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Identification of bacterial growth from medical waste & their susceptibility to antibiotics (A case from Rafedia hospital in the city of Nablus)

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Abstract:

This study objective is to identify bacterial growth originated from medical wastes in Rafedia hospital in Nablus City and their resistance to antibiotics. A sample of medical waste was taken from various departments in the hospital. Conventional bacteria identification methods were used to identify The presence of bacteria in medical waste. Numerous pathogenic bacteria; including opportunistic bacteria, were found in clinical wastes with the prominence of Escherichia coli, Acinetbacterbaumannii and Proteus mirabilis. The identified bacteria in the medical waste depicted high susceptibility to Ampicillin, Trimethoprime/sulfamethoxazole, cefapime, Cefotaxime and Ceftazidime. This study, accordingly, suggests a proper treatment of medical wastes before they are released in order to decrease the dissemination of infectious disease.

Key words: medical waste, pathogenic bacteria, multidrug resistant.,

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Introduction:

Medical waste is characterized by the kind of infectious and hazardous wastes which are the outcome from health care institutions, like: hospitals, clinics, dental offices, and medical laboratories (International Committee of the Red Cross, 2011). However, hospitals' waste is not necessarily all hazardous. Sometimes it could be the kind of waste one gets from the kitchen, while doing house work, and departments specialized in administrational work as paper and cardboard. This type of waste accordingly constitutes the bulk of the waste by almost 85%. Medical hazardous waste, on the other hand, is 15%. This 15% consequently consists of Infectious waste by 10% and non-infectious by 5%, such as: pathological waste, pharmaceutical waste, compressed packaging, etc (Singh et al, 2007).

Surgery rooms in Nablus's hospitals also generate medical waste; as well as other units such as Operations Department, Outpatient Clinics, Patient Accommodation Wards, Ambulance and Emergency Department, and other units. This waste gets all mixed together and moved to a site near the city.

Managing medical waste in Palestine is an issue of crucial significance. The treatment of medical waste as other types of waste by disposing it in ordinary landfills poses a risk on citizens and the community; be it during its production, transport, or disposal. Not to mention the fact that it endangers both health and environment. It is due to such risks that the issue of medical waste is one that receives major attention and concern by the Palestinian community.

Al Hayat Company, for instance, conducted a survey on the issue. It concluded from the survey that There is an evident flaw in the management of MSW. Since the hospital encounters many emergency cases, and due to its screening average which is almost 60%, medical waste is hardly sorted in the emergency department; consequently having medical wastes improperly mixed with other wastes. Hence, this causes the shedding of the concentrations of infectious agents and antibiotics resistance microbes.

Since medical waste is hardly sorted from other wastes, citizens, adults and children, would unknowingly frequent these landfills and use medical containers and tools without realizing the risk they put themselves and other in to by using such containers for, let's say, saving fruits.

This, accordingly, promotes the spreading of infectious bacteria & harming pathogen in the environment resulting in issues such as infectious diseases that can be fatal. Not to mention that such infections may have resistance against antibiotics.

Many death cases have been reported to be the cause of antibiotic- resistant infections. A report by WHO on the issue was published in April 2014 which alarmingly depicts high rates of resistance in the bacteria that lead to common infections in healthcare facilities and the society.

In countries of low- and middle income (LMICs), antibiotic resistance is more catastrophic since they are of limited resources and possibility of having an infectious diseases is relatively high. Simultaneously, infection prevention and management strategies in such countries are hardly effective (Sosa et al, 2010).

The increase of infectious bacteria could have been contributed hugely by hospitals waste(Jager et al, 1989). Microbes will be able to survive by adjusting and growing at various settings such as: subzero temperatures, extreme heat, desert conditions, in water, by having an excess of oxygen, and in anaerobic conditions (Anitha & Indira, 2012).

The present study aims to evaluate the existence of pathogenic bacteria and their resistance to antibiotics in Rafedia hospital's medical waste within the city of Nablus.

Material & methodology:

This study was conducted by al-Hayat Company for Studies & Research. The gathered samples were from various departments of Rafedia hospital in Nablus. The sample size was 106. Random sampling was applied after disposal of medical waste. The aforementioned samples were gathered by sterile polyester fibre tipped applicator swabs. By applying the streaking method, the samples were inoculated on different selective and differential media such as MacConkey, Mannitol salt agar (MSA), Eosin methylene blue (EMB), and Salmonella shigella agar (SS). Consequently, the samples underwent incubation at 36°C (+/- 1°C) in an incubator for 24 h. In accordance with standard procedures by biochemical test & API-20E test, microorganisms isolation and identification were conducted (Biomeriux, France) (Baron and Finglod, 1996). Not to mention that 4 to 5 well-isolated colonies of the same morphological type from an agar plate underwent inoculation in 4 to 5 mL tryptic-soy broth & incubated at 37°C until the achieving of the turbidity of 0.5 Mc. Kirby-Bauer (Antibiotic Sensitivity) method was also exploited for identification of bacteria's resistance by applying various types of antibiotics - see table (1). The zone sizes and the organism are to be interpreted and reported to be either susceptible, intermediate or resistant.

Table (1):Antibiotic used against bacteria & their concentration

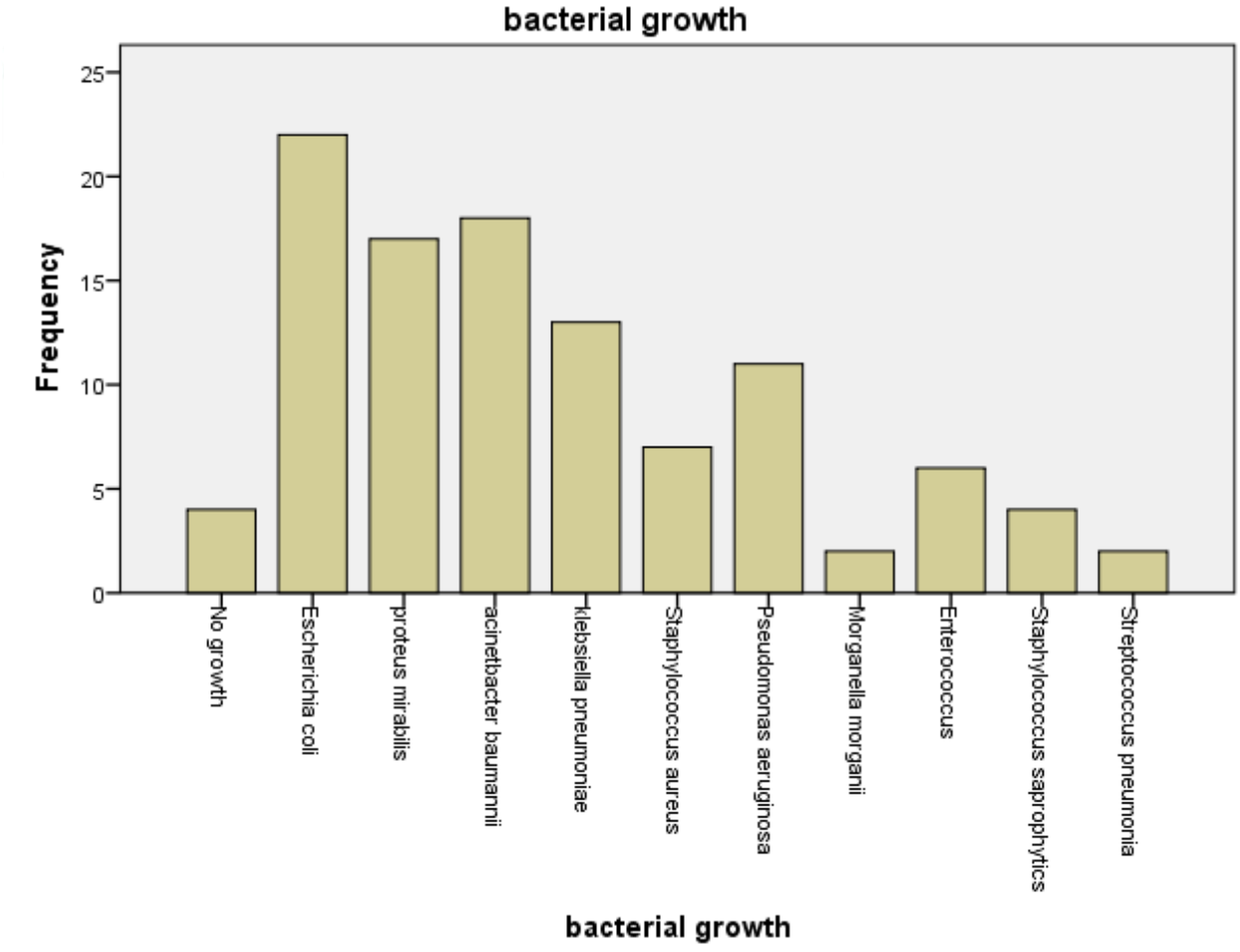
Antibiotics	Concentration
Ciprofloxacin	5mcg
Gentamycin	10mcg
Cefepime	30 mcg
Trimethoprime/Sulfamethoxazole	1.25/23.75
Amoxicillin/Clavulanic acid	20/10 mcg
Piperacillin/ Tazobactam	100/10 mcg
Ertapenem	10 mcg
Ceftazidime	30 mcg
Cefotaxime	30 mcg
Ampicillin	10 mcg
Amikacin	30 mcg
Meropenem	10 mcg

Results:

The results depict that 20.8% represent the highest incidence of bacteria in medical waste, whereas the percentage 17.0% was that of Acinetbacterbaumannii, 16.0% of Proteus mirabilis, 12.3% of klebsiella pneumonia. However, the lowest percentage of 1.9% was that of Streptococcus pneumonia and Morganellamorganii. The following charts and tables show the frequency and the percentages of the growth of the bacteria:

Table (2) frequencies and the percentages of the growth of bacteria

Bacteria		Frequency	Percent (%)
Valid	No growth	4	3.8
	Escherichia coli	22	20.8
	Proteus mirabilis	17	16.0
	Acinetbacter baumannii	18	17.0
	klebsiellapneumoniae	13	12.3
	Staphylococcus aureus	7	6.6
	Pseudomonas aeruginosa	11	10.4
	Morganellamorganii	2	1.9
	Enterococcus	6	5.7
	Staphylococcus saprophytics	4	3.8
	Streptococcus pneumonia	2	1.9
	Total	106	100.0



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Trimethoprime/sulfamethoxazole,cefapime, Cefotaxime, Ceftazidime are the bacteria which were identified to show high resistance to Ampicillin . The type of bacteria which depicted high resistance to Ampicillinare E are: coli, Proteus mirabilis, Klebsiella pneumonia. The bacteria which depicted high resistance toTrimethoprime/sulfamethoxazole are: E. coli, Proteus mirabilis. The bacteria which depicted high resistance to cefapime are: E. coli, Proteus mirabilis, Klebsiella pneumonia. The bacteria which depicted high resistance to Cefotaxime are: E. coli, Acinetbacterbaumannii. The bacteria which depicted high resistance to Ceftazidime are E. coli, Acinetbacterbaumannii, Klebsiella pneumonia.

The identified bacteria in the medical waste that showed to be highly sensitive to Ertapenem are: Piperacillin/ tazobactam, Amikacin, &Meropenem. The bacteria that showed to be highly sensitive Ertapenem are: E. coli, Proteus mirabilis, Klebsiella pneumonia, and Morganellamorganii. The bacteria that depicted high sensitivity to Piperacillin/ tazobactam are: E. coli, Proteus mirabilis, Klebsiella pneumonia. The bacteria that showed to be highly sensitive to Amikacin are: E. coli, Proteus mirabilis, Klebsiella pneumonia. The bacteria that depicted high sensitivity to Meropenem are: Acinetbacterbaumannii, Pseudomonas aeruginosa.

Discussion:

The study depicted that the most prominent existence of the bacteria in medical waste were *E. coli* having the percentage of 20.8%, *Acinetbacter baumannii* having the percentage of 17.0% and *Proteus mirabilis* 16.0%. Cook et al, 1992 & Suzan et al, 2018 both reported this type of bacteria. It is possible that due to medical waste being full with organic material that there is an increase in this bacteria as reported by Rheinheirer et al, 1989. Pavoni additionally stated that pathogenic bacteria may survive in solid medical waste.

Since there isn't any appropriate measures of treatment of medical waste before disposing it, the spread of these bacteria to the surrounding environment and community would be highly problematic in affecting the health (Svidhar&olajumoke, 2003).

the bacteria *E. coli* was the most isolated one since it is known to be a secret weapon in spreading infection (Vikash et al, 2019) and the mostly common cause of infections, more specifically UTI. E. coli worst type causes bloody diarrhea, and can sometimes ay lead to kidney failure and might even be fatal. In the present study, *E. coli* growth depicted multidrug resistance to Cefepime, Trimethoprime/Sulfamethoxazole, Ampicillin, Cefotaxime, Ceftazidime. Such results are a cause of alarm to multidrug resistant.

Acinetbacter baumannii comes in second place in the process of isolation in the present study. The aforementioned bacteria is one that leads to the infection of respiratory tract, blood, soft tissue, &UTI (Mohammed et al, 2018). Kramer states that Acinetbacter species are affiliated with increased morbidity and mortality rate (Kramer et al, 2006). *Acinetbacter baumannii* depicted multidrug resistance, including Cefotaxime and Ceftazidime, ciprofloxacin, gentamycin, Amoxicillin/Clavulanic acid, Amikacin, & Meropenem.

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Proteus mirabilis comes in third place in the process of isolation. This type could cause various infections of wound, eye, gastrointestinal tract and urinary tract (Armbruster& mobile, 2012). The said bacteria depicts a high resistance to Ampicillin, Amikacin, Trimethoprime/Sulfamethoxazole, Ertapenem, ciprofloxacin, & cefapime.

Conclusion:

Medical waste is significantly dangerous to the health of a community as it serves as reservoirs for the spread of a pathogenic infectious bacteria. This, subsequently would lead to infectious diseases. Additionally speaking, it is of huge concern that the said bacteria showed development of multidrug resistance. Fontain, for instance, illustrated that multiple incidences of resistance occurred in 87.8% of isolations from hospitals and it was transferable to *E.coli* (Fontaine & Hoadley, 1976). Accordingly, both of the spread of the infectious diseases and multidrug resistant bacteria would increase the rates of mortality. This study, hence, suggests that medical waste that originates from health care institutions should be disposed of safely throughout the processes of separation, collection, transportation and treatment; in order to prevent any transmission of infectious disease or the spread of the high rate of multidrug resistant bacteria to the surrounding environment and society.

References:

Anitha j, and Indira. J. Isolation and identification of bacteria from biomedical waste (BMW). *Pharmacy and Pharmaceutical Sciences*. 2012; 4: 386-388.

Armbruster CE, Mobley HL. Merging mythology and morphology: the multifaceted lifestyle of *Proteus mirabilis*. *Nat Rev Micro*. 2012;10:743–754.

Cook HA, Cromwell DL, Wilson HA. Microorganisms in house hold refuse and seepage water from Sanitary Landfills. *West Virginia Academy of Sciences*. 1964; 39: 107 -114.

Fontaine TD, Hoadley AW. Transferable drug resistance associated with coliforms isolated from hospital and domestic sewage. *Health Lab Sci*. 1976; 4: 238-45.

Jager E, Xander L, Ruden H. Hospital wastes. Communication: Microbiological Investigations of Hospital Waste From various wards of a big and of smaller Hospital in comparison to household Refuse. *Hygiene*. 1989; 188: 345-364.

Kramer A, Schwebke I, and Kampf G, "How long do nosocomial pathogens persist on inanimate surfaces? A systematic review," *BMC Infectious Diseases*. *BMC infectious diseases*. 2006; 6: 130 -138.

Medical waste management, *International Committee of the Red Cross*. 2011.

Mohammed K. Almaghrabi, Martin R. P. Joseph, Mohammed M. Assiry, and Mohamed E. Hamid Multidrug-Resistant *Acinetobacter baumannii*: An Emerging Health Threat in Aseer Region, Kingdom of Saudi Arabia. *Canadian Journal of Infectious Diseases and Medical Microbiology*. 2018; 4 pages.

Pavoni JL, Heer JE, Hagerty DL. Handbook of Solid Waste Disposal, Materials and Energy Recovery. *Van Nostrand Reinhold Company*. New York . 1975.

Razdan P. and Cheema AS. Bio-medical waste management system. Proceedings of ASCNT, CDAC. Available from: http://www.scribd.com/doc/41660937/ALU-Abstract.

Rheinheimer G, Gocke K, Hoppe HG. Vertical distribution of microbiological and hydrographic- chemical parameters in different areas of the Baltic Sea. *Mar. Ecol*. Prog. Ser. 1989; 52: 55-70.

Singh VS, Gautam B,and Jag S. Biomedical Waste Management - An Emerging Concern in Indian Hospitals. *Forensic medicine & toxicology*. 2007; 1: 1-12.

Sosa, A.J., D.K. Byarugaba, C.F.Ama´bile-Cuevas, P.-R. Hsueh, S. Kariuki, and I.N. Okeke, Antimicrobial Resistance in Developing Countries. 2010: *Springer New York Dordrecht Heidelberg London*.

Vikash S, Anthony D, Peter J. H, Vassilis K. Pathogenic *Escherichia coli* Hijacks GTPase-Activated p21-Activated Kinase for Actin Pedestal Formation. *M Bio*. 2019; 10: Issue 4 e01876-19.

WHO, Antibiotic resistance: global report on surveillance. 2014

Young L, Sabel L, and Price C S, "Epidemiologic, clinical, and economic evaluation of an outbreak of clonal multidrug-resistant *Acinetobacter baumannii* infection in a surgical intensive care unit," Infection Control & Hospital Epidemiology. 2007; 28:1247–1254

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The Impacts of Perceived Content Quality, Computer Self Efficacy, and Course Attributes on Behavioral Intention: The mediating roles of and Subjective Norms, Perceived Ease of Use, and Perceived Usefulness

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Abstract

The theory of e-learning acceptance is now moving forward to explore the very attributes of the e-learning happening, to ensure quality and relevance of an overall e-learning system. This study uses a survey of 301 students registered with the Public Authority for Applied Education and Training (PAAET) in Kuwait to explain the impacts of perceived content quality, computer self-efficacy, course attributes on behavioral intention. The PLS-SEM analysis suggest, that content quality, computer self-efficacy, and course attributes are important for generating the overall behaviour intention to use e-learning. In this regard, the research has importantly found that these impacts mediates through the subjective norms of the learners and their perceptions, including those related with the ease of use and the usefulness of the e-learning. These findings are important in the new theoretical and policy contexts of moving the technology adoption towards more intrinsic features of the e-learning, particularly in e-learning systems, introduced by the governments in relatively new countries to the e-learning.

Keywords: E-learning, content quality, self-efficacy, course attributes, behavioural intention, subjective norms, ease of use, usefulness.

Introduction

The recent surge in the technology as response to Covid-19 was more a necessity than an opportunity in education as part of maintaining physical distancing (Saxena et al., 2021). In this pretext, in addition to health services, education is considered the most affected sector in both Kuwait and throughout the world. In this regard, both