates are Gram negative organisms as earlier highlighted. However, 8(9%) patients from who wound swabs were taken yielded no positive culture result.

The antibiogram of the isolated organisms showed that Gram negative organisms demonstrated good antibiotic sensitivity of > 85% to the use of cephalosporins (ceftriaxone, ceftazidime and cefuroxime) and > 75% to quinolones (ciprofloxacin, sparfloxcin). From Bida, Nigeria, a lower sensitivity rate of 62% was observed with the use of cephalosporins and quinolones [11]. Non-response of these organisms in the remaining 15-25% in our study may denote the emergence of resistant strains. This may not be surprising as these agents are usually used as first line drugs for virtually most patients presenting to the hospital. To buttress this fact is the remarkable response with the use of gentamicin (100%) observed in this study; a drug that is not commonly used. Similar observations were made in Lagos[10] and India [17] where a poor response to the use of cephalosporins, quinolones and gentamicin were observed. Sonawane and his colleagues observed a poor response to the use of cephalosporins, quinolones (35.4%) and gentamicin (49.5%) hence, the decision to use vancomycin in their study[19]. The sensitivity of *Staph. aureus* to the tested antibiotics in our study is quite remarkable although a response rate of 17.7% observed with the use of ceftazidime calls for concern.

Conclusion

Gram negative organisms have been found to be responsible for SSI following laparotomies in the study centre. The isolated organisms demonstrated good response to the use of the tested antibiotics though with some pattern of resistance noted to be emerging.

Recommendations

1. The remarkable sensitivity of cheaper and readily available agents (like gentamicin and ampicillin) could make these drugs to be considered either for prophylactic or therapeutic use. These could be combined with metronidazole (anti-anaerobe). This combination will, to a large extent reduce the problem of MDR organisms and also provide a leverage to step up the antibiotic profile to the quinolones and cephalosporins when the need arises.
2. Further studies will be needed to carry out serological identification of organisms isolated from wound infections. This can serve as a useful epidemiological tool for future intervention. Likewise, typing these organisms to identify pathogenic strains will also be a worthwhile research needed for further genetic engineering.
3. Attention should be paid at ensuring adequate quality control with respect to agents used in operating theatre for patients prepping and observing theatre protocols.

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