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Microbial Analysis of Biomedical Wastes from Selected Health Facilities in Parts of Edo South and its Public Health Implication

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ABSTRACT

This study, aimed at the microbial analysis of biomedical waste (BMW) was carried out using 100 samples of 10 different BMW collected in duplicates from 5 busy primary healthcare centers (PHCs).The research findings showed a high prevalence of *E.coli* (39%) and *S.aureus* (32%) which were both statistically significant at P≤0.05, while the least isolated organisms were *K. pnuemoniae* (10%) and *B. subtilis* (4%) and were statistically not significant at P≥0.05. Samples from dressings and beddings were found to contain the highest microbial loadof 25 and 13 respectively while the least number of isolates were from expired cytotoxic drugs (2) and lancets (1).The biochemical tests showed the presence of Gram positive and negative organisms with record of both aerobic and anaerobic isolates from the BMW. The investigation revealed that BMW contains mixed bacterial community with some being pathogenic and pose a public health hazard to both health workers and other community members, therefore adequate treatment measures should be given to all BMW before disposal.

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1. INTRODUCTION

Biomedical waste (BMW) refers to those materials generated as a result of the diagnosis and /or treatment of a patient that require special precautions due to waste being infectious [1]. Biomedical waste is extremely hazardous type of waste and if not managed properly can lead to serious health and environment problems [2]. Biomedical waste generated in the hospital falls under two major categories- nonhazardous and bio-hazardous. Constituents of non-hazardous waste are non-infected plastic, cardboard, packaging material, paper etc., while bio-hazardous waste are either infectious wastes (sharps, non-sharps, plastic disposables, liquid wastes etc.) or non-infectious wastes (radioactive waste, discarded glass, chemical waste, cytotoxic waste, incinerated waste etc.). Specifically BMW includes cultures, stocks of infectious agents, human tissues, organs, body parts or blood, used and unused sharp objects such as broken glass wares and lancets that have been used to puncture, cut or scrape the body as well as human or animal body fluids or wastes [3]. The hospital is one of the complex institutions which are frequented by people from all walks of life in the society without distinction between age, sex, race and religion. This is over and above the normal inhabitants of hospital that is; patients and staff. All of them produce waste which is increasing in its amount and type due to advances in scientific knowledge [4]. The hospital wastes in addition to the risk for patients and personnel who handle these then pose a threat to public health and environment [5].

2. RESEARCH METHOD

The laboratory investigation for this study was carried out at Microbiology laboratory of the Department of Medical Microbiology, College of Medical Sciences, Ambrose Alli University, Ekpoma-Edo State.

2.1. Collection of Biomedical wastes samples

The microbial analysis was conducted using 10 different biomedical wastes (cell cultures, used syringes/needles, glass, expired cytotoxic drugs, dressings, beddings, catheters, intravenous sets, surgical gloves and lancets). A total of 100 specimens was collected (2samples/ BMW) from five (5) different busy Primary Healthcare centers (PHC) from the month of February to October, 2015. These health facilities (HFs) are all located within the State capital. They were collected with the aid of sterile swab sticks made wet with normal saline and transported in geostlyes with frozen icepacks to the laboratory.

2.2. Isolation, Identification and Characterization of Bacteria from Biomedical Wastes

The swab sticks were streaked onto blood agar and CLED (cysteine lactose electrolyte deficient) agar and incubated aerobically at 37^{o}C for 24-48 hours. After incubation, the plates were observed for bacterial growth, strains were morphologically identified using Gram staining reaction and other biochemical tests which include; methyl red, voges proskauer (MR-VP), catalase,coagulase, oxidase, indole, urease, starch hydrolysis, nitrate reduction, triple sugar iron (TSI), sugar fermentation and germ tube tests according to the procedure of Ogbulie *et al* (1998) [6]. The isolates were enumerated as described by Cheesebrough (2003) and Oyeleke (2009) [7],[8].

2.3. Statistical Analysis

Statistical analysis was done using the student t-test to determine level of significance. A p-value of less than or equal to 0.05 ($P \leq 0.05$) was considered to be statistically significant.

3. RESULTS

The results from the study show a high microbial loadin dressings, 25(32%) and beddings 13 (17%) that may have been contaminated by body fluids from patients, while lancet and expired cytotoxic drugs had the least microbial load of 1 (1.3%) and 2 (3%) respectively as shown in Table 1. The frequency of occurrence reveals that *E. coli* has the highest isolation rate (39%), followed by *S. aureus* (32%) while a 15% isolation rate was observed in *S. pyogenes* and the least, (10%) being *K. pnuemoniae* as shown in Table 2.

Table 1. Number and Type of Isolates from Samples analyzed

Sample	Isolates (N)					Total
	E. coli	*S. aureus*	*S. pyogenes*	*B. subtilis*	*K. Pneumoniae*	
Dressings	10	6	4	3	2	25
Beddings	6	4	2	1	-	13
Cellcultures	5	3	1	1	-	10
Surgical gloves	1	3	1	1	1	7
Used syringes/needles	3	1	2	-	-	6
Catheters	2	1	1	2	-	6
Glass wares	1	3	-	-	-	4
Intravenous sets	2	1	1	-	-	4
Expired cytotoxic drugs	-	2	-	-	-	2
Lancets	-	1	-	-	-	1
Total	30	25	12	8	3	78

KEY: N (Number of isolates)

Table 2. Occurrence of isolates and frequency of isolation

Microbial Isolates	Occurrence of Isolates	Frequency of Isolation (%)
E. coli	30	39
S. aureus	25	32
S. pyogenes	12	15
B. subtilis	8	10
K. pneumoniae	3	4
Total	78	100

The characterization of the isolates using biochemical test methods revealed that both Gram positive and negative bacteria are contained in biomedical wastes as shown in Table 3.

Table 3. Biochemical characteristics of bacterial isolates

Test	*S. aureus*	*S. pyogenes*	*E. coli*	*B. subtilis*	*K. pneumoniae*
Gram staining	+	+	-	+	-
Motility	Non motile	Non motile	Motile	Motile	Motile
Shape	Cocci	Cocci	Rods	Rods	Rods
Oxygen requirement	Anaerobic	Aerobic	Anaerobic	Aerobic	Anaerobic
Colony	Yellow	Grey	Blue	Yellow	Yellow
Endospore	+	-	-	+	-
Catalase	+	-	+	+	+
Coagulase	+	-	-	-	-
Oxidase	-	-	-	+	-
Urease	-	-	-	-	+
Gelatinase	-	-	-	+	-
H2S production	-	-	-	-	-
Nitrate reduction	+	+	+	+	+
Indole production	-	-	+	-	-
Methyl red test	+	+	+	-	-
Vogus Proskaur test	+	-	-	+	+
Glucose	+	+	+	-	+
Mannitol	+	-	-	+	-
Lactose	-	-	+	-	-
Sucrose	-	-	-	-	-
Fructose	-	+	-	+	-
Sobitol	-	-	+	-	+

4. DISCUSSION

The result of the study shows that beddings and dressings contaminated with body fluids of patients had the highest microbial load, which can be attributed to the long period of body contact before a fresh dressing is used. The organism with the highest prevalence rate was *E. coli* followed by *S. aureus,* which is in agreement with the work of Anitha *et al* (2012) who reported a high prevalence of *E.coli* from biomedical waste (BMW) [9], but at variance with the findings of Giroletti (1993) who reported a high prevalence of *Bacillus subtilis* [10]. This may be due to the difference and level of treatment of BMW before disposal from the health facilities where the BMW were collected. Findings from this research revealed that most of the sample sites did not treat BMW before disposal, while some were treated with disinfectants at low concentrations. The biochemical reaction revealed the presence of Gram negative and positive bacterial isolates as well as aerobic and anaerobic organisms from the samples analyzed. These points to the fact that, BMW serves as a substrate for the proliferation of diverse bacteria with clinical significance in terms of pathogenicity. This is in consonance with the findings of Anitha *et al* (2012) and Rheinheimer *et al* (1989), who both reported Gram positive, negative, aerobes and anaerobes in addition to cocci and rods, this is as a result of the rich organic content of hospital wastes [9],[11].

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