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Potential bacterial pathogens associated in wound infections at University Health Centre of a Southwest in Nigeria

BA Erinle [1,*] and AO Ajayi [2]

[1] *Microbiology laboratory, University Health Centre, Federal university of Technology, Akure, Nigeria.*
[2] *Microbiology Department, Adekunle Ajasin University Akungba. Nigeria.*

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Abstract

Healthy skin forms a formidable obstacle against microorganisms but once this defense process is altered or obstructed creating a wound, bacteria have an ideal environment for growth and reproduction. lt is hardly inevitable not to have a wound because bacteria are ambiguously present in every part of human body. Emergency cuts, wounds, burns and accident cases are common occurrence in most Teaching Hospitals, however this is not so rampant in the University Health Centre and this form the basis of the study to know the extent of potential bacterial pathogens associated in wound infections at the Health Centre of the Federal university of Technology, Akure. Nigeria.

Method: One hundred and seventy wound swab samples were collected from staff and students of the university aged 1-69 years from March 2022 to August 2022.The samples were processed via microscopy and cultured on MacConkey, Blood and Chocolate Agar respectively in the Microbiology laboratory where standard cultural techniques was carried out to identify,isolate and characterize the bacteria isolated.

Result: Of the 170 wound swab samples examined, 74(43.6%) was positive to bacteria growth, while 96(56.4%) had no bacteria isolated.

Conclusion: The result illustrated there were potential bacterial pathogens associated in wound infections isolated from the samples that was analyzed. This indicated that potential bacterial when not properly managed and treated appropriately can complicate the healing process of wound.

Keywords: Wound; Bacterial Pathogens; Samples; Associated

1. Introduction

Wound contamination occurs because of a dynamic host-pathogen interplay such that the sum of the pathogen load is greater than the host's immune defenses resulting in a systemic immune response [1]. Wound infection happens because of a unique interaction between humans and diseases causing microbes. Wound infection is the invasion of a wound by proliferating microorganisms to a level that invokes a local and or systemic response in the host.[2] .Wound contamination is defined as the appearances of the organism on the wound area [3] when the number of bacteria in a wound is low (contamination) there is no problem with wound healing. However, as the number of bacteria in the wound increases, the chance of infection increases. ln critical colonization the bacterial load in the wound becomes unbalanced leading to infection if the amount of bacteria is not managed fervently[4]. Breach in intact skin surface whelther it is caused by trauma, accident, surgical operation or burns provides an open door for bacterial infections.[5].lnfection can occur in acute wounds such as surgical wounds(surgery site infection) and in chronic wounds such as pressure ulcers, diabetic foot

* Corresponding author: BA Erinle

ulcers and leg ulcers which are more likely to be colonized by bacteria due to infection [6]. Wound infections can be superficial(skin only) deep (muscle and tissue) or spread to the organ or site where the surgery was perfomed[7]. Wound infections are classified on a continuum; contaminated, colonized, local infection, spreading infection, and systemic infection(sepsis). lnfections of the skin and soft tissue either due to trauma, surgery, or burns may result in the generation of exudates composed of dead leucocytes, cellular debris, and necrotic tissues [8]. Chronic wounds can be colonized on the surface by a wide range of organisms [9] Common bacterial pathogens associated with wound infection include *Staphylococcus aureus ,Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Streptococcus pyogenes, Proteus spp Sreptococcus sp*p and *Enterococcus spp* [10] .These organisms exhibit natural resistance to many antibiotics and antiseptics in which they may survive for long periods, and may even multiply in the presence of minimal nutrients and have the ability to colonize traumatized skin.[11,12]. Patients with wound complications arising from the dissemination of pathogenic microorganisms tend to be associated with bacteraemia, septicaemia, shock and prolonged hospital stay with an increasing chance of developing drugs resistant infections [13].

2. Materials and Methods

2.1. Study Area

The study was conducted in Akure, the capital and largest city of Ondo State.The city is located in the South western part of Nigeria which lies within latitude 7^0 09' and longitude 5^0 14' in the Tropical rain forest zone part of Nigeria.

2.2. Sample collection and processing

One hundred and seventy (170) wound swab samples were collected from consented inpatients and outpatients who are students and staff of the university.Wound bed was prepared before sample collection by using Levine's technique, where the wound were surface exudates and contaminants were cleaned off with a moistened sterile gauze and sterile normal saline solution. Aseptically the swab stick was rotated over 1 cm^2 area for 5 seconds with sufficient pressure to express fluid and bacteria to surface from within the wound tissue.[14].The wound swab samples were transported to Microbiology Laboratory after collection. The wound swab samples were cultured by plating on MacConkey agar, 5% blood agar and Chocolate agar plate and incubated aerobically at 37^0C for 18 -24 hours. Pure culture was isolated and identified based on characteristic morphological appearances on enriched (blood agar) and differential media (MacConkey agar.Motility, Gram stain reaction and other biochemical tests were conducted to identify, isolate and characterize the specific bacteria isolated. Pure isolate of bacteria was inoculated into Nutrient Broth and incubated at 37^0C for up to 5hours until turbidity equals to 0.5 Mcfarland standard in the turbidity scale. This turbidity scale was adjusted by adding 9.6ml of 1% aqueous solution of barium chloride in 0.4ml of 1% sulphuric acid to give an approximate bacterial density of 1.2 x 10^9CFU/ml [15].

2.3. Antimicrobial Susceptibility Testing

Pure isolates were tested against selected antibiotics sensitivity discs of Gram negative and Gram positives multidiscs. The Gram negative consist of the following antibiotics : Augmentin (30ug/ml), Gentamycin (10ug/ml), Cephalexin (10ug/ml), Ofloxacin (30ug/ml,) Pefloxacin (10ug/ml),Nalidixic acid (30ug/ml) Ampicillin (30ug/ml) Streptomycin (30ug/ml), Ciprofloxacin (10ug/ml) while the Gram positive multidisc consist of the following antimicrobial drugs :- Levofloxacin (20ug/ml), Norfloxacin (10ug/ml), Ampiclox 20ug/ml), Amoxicillin (20ug/ml), Chloramphenicol (30ug/ml), Rifampicin (20ug/ml), Erythromycin (30ug/ml), Gentamycin (10ug/ml) Streptomycin (30ug/ml) and Ciprofloxacin (10ug/ml).

Bacterial inoculum was prepared (1.2 X10 ^{9}CFU/ml) and seeded unto Mueller Hinton agar (MHA) plate under aseptic condition and the surface was allowed to absorb Gram negative and Gram positive multidisc was then carefully placed onto the surface of the seeded plate with the aid of sterile forceps and incubated at 37^0C for 18 – 24hours.The zones of inhibition were measured in millimetres. Results were interpreted in accordance with CLSI interpretation chart for antimicrobials susceptibility testing [16] The percentage frequencies of sensitivity and resistance were recorded.

3. Results

Of the 170 wound swabs examined 74 (43.6%) were positive, yielded bacterial growth while 96 (56.4%) did not produce growth that is, negative. Single bacterial species were the most frequently isolated in the study.The commonest bacterial isolated was predominantly gram negative bacterial 47 (63.5%) while the only gram positive bacteria is *Staphylococcus aureus* 27 (36.5%).Among the Gram negative organisms, *Escherichia coli* was the most prevalent 17

(23%) followed by *Pseudomonas aeruginosa* 14 (19%) next to it *Klebsiella* spp 10 (13.5%) and the least was *Proteus mirabilis* 6 (8.1%). Table 1.

Table 1 Potential bacterial pathogens isolated in wounds of patients.

Bacterial isolated	Samples that yielded growth	Percentage (%)
Staphylococcus aureus	27	36.4
Escherichia coli	17	23.0
Pseudomonas aeruginosa	14	19.0
Klebsiella spp	10	13.5
Proteus mirabilis	6	8,1
Total	74	100

Table 2 Frequency of bacterial isolation among patients with wound infection on the basis of their age and sex**.**

Age group(Years)	Male	Female
10	4	1
11 -20	8	2
21 – 30	28	7
31 – 40	10	3
41 –50	3	1
51 – 60	3	2
61 – 69	1	1
Total	57 (77%)	17 (23%)

Table 3 Percentage susceptibility profile of gram –positive bacteria isolated from infected wounds of patients. *Staphylococcus aureus* n =27

Antibiotic	Sensitive	Resistant
CH	35.4	64.6
LEV	72.5	27.5
CN	46.4	53.6
RD	54.6	45.4
NB	65.3	34.7
APX	17.4	82.6
E	38.6	61.4
AMX	11.3	88.7
S	52.5	47.5
CPX	70.3	29.7

Key: CH – Chloraphenicol; LEV : Levofloxacin; CN: Gentamycin ,RD: Rifampicin; NB : Norfloxacin, APX: Ampiclox, E : Erythromycin, AMX – Amoxillin, S : Streptomycin CPX : Ciprofloxacin

Table 4 Percentage susceptibility profile of gram – negative bacteria isolated from infected wounds of patients**.**

	E.coli n=17		***P.aeruginosa n=14***		***Klebsiella ssp n=10***		***Proteus mirabilis n=6***	
	S	R	S	R	S	R	S	R
CPX	80.6	19.4	75.4	24.6	80.2	19.8	84.6	15.4
SXT	32.3	67.7	31.2	68.8	16.4	83.6	18.5	71.5
S	64.5	35.5	58.6	41.4	62.5	37.5	76.0	24.0
PN	24.7	75.3	28.1	71.9	26.7	73.3	27.4	72.6
CEP	42.3	57.7	40.5	59.5	33.5	66.5	71.8	28.2
OFX	62.4	37.6	60.8	39.2	58.8	41.2	73.5	26.5
NA	26.3	73.7	30.2	69.8	31.4	68.6	16.7	83.3
PEF	71.2	28.8	59.1	41.9	72.6	27.4	71.5	28.5
CN	53.5	46.5	29.0	71.0	49.2	50.8	63.4	36.6
AU	52.6	47.4	68.6	31.4	67.4	32.6	66.6	33.4

KEY: S : Sensitive R : Resistant; CPX: Ciprofloxacin, SXT: Sulphamethoxazole-trimethoprim, S: Streptomycin PN: Ampicillin, CEP: Cephalexin, OFX: Ofloxacin, NA: Nalidixic acid, PEF: Pefloxacin, CN: Gentanycin, AU: Augmentin

4. Discussion

The study illustrated the potential causative pathogens of bacterial incriminated in wound infection the experienceof Health centre of a university system. The study revealed a lower rate. One can imagine why this is so ? This can be attributed to a number of reasons which among are that the environment is enlightened , elite class are more knowledgeable about the welfare of their health and they embark on steps to curtail rapid deterioration of the wounds by constant visitation to clinic for dressing of the wounds which keep at bay microbial population that live on the skin surface under control to prevent possible pathogens from colonizing and invading underlying tissue.[21,22] The result of this study is at variance with [17,18] of occurrence (62.7%) and by *Pseudomonas aeruginosa* (23.1%).The frequency of our study not at par with report of [17,18] which was high whereas not high with our report *Staphylococcus aureus* (36.4%) and *Pseudomonas aeruginosa* (19%) Findings from [20]

carried out at a university hospital in Nigeria showed that the commonly isolated bacteria were *Staphylococcus aureus* (35%) and *Pseudomonas aeruginosa* (20%) which when compared with the result of our study concurred. ln this study, *Staphylococcus aureus* was the most predominant bacteria this is contrary to the finding of [23] but in consonance with reports of similar studies conducted from different parts of Nigeria[24,25,26,] and other country , Turkey.[27].

Burns, wounds and traumatic wounds occurring impromptu, promote multiple infections due to damage to the skin and can induce immune suppression.[28] The quinolones and aminoglycosides antibiotics were most effective in this study with the exception of Gentamycin and Nalidixic acid which were partially sensitive (Table 4).Similarly, Levofloxacin, Norfloxacin and Ciprofloxacin were the most active and effective antibiotics on *Staphylococcus aureus*.(Table 3). Ampicillin and Amoxillin had the highest resistance rate in this study.This is in agreement with report of findings of [29] .

5. Conclusion

No matter the situation potential bacterial pathogens are associated with wound infection in the University Health Centre but the level of incrimination encountered is low and cannot be compared with the occurrence in the Teaching Hospital which are generally high. The bacterial pathogens isolated are: *Staphylococcus aureus*; *Escherichia coli, Pseudomonas aeruginosa, Klebsiella spp and Proteus mirabilis.*These isolates reflected marked resistance towards.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declare that they have no competing interests.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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