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Antibiogram of Bacterial Isolates at Hail General Hospital, KSA June 1 – December 31, 2012

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Abstract: *This research study focused on the antibiogram of bacterial isolates at Hail General Hospital, Kingdom of Saudi Arabia. It sought to answer the following questions: (1) What is the percentage distribution of the isolates on the specimens when classified according to the following bacteria? Enterobacter aerogenes, Enterobacter cloacae, Escherichia coli, Klebsiella pneumoniae, Proteus spp., Pseudomonas aeruginosa, Raoultella (K.) ornithinolytica. (2) What is the antibiogram result of the bacterial isolates? Descriptive research using content analysis was employed wherein the Automated Sensitivity Testing Machine data obtained from the Microbiology section of Hail General Hospital. The statistical tools were frequency and percentage. The results revealed that based on the percentage distribution of the specimens, the highest number of isolates for Enterobacter aerogenes, Enterobacter cloacae, Klebsiella pneumoniae and Proteus spp. was from throat swab, urine for Escherichia coli and Psedomonas aeruginosa, ward swab and high vaginal swab for Raoultella (K.) ornithinolytica. On antibiogram result, the most sensitive antibiotics for Enterobacter aerogenes was Meropenem; Cirpofloxacin and Levofloxacin for Enterobacter cloacae; Imipenem for Escherichia coli; Amikacin for Klebsiella pneumoniae; Ertapenem, Imipenem and Pip/Tazo for Proteus spp.; Pip/Tazo for Pseudomonas aeruginosa, and Imipenem for Raoultella (K.) ornithinolytica. The most resistant antibiotics for Enterobacter aerogenes, Escherichia coli, Klebsiella pneumonaie and Raoultella (K.) ornithinolytica was Ampicillin; Amox/K Clav, Cefazolin and Cefoxitin for Enterobacter cloacae; Cefotaxime for Pseudomonas aeruginosa and for Proteus spp. was Cefazolin. The researchers recommend for the conduct of an annual antibiogram study by institution, disseminate the information through seminars/fora especially to clinicians, conduct another study to include other hospitals and other types of bacteria.*

Keywords: *Antibiogram, Antimicrobial sensitivity testing, Bacterial isolates, Resistant, Sensitive*

I. Introduction

The constant increase in the incidence of antimicrobial resistance has been a major public health concern. Improper treatment of infection with antibiotics has led to increase morbidity and mortality.

Antimicrobial susceptibility testing is done to determine the effective antibiotics to combat infections. This information may be used by medical practitioners, laboratory microbiologists and health professionals as a reference guide. In addition, antibiogram contribute data that aid clinicians in the experiential treatment of infections prior to the availability of antimicrobial susceptibility results. Antibiogram also present information to elevate consciousness on resistance problems and recognize prospect to decrease use of inappropriate antibiotics. These susceptibility testing reports on bacterial isolates are summarized into tables termed as antibiogram. Hospital antibiograms are commonly used to help guide empiric antimicrobial treatment and are an important component for detecting and monitoring trends in antimicrobial resistance [1].

The hospital antibiogram is a periodic summary of antimicrobial susceptibilities of local bacterial isolates submitted to the hospital's clinical microbiology laboratory. Antibiograms are often used by clinicians to assess local susceptibility rates, as an aid in selecting empiric antibiotic therapy, and in monitoring resistance trends over time within an institution. Antibiograms can also be used to compare susceptibility rates across institutions and track resistance trends. [2].

1.1 Problems of the Study

1. What is the percentage distribution of the isolates on the specimens when classified according to the following bacteria? Enterobacter aerogenes, Enterobacter cloacae, Escherichia coli, Klebsiella pneumonia, Proteus spp., Pseudomonas aeruginosa, Raoultella (K.) ornithinolytica.

2. What is the antibiogram result of the bacterial isolates?

1.2 Study Objectives

This study aims to construct an antibiogram that will provide information on the susceptibility and resistance patterns of bacterial isolates to antibiotics at Hail General Hospital.

Significantly, the study will impart data that can be used by health professionals of Hail General Hospital and government health officials in monitoring the resistance pattern of bacteria to antibiotics, in empirical treatment and infection control.

II. Research Methods

This study was conducted in Hail General Hospital – Clinical Microbiology Unit. Only Antimicrobial Susceptibility Testing reports generated from Automated Sensitivity Testing Machine for the period of June – December 2012 were utilized in order to standardize the data of the study.

Descriptive research using content analysis was used in the investigation of data. Frequency and percentage were utilized as statistical tools. Information on all bacterial isolates primarily their susceptibility patterns were analyzed and processed by SPSS 17.0 software package.

III. Presentation Of Results And Interpretation

Table 1 presents the result of percentage distribution of specimens according to bacterial isolates. Among the specimens, throat swab (26.7 %) obtained the highest percentage of Enterobacter aerogenes detected, followed by tip and blood (13.3 %) and the lowest percentage were the samples taken from eye, groin, high vaginal and ward swabs and nasal and sputum samples (6.7 %).

The specimen that obtained the highest percentage of Enterobacter cloacae, was throat swab (60 %), followed by urine (13.3 %), and the lowest were axilla, sputum, ward swab and wound (6.7 %). For Escherichia coli, urine (56.5 %) had the highest percentage, followed by throat swab (15.2 %), ward swab (8.7 %), blood and groin (4.3 %) and the lowest were the specimens coming from eye swab, high vaginal swab, tip, wound and other sites (2.2 %).

Throat swab (58.1 %) had the highest percentage of Klebsiella pneumoniae isolated, followed by urine (24.2 %), blood (6.5 %) and the lowest were the specimens taken from axilla, high vaginal swab, nasal swab, tip, ward swab, wound and others (1.6 %).

Table 1

Result of Percentage Distribution of Specimens According to Bacterial Isolates

Specimen	Enterobacter aerogenes	Enterobacter cloacae	Escherichia coli	Klebsiella pneumoniae	Proteus spp.	Pseudomonas aeroginosa	Raoutella (K.) ornithinolytica
Total Number	15	15	46	62	10	25	11
Axilla	-	(1) 6.7 %	-	(1) 1.6 %	-	(1) 4 %	-
Blood	(2) 13.3 %	-	(2) 4.3 %	(4) 6.5 %	-	(1) 4 %	-
Eye Swab	(1) 6.7 %	-	(1) 2.2 %	-	-	-	-
Groin Swab	(1) 6.7 %	-	(2) 4.3 %	-	-	-	(2) 18.2 %
High Vaginal Swab	(1) 6.7 %	-	(1) 2.2 %	(1) 1.6 %	-	-	(3) 27.3 %
Nasal Swab	(1) 6.7 %	-	-	(1) 1.6 %	-	-	-
Sputum	(1) 6.7 %	(1) 6.7 %	-	-	(1) 10 %	-	-
Throat Swab	(4) 26.7 %	(9) 60 %	(7) 15.2 %	(36) 58.1 %	(3) 30 %	(4) 16 %	-
Tip	(2) 13.3 %	-	(1) 2.2 %	(1) 1.6 %	-	(4) 16 %	-

Urine	(1) 6.7 %	(2) 13.3 %	(26) 56.5 %	(15) 24.2 %	(2) 20 %	(12) 48 %	(1) 9.1 %
Ward Swab	(1) 6.7 %	(1) 6.7 %	(4) 8.7 %	(1) 6.7 %	(1) 10 %	(1) 4 %	(3) 27.3 %
Wound	-	(1) 6.7 %	(1) 2.2 %	(1) 1.6 %	(2) 20 %	(1) 4 %	(1) 9.1 %
Rectal Swab	-	-	-	-	-	-	(1) 9.1 %
Others	-	-	(1) 2.2 %	(1) 1.6 %	(1) 10 %	(1) 4 %	-

For Proteus spp., the highest percentage isolated was from the specimen taken from throat swab (30 %), followed by urine and wound (20 %) and the least was the specimen taken from ward swab and other sites (10 %).

Among the specimens tested, urine samples (48 %) obtained the highest percentage of Pseudomonas aeruginosa detected, followed by throat swab and tip (4 %), and the lowest were samples taken from axilla, blood, ward swab, wound and other sites (4 %).

High vaginal swab and ward swab (27.3 %) had the highest percentage of Raoultella (K.) ornithinolytica isolated, followed by groin (18.2 %) and the lowest came from the specimens taken from urine, wound and rectal swab (9.1%).

Table 2.A

Sensitivity Results on Susceptibility Tests on Bacterial Isolates at Hail General Hospital June 1 – December 31, 2012

Antibiotics	Enterobacter aerogenes	Enterobacter cloacae	Escherichia coli	Klebsiella pneumoniae	Proteus spp.	Pseudomonas aeroginosa	Raoutella (K.) ornithinolytica
Total isolates	15	15	46	62	10	25	11
Amikacin	(11) 73.3%	(13) 86.7%	(40) 87 %	(58) 93.5%	(7) 70%	(9) 36%	(9) 81.8%
Amox/K Clav.	(4) 26.7%	(0) 0%	(21) 45.7 %	(43) 69.4%	(2) 20%	-	(5) 45.5%
Ampicillin	(1) 6.7%	(0) 0%	(4) 8.7 %	(2) 3.2%	(2) 20%	-	(0) 0%
Cefazolin	(4) 26.7%	(0) 0%	(16) 34.8 %	(27) 43.5%	(0) 0%	-	(4) 36.4%
Cefepime	(11) 73.3%	(13) 86.7%	(18) 39.1 %	(41) 66.1%	(5) 50%	(7) 28%	(7) 63.6%
Cefotaxime	(9) 60%	(11) 73.3%	-	-	-	(2) 8%	(5) 45.5%
Cefoxitin	(5) 33.3%	(0) 0%	(35) 76.1 %	(41) 66.1%	(3) 30%	-	(4) 36.4%
Ceftazidime	(8) 53.3%	(13) 86.7%	(19) 41.3 %	-	-	(8) 32%	(7) 63.6%
Cefuroxime	(7) 46.7%	(3) 20%	(13) 28.3 %	(33) 53.2%	(4) 40%	-	(5) 45.5%
Ciprofloxacin	(9) 60%	(15) 100%	(18) 39.1 %	(50) 80.6%	(5) 50%	(7) 28%	(6) 54.5%
Ertapenem	(11) 73.3%	(11) 73.3%	(41) 89.1 %	(53) 85.5%	(8) 80%	-	(9) 81.8%
Fosfomycin	(12) 80%	(5) 33.3%	(43) 93.5 %	(40) 64.5%	(5) 50%	-	(9) 81.8%
Gentamycin	(7) 46.7%	(12) 80%	(25)54.3%	(47) 75.8%	-	(10) 40%	(5) 45.5%
Imipenem	(13) 86.7%	(13) 86.7%	(45) 97.8%	(57) 91.9%	(8) 80%	(16) 64%	(11) 100%
Levofloxacin	(10) 66.7%	(15) 100%	(19) 41.3 %	(53) 85.5 %	(5) 50%	(8) 32%	(6) 54.5%
Meropenem	(14) 93.3%	-	-	-	-	-	-
Mezlocillin	(7) 46.7%	(8) 53.3%	(6) 13%	-	(3) 30%	(7) 28%	(3) 27.3%
Pip/Tazo	(13) 86.7%	(14) 93.3%	(38) 82.6%	(56) 90.3%	(8) 80%	(19) 76%	(10) 90.9%
Piperacillin	(7) 46.7%	(13) 86.7%	(7) 15.2%	-	(8) 80%	(12) 48%	(3) 27.3%
Tetracycline	(9) 60%	(9) 60%	(18) 39.1%	(45) 72.6%	(4) 40%	-	(4) 36.4%
Tobramycin	(7) 46.7%	(11) 73.3%	(23) 50%	(46) 74.2%	(6) 60%	(8) 32%	(5) 45.5%
Trimeth/Sulfa	-	(13) 86.7%	(10) 21.7%	(46) 74.2%	(4) 40%	-	(4) 36.4%
Tigecycline	-	(12) 80%	(38) 82.6%	(51) 82.3%	-	-	(6) 54.5%

Table 2.A presents the sensitivity results on susceptibility tests on bacterial isolates at Hail General Hospital. The table revealed that the antibiotic that showed the highest sensitivity to Enterobacter aerogenes was

Meropenem (93.3 %); followed by Imipenem and Pip/Tazo (86.7 %); Fosfomycin (80 %); Amikacin, Cefepime and Ertapenem (73.3 %) and the lowest was Ampicillin (6.7 %). This implies that Meropenem is the best antibiotic to treat infections caused by Enterobacter aerogenes.

The antibiotics that showed the highest sensitivity to Enterobacter cloacae were Ciprofloxacin and Levofloxacin (100 %); followed by Pip/Tazo (93.3 %); Amikacin, Cefepime, Ceftazidime, Imipenem, Piperacillin and Trimeth/Sulfa (86.7 %); Gentamicin and Tigecycline (80 %), Cefotaxime, Eratpenem and Tobramycin (73.3 %) and the lowest were Amox/K Clav, Ampicillin, Cefazolin and Cefoxitin (0%). This implies that Ciprofloxacin and Levofloxacin are the antibiotics of choice for the treatment of infections caused by Enterobacter cloacae.

The antibiotic that showed the highest sensitivity to Escherichia coli was Imipenem (97.8 %); followed by Fosfomycin (93.5 %), Ertapenem (89.1 %), Amikacin (87 %), Tigecycline (82.6 %), and the lowest was Ampicillin (8.7 %). This implies that Imipenem is the drug of choice for the treatment of Escherichia coli infections.

The antibiotics that showed the highest sensitivity to Klebsiella pneumoniae was Amikacin (93.5 %), followed by Imipenem (91.9 %), Pip/Tazo (90.3 %), Ertapenem and Levofloxacin (85.5 %), Tigecycline (82.3 %) and the lowest was Ampicillin (3.2 %). This implies that Amikacin is the best antibiotic to treat infections caused by Klebsiella pneumoniae.

The antibiotics that showed the highest sensitivity to Proteus spp. were Ertapenem, Imipenem and Pip/Tazo (80 %); followed by Amikacin (70 %); Tobramycin (60 %); Cefepime, Ciprofloxacin, Fosfomycin and Levofloxacin (50 %) and the lowest was Cefazolin (0 %).. This implies that Proteus spp. responds best to the antibiotics Ertapenem, Imipenem and Pip/Tazo.

The antibiotic that showed the highest sensitivity to Pseudomonas aeruginosa was Pip/Tazo (76 %), followed by Imipenem (64 %) , and the lowest was Cefotaxime (8 %). This implies that Pip/Tazo is the best antibiotic to treat infection caused by Pseudomonas aeruginosa.

The antibiotic that showed the highest sensitivity to Raoultella (K.) ornithinolytica was Imipenem (100 %); followed by Pip/Tazo (90.9 %); Amikacin, Ertapenem and Fosfomycin (81.8 %); Cefepime and Ceftazidime (63.6 %); Ciprofloxacin, Levofloxacin and Tigecycline (54.5 %) and the lowest was Ampicillin (0 %). This implies that Imipenem is the drug of choice for the treatment of Raoultella (K.) ornithinolytica infections.

Table 2.B presents the resistant results on susceptibility tests on bacterial isolates at Hail General Hospital. The table revealed that the antibiotic with the highest resistance to Enterobacter aerogenes was Ampicillin (93.3 %), while the lowest resistance were antibiotics Imipenem, Meropenem and Pip/ Tazo (6.7 %). This implies that Enterobacter aerogenes developed the ability to resist the effects of Ampicillin antibiotics.

The antibiotics with the highest resistance to Enterobacter cloacae were Amox/K Clav,Cefazolin and Cefoxitin (100 %) and the lowest resistance were Ciprofloxacin, Levofloxacin and Pip/Tazo (0%). This implies Enterobacter cloacae has the ability to resist the effect of the antibiotics Amox/K Clav, Cefazolin and Cefoxitin.

The antibiotic that showed the highest resistance to Escherichia coli was Ampicillin (91.3 %) and the lowest were Imipenem and Pip/Tazo (2.2 %). This implies that Escherichia coli has the ability to resist the effects of Ampicillin.

The highest resistance to Klebsiella pneumoniae was Ampicillin (87.1 %) and the lowest was Pip/Tazo (0 %). This implies that Klebsiella pneumoniae has the ability to resist the effects of Ampicillin antibiotics.

The highest resistance to Proteus spp. was Cefazolin (100 %) and the lowest was Amikacin (10 %). This implies that Proteus spp. has the ability to resist the effects of Cefazolin.

The antibiotic that showed the highest resistance to Pseudomonas aeruginosa was Cefotaxime (80 %) and the lowest resistance was Pip/Tazo (24 %). This implies that Pseudomonas aeruginosa has the ability to resist the effects of Cefotaxime.

Table 2.B

Resistant Results on Susceptibility Test on Bacterial Isolates at Hail General Hospital

Antibiotics	Enterobacter aerogenes	Enterobacter cloacae	Escherichia coli	Klebsiella pneumoniae	Proteus spp.	Pseudomonas aeroginosa	Raoutella (K.) ornithinolytica
Total isolates	15	15	46	62	10	25	11
Amikacin	(3) 20%	(1) 6.7%	(2) 4.3%	(4) 6.5%	(1) 10%	(15) 60%	(1) 9.1%
Amox/K Clav.	(10) 66.7%	(15) 100%	(12) 26.1%	(14) 22.6%	(4) 40%	-	(6) 54.5%
Ampicillin	(14) 93.3%	(13) 86.7%	(42) 91.3%	(54) 87.1%	(7) 70%	-	(11) 100%

Cefazolin	(11) 73.3%	(15) 100%	(29) 63%	(32) 51.6%	(10) 100%	-	(7) 63.6%
Cefepime	(4) 26.7%	(1) 6.7%	(27) 58.7%	(21) 33.9%	(5) 50%	(14) 56%	(3) 27.3%
Cefotaxime	(6) 40%	(1) 6.7%	-	-	-	(20) 80%	(4) 36.4%
Cefoxitin	(10) 66.7%	(15) 100%	(11) 23.9%	(21) 33.9%	(7) 70%	-	(7) 63.6%
Ceftazidime	(6) 40%	(1) 6.7%	(24) 52.2%	-	-	(17) 68%	(3) 27.3%
Cefuroxime	(7) 46.7%	(10) 66.7%	(32) 69.6%	(23) 37.1%	(6) 60%	-	(6) 54.5%
Ciprofloxacin	(6) 40%	(0) 0%	(27) 58.7%	(9) 14.5%	(5) 50%	(18) 72%	(5) 45.5%
Ertapenem	(4) 26.7%	(2) 13.3%	(4) 8.7%	(6) 9.7%	(2) 20%	-	(2) 18.2%
Fosfomycin	(3) 20%	(10) 66.7%	(3) 6.5%	(22) 35.5%	(5) 50%	-	(2) 18.2%
Gentamycin	(8) 53.3%	(3) 20%	(21) 45.7%	(14) 22.6%	-	(15) 60%	(6) 54.5%
Imipenem	(1)6.7%	(2) 13.3%	(1) 2.2%	(4) 6.5%	(2) 20%	(7) 28%	(0) 0%
Levofloxacin	(5) 33.3%	(0) 0%	(27) 58.7%	(5) 8.1%	(5) 50%	(17) 68%	(5) 45.5%
Meropenem	(1) 6.7%	-	-	-	-	-	-
Mezlocillin	(6) 40%	(2) 13.3%	(38) 82.6%	-	(6) 60%	(17) 68%	(7) 63.6%
Pip/Tazo	(1) 6.7%	(0) 0%	(1) 2.2%	(0) 0%	(1) 10%	(6) 24%	(1) 9.1%
Piperacillin	(6) 40%	(2) 13.3%	(38) 82.6%	-	(6) 60%	(13) 52%	(6) 54.5%
Tetracycline	(6) 40%	(1) 6.7%	(26) 56.5%	(14) 22.6%	(6) 60%	-	(7) 63.6%
Tobramycin	(7) 46.7%	(3) 20%	(21) 45.7%	(16) 25.8%	(4) 40%	(17) 68%	(6) 54.5%
Trimeth/Sulfa	-	(2) 13.3%	(27) 58.7%	(16) 25.8%	(6) 60%	-	(7) 63.6%
Tigecycline	-	(3) 20%	(5) 10.9%	(9) 14.5%	-	-	(4) 36.4%

The highest resistance antibiotic to Raoultella (K.) ornithinolytica was Ampicillin (100 %) and the lowest was Imipenem (0 %). This implies that Raoultella (K.) ornithinolytica has developed the ability to resist the effects of Ampicillin.

IV. Discussion

Microbes are ubiquitous in nature. Some may be considered as normal flora and commensals of the human body, however, they become opportunistic pathogens to immunocompromised and unhealthy individuals. Bacteria surmount innate host immunity and antimicrobial resistance continues to increase worldwide.

Many microorganisms have been implicated in human infections leading to morbidity and mortality. Gram negative organisms such as Klebsiella pneumonia is incriminated in nosocomial infections and in spectrum of clinical syndromes such as pneumonia, bacteremia, urinary tract infections, upper respiratory tract infections, meningitis and wound infection [3], Enterobacter cloacae and Enterobacter aerogenes are responsible for lower respiratory tract infection, skin and soft tissue infections, urinary tract infection, endocarditis, osteomyelitis and ophthalmic infection [4], Pseudomonas aeruginosa, a frequent cause of nosocomial and acute fulminant infections such as bacteremia, pneumonia, sepsis, burn wound infections, meningitis and urinary tract infections (CDPH, 2011), Proteus spp. is implicated in pyelonephritis , splenomegaly, hepatic lesions, and fibrinopurulent exudates (CLRI, 2009) and Escherichia coli, one of the most frequent causes of many common bacterial infections, including cholecystitis, urinary tract infections, traveler's diarrhea and other clinical infections (Madappa, 2012) are some of the medically important microorganisms [5] .

Many studies on antibiogram have been undertaken from different perspective of healthcare including its application in other fields of science. [6] Hindler et.al (2007) made a study on analysis and presentation of cumulative antibiograms to provide guidance to clinical laboratories in the preparation of a cumulative antibiogram. [7] El-azizi et al (2005) found out that many laboratories are unaware of the CLSI guideline and the laboratories that use the documents find it difficult to adhere to all recommendations and lack microbiology supervisor with insight in the clinical relevance of the results they generate.

Furthermore, studies on the resistance patterns of medically important bacteria gain insights and attention because of its significant implications in combating infections. A retrospective study was conducted at Van Training and Research Hospital to analyze the bacterial isolates from the wounds of patients admitted to the Burn unit and to determine the susceptibility patterns of the commonly cultured organisms. Tigecycline and colistin were found to be the most active drugs against Acinetobacter baumannii. Carbapenems and amikacin were found to be the most active drugs against other gram negative bacteria. Vancomycin and linezolid were active against gram positive bacteria [8].

[9].A study made by Orhue et.al (2012) on 347 healthy females ages 16-30 years who were randomly selected and screened for Staphylococcus, a normal flora, in the nostrils. The antibiogram typing showed that strain 0534135 was most sensitive while the most resistant strain was 00500015. The isolates were all sensitive to Gentamycin (100%). While Ampiclox (0%) and the Penicillin's (Amoxicillin, Ampicillin and Cloxacillin)

(0%) had no strain showing sensitivity. Lister et.al (2009) made a study on the antibacterial resistant Pseudomonas aeruginosa because of its ability to rapidly develop resistance during the course of treating an infection and the relevance of the chromosomally encoded AmpC cephalosporinase, the outer porin OprD and the multidrug efflux pumps to therapeutic challenge [10]..

V. Conclusion

Based on the findings of the study, throat swab specimen had the highest number of bacterial isolates. The highest percentage of bacteria such as Enterobacter aerogenes, Enterobacter cloacae, Klebsiella pneumoniae and Proteus spp. were isolated from throat swab; the highest percentage of Escherichia coli and Pseudomonas aeroginosa were isolated from urine samples and Raoultella (K.) ornithinolytica from high vaginal swab and ward swab.

The bacterial isolates such as Enterobacter aerogenes showed high sensitivity to Meropenem; Enterobacter cloacae showed high sensitivity to Ciprofloxacin and Levofloxacin; Escherichia coli showed high sensitivity to Imipenem; Klebsiella pneumoniae was highly sensitive to Amikacin; Proteus spp. showed high sensitivity to Ertapenem, Imipenem and Pip/Tazo; Pseudomonas aeroginosa was highly sensitive to Pip/Tazo and Raoultella (K.) ornithinolytica showed high sensitivity to Imipenem.

On the other hand, Enterobacter aerogenes, Escherichia coli, Klebsiella pneumoniae, Raoultella (K.) ornithinolytica showed the highest resistance to Ampicillin; Enterobacter cloacae was highly resistant to Amox/K Clav, Cefazolin and Cefoxitin; Proteus spp. showed the highest resistance to Cefazolin and Pseudomonas aeroginosa was highly resistant to Cefotaxime. It showed that many bacteria exhibits resistance to some commonly prescribed antibiotics.

The researchers recommend for the conduct of an annual antibiogram study by institution, disseminate the information through seminars/fora especially to clinicians, conduct another study to include other hospitals and other types of bacteria.

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