Development of Antibigram for Evaluation of Antibiotic Resistance Pattern in Tertiary Care Teaching Hospital: a Cross Sectional Study

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Abstract

Background: Antimicrobial resistance threatens the effective prevention and treatment of increasing number of cases of antibiotic resistance worldwide. So there is need of effective implementation of the treatment strategy to rationalize the antimicrobial use in the treatment of infectious disease. So the present study is aims to attempts to find the local antibiotic resistance, various microorganism responsible for infection using the antibiogram in the tertiary care teaching hospital.

Methods: A cross-sectional study was carried out to check the Antibiotic resistance pattern based on the inclusion and exclusion criteria at Parul Sevasharam Hospital, Vadodara, Gujarat. Total 150 patients were included in study, culture sensitivity test and bacterial identification was done as per the microbiology department standard guidelines. Patient's data regarding to demographic details, culture sensitivity test results and prescribed antibiotics was collected for 6 months' duration from October 2019 to March 2020.

Results: Total 150 samples were collected throughout the study period of six months in the various departments in the hospital. The main finding of our study, greater resistance found in Ceftriaxone (78%), Meropenem (71%), Azithromycin (66%), linezolid (66%), Amoxicillin+clavulanic acid (63%), Ciprofloxacin (56%) of patients in these antibiotics. Greater susceptibility was found in Clindamycin (75%), Amikacin (65%), Piperacilline+tazobactam (62%), Cefoperazone (48%), ciprofloxacin (44%) of the patients. During our study, 20 antibiotics were commonly prescribed out of which ceftriaxone was most commonly prescribed in our study and which was found to most resistant in patient population. The most common bacteria identified in our study was gram negative bacteria in that E. Coli, Pseudomonas Aeruginosa and Klebsiella Pneumoniae was most commonly isolated.

Conclusion: This study shows that there is increasing cases of antibiotic resistance identified in the hospital. Ceftriaxone is found to be most resistant in our study. So there is need of effective treatment strategies and use of antibiogram to find out the local antibiotic resistance pattern and to develop antibiotic policy for the safe use of antibiotic which is helpful for to reduce the antibiotic resistance.

Background

Currently antibiotic resistant is major global health problem which is responsible for major death due to infectious disease worldwide. Antibiograms are the important tool for healthcare providers which showing how various microorganisms are resistant and susceptible to antibiotics used in the hospital. Antibiogram is very useful for physician for selecting appropriate empirical antibiotic treatment and selection of individual patient antibiotic treatment. Thus beneficial for to reduce antibiotic resistance, improving antibiotic treatment effectiveness, reduce total healthcare cost. ^[1]

Antibiogram will be used to monitor hospital antimicrobial resistance trends in various bacterial species and identify most commonly found bacterial in hospital. It can also be used to study the epidemiology of resistance and evaluate the efficacy of new antibiotics. Antimicrobial resistance (AMR) has emerged as a major risk to public as health survey shows 10 million deaths annually by 2050 mainly due to Antibiotic resistance. India carries one of the largest burdens of drug-resistant pathogens all over world. ^[2] Antimicrobial resistance (AMR) a growing public health concern where the microorganism is able to survive exposure to antibiotic treatment. In India the cases of antibiotic resistance increasing due to irrational use of antibiotic. ^[3] Various guidelines are developed by the Clinical and Laboratory Standard Institute (CLSI) to standardize methods used to develop antibiograms. These guidelines can be combined into the WHONET software for analysis of various data. In antibiogram the results are calculated by measuring minimum inhibitory concentrations (MICs) or growth inhibition zone diameters around disks, and then converted into susceptibility categories according the clinical breakpoints which are defined by various committees. ^[4]

Antibiotic susceptibility testing (AST) is used to select effective dose of antibiotic and an empirical therapy is formulated to maintain patient's health against disease state condition. When any bacterial disease has caused a problem then isolation of suitable culture from patient, identification of the microbes done by using various method of bacterial identification. ^[5] The cut off points are established by the Committees of the Clinical and Laboratory Standards Institute in the United States (CLSI) and by the European Committee on Antimicrobial Susceptibility Testing in Europe (EUCAST) both for inhibition of halo values as in the MICs to differentiate the clinical categories of the treatment (EUCAST-2008) ^[6]. These categories have been defined as success or therapeutic failure in the following manner by CLSI and EUCAST: Susceptible, Intermediate and Resistant. ^[7]

Antimicrobial stewardship includes selection of an appropriate antimicrobial agent and then optimizes its dose and duration to cure an infection while minimizing the toxicity and conditions for selection of resistant bacterial strains. ^[8, 9]. Many pharmacists in clinical practice have establishes roles as expertise in multidisciplinary AMS team along with microbiologists and infection-specialist physicians which are conventionally responsible for providing advice on management of infection in the UK ^[10, 11]. So Antimicrobial stewardship program is very beneficial for reducing antibiotic resistance and development of antibiogram is one of main stage in the implementation of antimicrobial stewardship program. Therefore, the present study was planned to find out resistance and sensitivity pattern of bacteria to antibiotics used in the hospital and to study the usage pattern of antibiotics in tertiary care hospital.

Material And Methods

Data Source:

A cross sectional study was conducted for period of six months from October 2019 to March 2020 in various department of ParulSevashram Hospital is tertiary care teaching hospital located in Vadodara, Gujrat. The main aim of the study is to find out the local antibiotic resistance pattern by using Antibigram. Patients who are on antibiotic treatment and who have gone through the culture sensitivity test were included in study as per the inclusion and exclusion criteria. The study approved by Institutional Human Ethics Committee with Registration Number **PUIECHR/PIMSR/00/081734/2310**. The study was explained to the patients enrolled in the study emphasizing the benefits of the study as well as the outcomes. The signed informed consent was taken from the patient or from the relative in case of special population. After obtaining informed consent from patient the data was collected and reported in the data collection form and information like patient demographic details, diagnosis, antibiotic given, culture sensitivity details regarding resistance and susceptibility data was collected from patients file.

Data analysis:

Data of the patients was analyzed to evaluate the resistance pattern of antibiotics in the hospital, to find out gram negative and gram-positive organism bacterial isolates and overall antibiotic resistance using antibiogram. Data entry was done from data collection form to Microsoft Excel 2007 Program. Descriptive statistics were used to present the results of study.

Results

Patient Demographic details:

In the study duration, 150 patients were enrolled in the study and out of total patients 73% were adults, 16% were elderly and 11% were children **Fig 1**. In our study, most of the patients were adult as compare to children and elderly patients as culture sensitivity test mostly performed in adult patient. Out of total patients, 100 males and 50 female patients were included in the study. The demographic details were of study participant detailed in **Table no.01**

Distribution Of Bacterial Isolates And Culture:

A total 150 culture sensitivity reports were collected in this study period, and among them urine (40%) was the commonly received samples followed by pus (33%), blood (14%) and sputum (8%). Urine samples showed a culture positivity of 40% with 65 bacterial isolates. E. coli (34) was mostly isolated. Pus samples showed a culture positivity of 33% with 53 bacterial isolates and Pseudomonas Aeruginosa (14) was the prominent isolate from the pus samples and blood samples showed a culture positivity of 14% with 23 bacterial. Sputum samples showed a culture positivity of (8%). E. coli (3) and Pseudomonas Aeruginosa (3) were the prominent bacterial isolates. During our study most commonly, isolated type of bacterial species was gram-negative organism in that E. Coli, Pseudomonas Aeruginosa and Klebsiella Pneumoniae was most commonly isolated, in gram positive bacteria is S Aureus was found to most commonly isolated. E. coli was mostly isolated in urine sample and Pseudomonas Aeruginosa & Klebsiella Pneumoniae was mostly isolated in pus. The details of various bacterial species isolated and number of bacterial species isolate in each culture detailed in **Figure. 3**

Antibiotic Usage In Study Population

In our study period, almost 20 types of antibiotic were prescribed in that most commonly used antibiotics were found to be Ceftriaxone, Cefoperazone plus sulbactam, Amoxicillin and clavulanic acid and piperacillin. In our study most of the antibiotic resistance was found to be in third generation cephalosporin antibiotics. The details of antibiotic usage given in **Fig. 4**

Antibiotic Resistance And Susceptibility Pattern

Table 2 which gives information about During our study, the resistance rate was found to be more than susceptibility rate and study shows that resistance rate of various bacteria to various antibiotics is increasing. (**Fig. 2**) amongst which the most prescribed antibiotic was found to be Ceftriaxone (23%), Amoxicillin /clavulanic acid (19%), Cefoperazone/Sulbactam (10%) and Amikacin (7%). In our study most resistant antibiotic was found to be Ceftriaxone (78%) followed by Meropenem (71%), Azithromycin (66%), Linezolid (66%), Amoxicillin/Clavulanic acid (63%) and highest sensitivity was shown to Clindamycin (75%), Amikacin (65%), Piperacillin/tazobactam (62%), Cefoperazone (48%) and Ciprofloxacin (44%).

The antibiotic resistance data was presented department wise in **Fig. 5,6,7** most of the cases were from these departments.

In our study, ceftriaxone was found to be most widely used and highly resistant antibiotic through the study periods. The antibiotic resistance and susceptibility data is represented in **Fig. 8**

Table 3 shows the detailed antibiogram developed using 150 patients culture sensitivity test results, which give information regarding most resistant and susceptible antibiotic in the study. In our study ceftriaxone was found to be most resistant antibiotic and clindamycin was found to be most susceptible antibiotic. So this antibiogram which helps to find out the resistance and susceptibility pattern of various antibiotics and useful for the selection of antibiotic to individual patients.

Discussion

The current study is mainly focusing on to find out the resistant rate in the hospital using Antibiogram and to find out the common bacterial isolates, which are responsible for infectious disease in the hospital. Currently antimicrobial resistance is increasing and in this condition each hospital has to develop its own Antibiogram, which is useful for developing antibiotic policy and it, is one of the integral parts of antimicrobial stewardship program.

In our study period during six-month 150 patients were enrolled according to the inclusion criteria. In general, the study results show there is high usage of third generation cephalosporin antibiotic in hospital and same antibiotic class found to most resistant during our study.

In gender wise distribution as 66.6% of total population was male and 33.3% of total population were female and similar study was conducted by Qadeer et al., 2016^[12] where 56.6% were males and 43.3% were female patient were found. Therefore, study data shows that the male was most exposed population to the antibiotic than female.

Our study shows that ceftriaxone was found to most resistance antibiotics to most of the bacteria and clindamycin and Amikacin was found to most susceptible antibiotic in our study. One study was conducted by Thakur P, et al., 2012^[13] they also found that amikacin was found to be most susceptible antibiotic in the study and found to be most effective and susceptible antibiotic. In another study conducted by Soman N et al ^[14] reported that increased cephalosporin prescribing practice, which may result in antibiotic resistance, and there is need of strict monitoring of cephalosporin antibiotic usage in hospital.

In our study for isolation and identification of bacteria, various samples were used in that most of the microorganism was isolated in urine, blood, pus, sputum, swab respectively. It was found that sample from urine (N = 65); blood (N = 23), pus (N = 53) and sputum (N=16) number of bacteria were isolated using various sample. In our study E. coli was mostly isolated in urine sample and Pseudomonas aeruginosa is most commonly found in pus and a similar study was conducted from Tripura shows the high rate of isolation of Pseudomonas aeruginosa from sputum (Debnat j. et al., 2019)^[15]

E. coli is mostly responsible for the UTI and it is found to be mostly resistant to the ciprofloxacin as it the main antibiotic used in treatment of UTI. In our study, out of the total bacterial isolates, gram-negative bacteria were more prevalent than were gram-positive bacteria. This predominance of gram-negative bacteria is in concordance with the findings of the similar study conducted (Qadeer et al. 2016) ^[12] and result showed lower resistance in E. coli. According to Saravanan R. et al., 2013^[16] E. coli was found to be the most common and highly resistant organism.

In our study E. coli was found to be the most common and resistant bacteria followed by pseudomonas aeruginosa, klebsiella spp and S. Aureus, Klebsiella pneumonia were isolated and found most resistant bacteria in our study. Various studies have reported varying range of E. coli isolation; while Gupta P et al., 2018^[17], Eshwarappa et al., 2011^[18] and Bency et al., 2017^[19] reported most common isolation of E. coli. Now currently there is increasing cases of E. coli resistance to fluoroquinolone antibiotic and in our study 50% cases of E. coli was found to be resistant to ciprofloxacin which is alarming feature so to use antibiotics very cautiously to prevent antibiotic resistance.

During our study, 20 antibiotics were prescribed to the study population and out of which 58% (138) times antibiotics came resistant to one of the bacteria and susceptible rate was found to be 42% (98). Ceftriaxone was found to be most widely utilized antibiotic in our study. Bilal Bin Y. et al., 2015^[20] reported the consumption of ceftriaxone was more and most prescribed antibiotics in medicine and surgery ward which is similar to our findings where ceftriaxone was had highest share of prescriptions which is about 24 percentage. Baidya S. et al., 2017^[21] reported Ceftriaxone (36.3%), Amoxicillin + clavulanic acid (13.5%) and amikacin (10.7%) were most frequently prescribed. The Kathmandu Valley study reported that cephalosporins were the most commonly prescribed antibiotic followed by penicillins. Among cephalosporins, ceftriaxone was frequently prescribed (Palikhe N. et al., 2004) ^[22].

The Tripura study reported that (Debnat j. et al., 2019) ^[15] Higher level of resistance was observed with Gentamicin (60.7%), Amikacin (42%), Ciprofloxacin (46%), Levofloxacin (42%) and Nitrofurantoin. In our study Ceftriaxone, meropenam, azithromycin, linezolid, amoxicillin + clavulanic acid was found to be most resistant. Thakur P, et al., 2012^[13] reported that amikacin was found to showed the highest susceptibility of 96.25% followed by nitrofurantoin, gentamicin, cefotaxime and ceftazidime with 92.5%, 77.5%, 72.5% and 71.25% respectively. In our study Clindamycin (75%), amikacin (65%), piperacillin + tazobactam (62%), cefoperazone (48%), ciprofloxacin (44%) were found to be most susceptible.

Conclusion

The antibiotic resistance is increasing globally, so we need to use antibiotic and available resources cautiously to prevent antibiotic resistance. In this study, most of the antibiotics were resistant to various bacterial species. Therefore, there is, need of suitable system in hospital to track the antibiotic

resistance regularly and based on that every hospital has to develop antibiotic policy for physician that is used for prescribing antibiotic to patient. There is need of strict implementation of antimicrobial stewardship program to evaluate and prevent antibiotic resistance and need of culture sensitivity based Antibiogram developed by microbiology department.

Declarations

Ethical approval and consent to participants

The study was approved by Human Institutional Ethics Committee of ParulSevashram Hospital, Vadodara, Gujrat, India with Registration Number PUIECHR/PIMSR/00/081734/2310.

Consent for publication

Before collecting data from patients signed informed consent form was taken from each patient and study was explained to each patients.

Availability of data and materials

The data is available with corresponding author and microbiology department in the hospital.

Competing interest

The author declares that they have no competing interests.

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Not applicable

Author contributions

All authors contributed in the development of manuscript and all author read and approved the final manuscript. Firdosh Mansuri, Mukesh Nath and Madhuri Chaudhari collected the patient data, Dr. Anant Marathe helped in collection of culture sensitivity results of patients. Manoj Dikkatwar and Dr. Jitendra Vaghasiya developed concept, research design for to carry out study.

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References

1. Kumari H, Dusi H, et al., A Cumulative Antibiogram for a Period of one year and its Analysis in a Tertiary Care Hospital JMSCR, 2019, Vol 07, Issue 06, Page 996-1006.
2. Joshi Hospitalantibiogram: A necessity. Indian Journal of Medical Microbiology. 2010;28(4):277-80.
3. Raghunath D. Emerging antibiotic resistance in bacteria with special reference to India. J Biosci 2008; 33:593-603.
4. Lacy, Melinda & Klutman, N.E. & Horvart, Rebecca & Zapantis, Antonia et al., Antibiograms: New NCCLS Guidelines, development, and clinical application. Hospital Pharmacy, 2004, <https://doi.org/10.1177%2F001857870403900608>.
5. Zeeshan A. Khan, Mohd F. Siddiqui and Seungkyung Park Et al. Current and Emerging Methods of Antibiotic Susceptibility Testing. Diagnostics 2019, 9, 49; doi:10.3390/diagnostics9020049
6. European Committee on Antimicrobial Susceptibility Testing 2008. <http://www.eucast.org/fileadmin/src/>
7. Canton R. et al. Interpretive reading antimicrobial susceptibility: a clinical need. Infect Microbiol Dis Clin. 2010; 28(6):375–85, doi: 10.1016/j.eimc.2010.01.001. Epub 2010 Apr 9.
8. Davies SC. et al, Annual report of the chief medical officer, volume two, 2011: infections and the rise of antimicrobial resistance. Department of Health (London), 2013, May 11; 381(9878):1606-9.
9. Gilchrist M, Wade P, Ashiru-Oredope A et al. Antimicrobial stewardship from policy to practice: experiences from UK antimicrobial pharmacists. Infect Dis Ther 2015; 4(Suppl 1):51–64. doi: 10.1007/s40121-015-0080-z
10. Ashiru-Oredope D, Budd EL, Bhattacharya A Et al. Implementation of antimicrobial stewardship interventions recommended by national toolkits in primary and secondary healthcare sectors in England: J Antimicrob Chemother 2016; 71(5):1408–1414. doi: 10.1093/jac/dkv492
11. Dixit A, et al., Antimicrobial resistance: Progress in the decade since emergence of New Delhi metallo- β -lactamase in India. Indian J Community Med 2019; 44:4-8, doi: 10.4103/ijcm.IJCM_217_18.
12. Qadeer A, Akhtar A, Ain Q, et al. (September 29, 2016) Antibiogram of Medical Intensive Care Unit at Tertiary Care Hospital Setting of Pakistan. Cureus 8(9): e809. DOI 10.7759/cureus.809.

13. Thakur, P, Ghimire, P, Rijal, K., & Singh, G. (2013). Antimicrobial resistance pattern of *Escherichia coli* isolated from urine samples in patients visiting tertiary health care centre in Eastern Nepal. *Sunsari Technical College Journal*, 1(1), 22-26. <https://doi.org/10.3126/stcj.v1i1.8657>
14. Nikki Soman, Bijoy Kumar Panda¹, J. K. Banerjee, Shinu Mary John, A study on prescribing pattern of cephalosporins utilization and its compliance towards the hospital antibiotic policy in surgery ward of a tertiary care teaching hospital in India, *IntSurg J*. 2019 Oct;6(10):3614-3621, DOI: <http://dx.doi.org/10.18203/2349-2902.isj20194413>
15. Debnath J, Saha A, et al., Antibiotic Susceptibility Pattern in Clinical Isolates of *Pseudomonas aeruginosa* from a Tertiary Care Hospital of Tripura, *Int.J.Curr.Microbiol.App.Sci* (2019) 8(3): 291-298.
16. Saravanan R ,Raveendaran V, et al., Antimicrobial resistance pattern in a tertiary care hospital: An observational study June 2013-August 2013; *J Basic ClinPharm*.doi: 10.4103/0976-0105.118797.
17. Gupta P, Gupta K,, the Profile of Uropathogens and their Antibiotic Susceptibility in IPD Adults in a Tertiary Care Hospital in North India *ISSN: 2319-7706* Volume 7 Number 06 (2018), <https://doi.org/10.20546/ijcmas.2018.706.374>.
18. Eshwarappa, M, Dosegowda, et al.,2011. Clinicomicrobiological profile of urinary tract infection in south India. *Indian J. Nephrol.*, 21(1): 30–36.
19. Bency JAT, Priyanka R, et al, A study on the bacteriological profile of urinary tract infection in adults and their antibiotic sensitivity pattern in a tertiary care hospital in central Kerala, India. *Int J Res Med Sci* 2017; 5: 666-9, DOI: [18203/2320-6012.ijrms20170171](https://doi.org/10.18203/2320-6012.ijrms20170171)
20. Bilal Bin Y, RozinaA,, A Study of Unnecessary Use of Antibiotics at a Tertiary care hospital: Urgent need to implement antimicrobial stewardship programs Vol 7, Issue 4 Oct-Dec 2015, DOI: 10.5530/jyp.2015.4.5.
21. Baidya S, Hazra A, et al., A study of antimicrobial use in children admitted to paediatric medicine ward of a tertiary care hospital 2017 Jan-Feb; 49(1): 10–15.
22. Palikhe N. et al., Prescribing pattern of antibiotics in paediatric hospital of Kathmandu, Valley. *J Nepal Health Counc*. 2004; 2:31–6.

Tables

Table no.1 Demographic details of patient

1.1 AGE WISE DISTRIBUTION OF PATIENT		
	No. of Patient	Percentage (%)
Children (below 18 year)	16	11
Adult (18-65 years)	110	73
Elderly (more than 65 years)	24	16
1.2 GENDER WISE DISTRIBUTION		
Male	100	67%
Female	50	33%

Table No. 2 Antibiotic Resistance and Susceptibility Pattern

SL. NO	ANTIBIOTIC	R	S	Total
1	Amikacin	6	11	17
2	Ceftriaxone	44	12	56
3	Amoxicillin + Clavulanic acid	29	17	46
4	Piperacillin + Tazobactam	5	8	13
5	Levofloxacin	3	2	05
6	Azithromycin	4	2	06
7	Linezolid	6	3	09
8	Meropenem	5	2	07
9	Cefoperazone + Sulbactam	12	11	23
10	Gentamycin	1	2	03
11	Cefixime	6	5	11
12	Ciprofloxacin	9	7	16
13	Cefotetan	1	0	01
14	Clindamycin	2	6	08
15	Metronidazole	2	4	06
16	Nitrofurantoin	0	3	03
17	Cefotaxime	1	2	04
18	Colistin	1	0	01
19	Ofloxacin	1	0	01
20	Ampicillin	1	0	01
TOTAL		138	98	236

Table no. 3 Antibigram of most commonly found bacteria in Hospital

Antibiotics	E. coli		P.Auriginosa		Klebsellaspp		K.Pneumoniae		Acinobacter baumanni		Enterobacter Cloacae		S. Aureus	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S
Ceftriaxone	10	5	4	1	6	4	11	1	0	0	1	1	3	1
Cefixime	1	1	0	0	1	2	0	1	0	0	0	0	0	0
Cefoperazone+salbactam	2	2	2	4	0	0	0	0	2	0	1	0	1	2
Cefotaxim	0	0	1	0	0	0	0	0	0	0	1	1	0	0
Cefotetan	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Amikacin	3	2	0	2	1	0	2	2	0	0	0	0	1	1
Gentamicin	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Amoxicillin+clavulanic acid	8	3	4	4	2	0	12	2	2	2	0	1	2	1
Ampicillin	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Piperacilline+tazobactam	3	1	1	3	0	0	0	0	0	0	0	0	0	0
Ofloxacin	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ciprofloxacin	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Levofloxacin	0	0	0	1	0	0	3	0	0	0	0	0	0	0
Azithromycin	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Clindamycin	1	3	0	1	0	0	1	1	0	0	0	0	0	1
Linezolid	1	0	0	1	0	0	0	2	0	0	1	0	1	1
Megazolid	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meropenem	2	2	0	0	0	0	0	2	0	0	0	0	0	0
Metronidazole	1	1	0	0	0	0	0	0	0	0	0	0	0	1
Vencomycin	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colistin	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrofurantoin	1	1	0	0	0	0	0	2	0	0	0	0	0	0

Figures

Figure 1

Patient age wise distribution

Figure 2

Resistance and Susceptibility rate in study.

Figure 3

Various bacterial isolated in different cultures

Figure 4

Antibiotic usage pattern in the hospital

Figure 5

Antibiotic Resistance Pattern in General Medicine Ward

Figure 6

Antibiotic Resistance Pattern in General ICU Ward

Figure 7

Antibiotic Resistance Pattern in General Surgery Ward

Figure 8

Overall antibiotic resistance and susceptibility pattern to various antibiotics