TO DETERMINE THE ANTIMICROBIAL RESISTANCE PATTERN IN DENTAL PATIENTS

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Abstract

Aim: The aim of this study to determine the antimicrobial resistance pattern in dental patients.

Methods and Materials: This research involved 80 participants. Pus samples were collected at the department of microbiology for bacterial isolation and identification. Samples were put into MacConkey agar culture medium plates, which were then incubated for 24 hours to see whether any bacteria grew. Those samples that were positive after 24 hours were subjected to grams staining. Antibiotic disc diffusion techniques were utilised for manual assessment of sensitivity and resistance of bacteria. The diameter of the colony as measured in millimetres was used to detect and distinguish between sensitive and resistant conditions.

Results: The research found that the most patients were 45-65 years old, with 35 (43.75%), followed by 25-45 years old, with 26(32.5%), over 65 years old, with 15 (28.75%), and under 25 years old, with 4 (5%) patients. Out of 80 pus samples, 54 (67.5%) show positive culture whereas 26 (32.5%) samples yielded no growth. Apart from other isolates such as Escherichia coli (12.96%), Coagulase negative staphylococcus (29.63%), and Streptococcus sp (7.41%), the most prevalent grame positive bacteria identified were Staphylococcus aureus (33.33%) and Klebsiella pneumonia (16.67%). Most antibiotics were resistant, such as amikacin, gentamicin, imipenem, cefazolin, and others, while by manual method there was Staphylococcus aureus 88.89% sensitivity with Teigocycline, Colistin, and Fosfomycin, and both nitrofurantoin 16.67% and netilimycin 5.56% sensitivity. Most antibiotics, such as Amikacin, Gentamicin, Imipenem, cefazolin, and others, were resistant, however by manual technique, E.coli was responsive to Colistin 6(85.71%), Teigocycline 4(57.14%), Fosfomycin 6(85.71%), Nitrofurantoin 1(14.29%), and Netilimycin 1(14.29%), as indicated.

Conclusion: Antimicrobial resistance poses a significant risk to human health. Inappropriate antibiotic usage in healthcare and animal husbandry are major contributors to antimicrobial resistance. A concerted effort from all relevant authorities to fight antimicrobial resistance in all aspects is required to prevent bacteria from becoming resistant, resulting in serious consequences for human health and the future economy

Keywords: Pus, Resistance, Antibiotic, Sensitive

Introduction

AAntimicrobial resistance develops when germs live and proliferate in the presence of antimicrobial medicines. Paul Ehrlich, the pioneer of modern chemotherapy, noticed in 1907 that the organism in trypanosome infections seemed to be resistant to the chemical employed at times. He discovered that a fuchsin dye-resistant strain was nevertheless vulnerable to an arsenic compound due to specific resistance, whilst a strain resistant to the arsenic compound preserved sensitivity to the dye. Later in 1908, he claimed that once acquired, resistance might be progressively inherited. [1]

Antibiotic-resistant bacteria are a severe public health concern.[2] Because of the lack of strength of the treatments against common diseases, developed nations have moved their drugs to more costly ones. Meanwhile, owing to budgetary restrictions, underdeveloped and least developed nations choose alternative medications, resulting in increased morbidity and death. [3]

The World Health Organization (WHO) has developed a surveillance system known as GLASS (Global Antimicrobial Surveillance System). An early release of the data revealed a significant frequency of antibiotic resistance in both high-income and low-income nations, with up to 500,000 instances occurring across 22 countries. [4]

According to a World Bank research on antimicrobial resistance published in 2016, the financial burden would be borne mostly by low- and middle-income nations.[5] Antimicrobial resistance has more than doubled in the previous 20 years, killing around 700,000 people worldwide each year. The figure is expected to rise to 10 million fatalities per year by 2050, with a financial cost of up to US$100 trillion (RM416.65 trillion).[6] This circumstance emphasises the need of developing a thorough action plan to address the problem.

Methods and Materials

This study was conducted at the department of microbiology at Genesis Institute of Dental Science and Research Centre with the assistance of Anil Baghi Hospital in Firozpur, Punjab, India, after receiving ethical permission from the institutional ethics council. All patients' demographic information, such as age, gender, and medical history, was recorded. This research involved 80 participants. Pus samples were collected at the department of microbiology for bacterial isolation and identification. Samples were put into MacConkey agar culture medium plates, which were then incubated for 24 hours to see whether any bacteria grew. Those samples that were positive after 24 hours were subjected to grammes staining. For 24 hours, the B D Phoenix sophisticated automated microbiology system was employed for bacterial identification and sensitivity. Antibiotic disc diffusion techniques were utilised for manual assessment of sensitivity and resistance of bacteria. In the disc technique, a little quantity of culture is disseminated on Mueller hinton agar medium and a standardised antibiotic disc is put on the plate surface and the culture media plate is incubated overnight. If the antibiotic is able to block the development of the microorganism, it does not grow around the bacterial disc, indicating that it is sensitive; if the mi-

croorganism grows around the antibiotic disc, indicating organism resistance to this antibiotic. The diameter of the colony as measured in millimetres was used to detect and distinguish between sensitive and resistant conditions.

Following manual antibiotic were used in this study

Imipenem, Meropenem, cefepim, Ciprofloxacin, Amikacin, Ceftazidime, Ceftriaxon, Cefotaxime, Ampicilin, Colistine , Fosfomycin and tigecyclin.

Statically analysis

For statically analysis SPSS version 25.0 were used.

Results

The research found that the most patients were 45-65 years old, with 35 (43.75%), followed by 25-45 years old, with 26(32.5%), over 65 years old, with 15 (28.75%), and under 25 years old, with 4 (5%) patients. Table 1 shows that the number of male patients is 49 (61.25%) more than the number of females is 31 (38.75%).

Age	Number of patients =80	Percentage
Below 25	4	5
25-45	26	32.5
45-65	35	43.75
Above 65	15	18.75
Gender		
Male	49	61.25
Female	31	38.75

Table 1: Age and gender of the patients

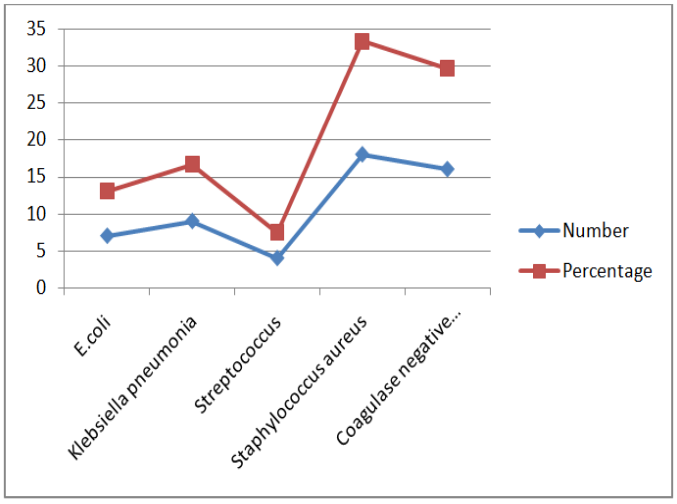
Culture	Number of sample	Percentage
Positive	54	67.5
Negative	26	32.5

Table 2: Bacterial culture status

Out of 80 pus samples, 54 (67.5%) show positive culture whereas 26 (32.5%) samples yielded no growth.

Bacteria	Number	Percentage
E.coli	7	12.96
Klebsiella pneumonia	9	16.67
Streptococcus	4	7.41
Staphylococcus aureus	18	33.33
Coagulase negative staphylococcus	16	29.63

Table 3: Isolated bacteria form pus sample



Graph 1: Isolated bacteria form pus sample

Apart from other isolates such as Escherichia coli (12.96%), Coagulase negative staphylococcus (29.63%), and Streptococcus sp (7.41%), the most prevalent grame positive bacteria identified were Staphylococcus aureus (33.33%) and Klebsiella pneumonia (16.67%). Most antibiotics were resistant, such as Amikacin, Gentamicin, Imipenem, cefazolin, and others, while by manual method there was Staphylococcus Aureus 88.89% sensitivity with Teigocycline, Colistin, and Fosfomycin, and both Nitrofurantoin 16.67% and Netilimycin 5.56% sensitivity, as shown in Tables 4 and 5.

Antibiotic	Staphylococcus aureus=18		Coagulase negative staphylococcus=16		Streptococcus=4	
	Sensitive	Resistances	Sensitive	Resistances	Sensitive	Resistances
Amikacin	0	18(100%)	0	16(100%)	0	4 (100%)
Gentamicin	0	18 (100%)	0	16(100%)	0	4 (100%)
Imipenem	1 (5.56%)	17 (94.44%)	0	16(100%)	0	4 (100%)
Meropenem	1 (5.56%)	17 (94.44%)	0	16(100%)	0	4 (100%)
Cefazolin	0	18 (100%)	1(6.25%)	15 (93.75%)	0	4(100%)
Cefoxitin	2 (11.11%)	16(88.89%)	1(6.25%)	15 (93.75%)	0	4 (100%)
Ceftadizime	0	18(100%)	2(12.50%)	14 (87.50%)	1 (25%)	3 (75%)
Cefotaxime	1 (5.56%)	17 (94.44%)	0	16(100%)	2(50%)	2 (50%)
Cefepime	3 (16.67%)	15 (83.33%)	0	16(100%)	0	4(100%)
Aztreonam	0	18 (100%)	0	16(100%)	0	4 (100%)
Ampicillin	0	18 (100%)	0	16(100%)	1(25%)	3 (75%)
Piperacillin	1 (5.56%)	17 (94.44%)	1(6.25%)	15 (93.75%)	0	4(100%)
Amoxycillin- clavulanate	2 (11.11%)	16(88.89%)	1(6.25%)	15 (93.75%)	0	4 (100%)
Piperacillin- tazobactum	4(22.22%)	14 (77.78%)	2(12.50%)	14 (87.50%)	0	4 (100%)
Trimethoprim- sulfamethoxazole	8 (44.44%)	10 (55.56%)	4(25%)	12(75%)	0	4 (100%)
Chloramphenicol	0	18 (100%)	0	16(100%)	0	4 (100%)
Ciprofloxacin	0	18 (100%)	0	16(100%)	0	4 (100%)
Levofloxacin	0	18 (100%)	1(6.25%)	15 (93.75%)	2(50%)	2 (50%)
Tetracycline	0	18(100%)	0	16(100%)	0	4 (100%)

Table 4: The sensitivity and resistance for antibiotics

	Staphylococcus aureus=18		Coagulase negative staphylococcus=16		Streptococcus=4	
	Sensitive	Resistances	Sensitive	Resistances	Sensitive	Resistances
Colistin	16(88.89%)	2(11.11%)	14(87.5%)	2(12.5%)	3(75%)	1(25%)
Teigocycline	16(88.89%)	2(11.11%)	9(56.25%)	7(43.75%)	2(50%)	2(50%)
Fosfomycin	16(88.89%)	2(11.11%)	15(93.75%)	1(6.25%)	4(100%)	0
Nitrofurantoin	3(16.67%)	15(83.33%)	2(12.5%)	14(87.5%)	0	4(100%)
Netilimycin	1(5.56%)	17(94.44%)	2(12.5%)	14(87.5%)	0	4(100%)

Table 5 : Manual method for gram positive bacteria

Most antibiotics, such as Amikacin, Gentamicin, Imipenem, cefazolin, and others, were resistant, however by manual technique, E.coli was responsive to Colistin 6(85.71%), Teigocycline 4(57.14%), Fosfomycin 6(85.71%), Nitrofurantoin 1(14.29%), and Netilimycin 1(14.29%), as indicated in Tables 6 and 7.

Antibiotic	E.coli=7		Klebsiella pneumonia=9	
	Sensitive	Resistances	Sensitive	Resistances
Amikacin	0	7(100%)	0	9(100%)
Gentamicin	0	7(100%)	0	9(100%)
Imipenem	0	7(100%)	0	9(100%)
Meropenem	0	7(100%)	0	9(100%)
Cefazolin	1(14.29%)	6(85.71%)	0	9(100%)
Cefoxitin	0	7(100%)	0	9(100%)
Ceftadizime	1(14.29%)	6(85.71%)	0	9(100%)
Cefotaxime	0	7(100%)	0	9(100%)
Cefepime	0	7(100%)	0	9(100%)
Aztreonam	0	7(100%)	0	9(100%)
Ampicillin	0	7(100%)	0	9(100%)
Piperacillin	0	7(100%)	0	9(100%)
Amoxycillin- clavulanate	0	7(100%)	0	9(100%)
Piperacillin-tazobactum	1(14.29%)	6(85.71%)	0	9(100%)
Trimethoprim-sulfamethoxazole	0	7(100%)	0	9(100%)
Chloramphenicol	0	7(100%)	0	9(100%)
Ciprofloxacin	0	7(100%)	0	9(100%)
Levofloxacin	0	7(100%)	0	9(100%)
Tetracycline	0	7(100%)	0	9(100%)

Table 6: The sensitivity and resistance for antibiotics for gram negative bacteria

Antibiotic	E.coli=7		Klebsiella pneumonia=9	
	Sensitive	Resistances	Sensitive	Resistances
Colistin	6(85.71%)	1(14.29%)	8(88.89%)	1(11.11%)
Teigocycline	4(57.14%)	3(42.86%)	5(56.25%)	4(43.75%)
Fosfomycin	6(85.71%)	1(14.29%)	8(88.89%)	1(11.11%)
Nitrofurantoin	1(14.29%)	6(85.71%)	1(11.11%)	8(88.89%)
Netilimycin	1(14.29%)	6(85.71%)	1(11.11%)	8(88.89%)

Table 7: Manual method for gram negative bacteria

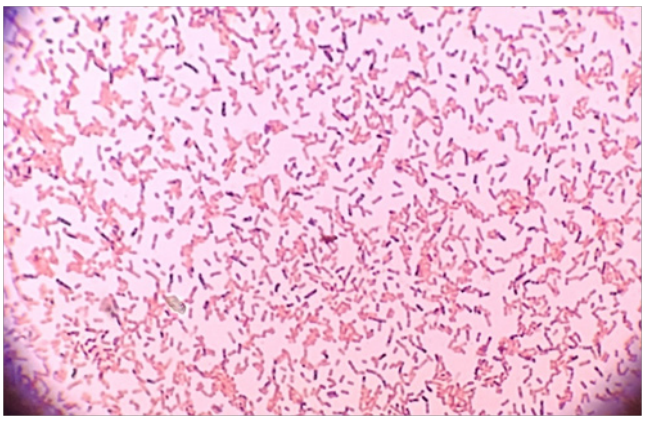


Figure 1: Gram Negative bacteria under microscope

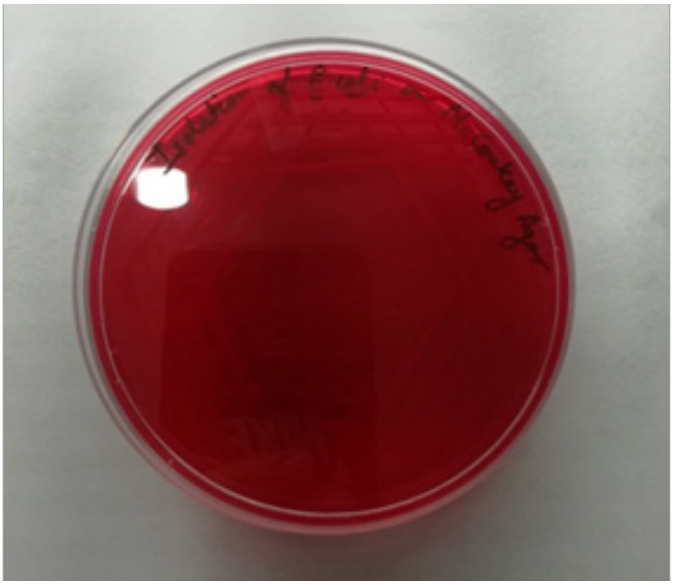


Figure 2: Growth of E.coli on MacConkey agar media

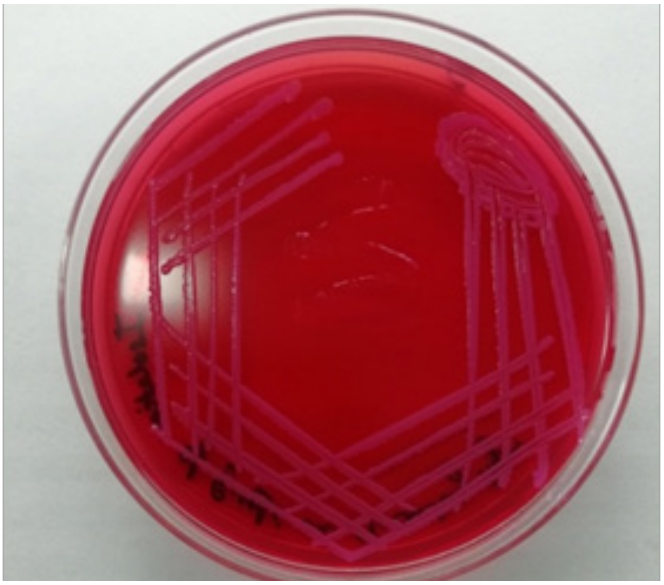


Figure 3: Growth of Klebsiella on MacConkey agar media

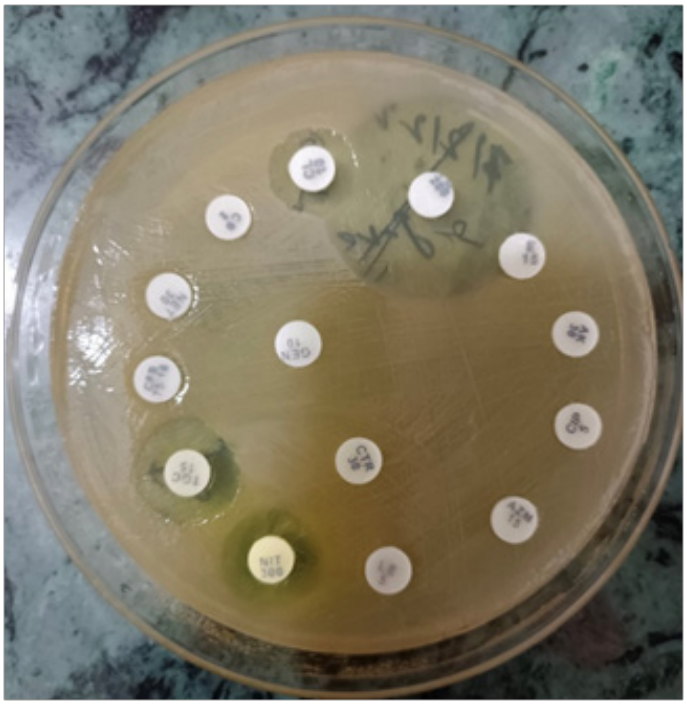


Figure 4: Sensitivity effect of Fo, Tgc, Nit, Cl on Staphylococcus aureus on mueller hinton agar media

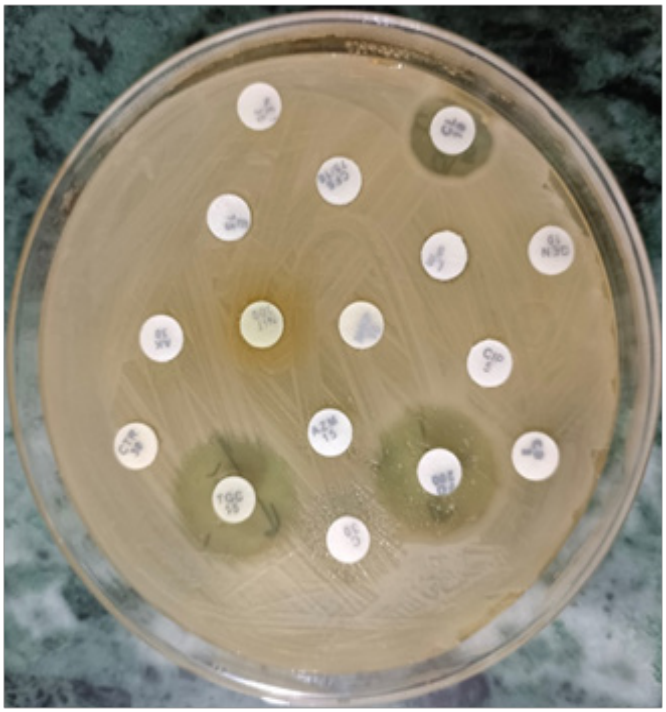


Figure 5: Sensitivity effect of Fo, Tgc, Nit, Cl on Klebsiella sp. on mueller hinton agar media

Discussion

Gram negative bacteria like E. coli and Klebsiella spp. and grame positive cocci like Staphylococcus aureus are the most prevalent causal agents of pyogenic infections. The emergence of resistance genes in such bacteria through multiple pathways is cause for worry. In our investigation, gramme negative bacteria predominated as the primary agent of pyogenic lesions, which is corroborated by Zubair et al. [7] According to Tiwari et al.[8] and Lee C Y et al.[9], Staphylococcus aureus (33.33%) is the most prevalent gramme positive isolate in our investigation. Similarly to Pramila et al.9, the prevalence of MRSA is 35.90%. According to the findings of Basu et al., Klebsiella pneumonia (16.67%) is the most prevalent gramme negative bacterial isolate. [10] The current investigation found that the male: female ratio of pus isolates was 1.58:1, which is consistent with the findings of Pappu A.K. et al. In contrast to Samra et alinvestigation, .'s [11] Staphylococcus aureus were sensitive to Teigocycline (88.89%) and Fosfomycin (88.89%). [12] An antibiotic sensitivity profile of gramme negative bacteria revealed susceptibility to

Teigocycline (57.14%) and Fosfomycin (85.71%), as previously shown by Balan et al. [13] Given the limited number of antimicrobial medicines now available or in the pharmaceutical industry's drug development pipelines to tackle these organisms, the introduction and multiplication of these highly resistant microbes identified from pus samples is quite concerning. Every effort should be made to carefully pick antibiotics, balancing the necessity for wide empirical coverage of possible bacteria with the need to conserve existing antibiotics for when they are really essential. [14]

Conclusion

Antimicrobial resistance poses a significant risk to human health. Inappropriate antibiotic usage in healthcare and animal husbandry are major contributors to antimicrobial resistance. A concerted effort from all relevant authorities to fight antimicrobial resistance in all aspects is required to prevent bacteria from becoming resistant, resulting in serious consequences for human health and the future economy.

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