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Research Article

Antibiotic Susceptibility Pattern of Gram Negative Clinical Isolates in a Teaching Tertiary Care Hospital

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Abstract: The study was undertaken over a period of 10 months at the department of Microbiology in a tertiary care hospital, Chennai. Gram negative clinical isolates of out-patients and in-patients who were admitted to different wards and ICU at our hospital were taken for our study. The clinical data was obtained from the respective units and wards of the patients. Two hundred and twenty gram negative isolates from various clinical specimen like pus, urine, blood etc. and the antibiotic susceptibility were studied. Majority of the gram negative organisms isolated were found to be sensitive to Amikacin, Imipenem, Piperacillin+Tazobactum and Cefeperazone+sulbactum. Most of the gram negative organisms were resistant to ampicillin and cephalosporins. The results of the retrospective study conducted in our tertiary care hospital demonstrates the distribution and their susceptibility pattern to most commonly used oral and parenteral antimicrobial agents. To prevent the spread of the resistant bacteria, it is critically important to have strict antibiotic policies while surveillance program for multidrug resistance organism and infection control procedures needs to be implemented.

Keywords: Antibiotic, Amikacin, Gram negative bacterial, resistant, isolates.

INTRODUCTION:

The discovery and development of antibiotics is one of the greatest advances in modern medicine [1]. Unfortunately, bacteria have developed several mechanism of resistance mechanism of resistance against various antibiotics like synthesis of drug inactivating enzymes like β lactamases which hydrolyses the β lactam antibiotics, decreased target susceptibility by target alteration, development of efflux system and modification of diffusion barrier, altered metabolic activity [2]. Antibiotic resistance genes do not increase virulence nature of bacteria, however infections caused by these resistant bacteria do not respond to treatment, leading to morbidity and mortality. Now-a-days, bacterial drug resistance is an important problem and due to wide variation in bacterial drug resistance, results of various studies and reports in one region or in one period of time are not necessarily true for other region or periods of time [3, 4]. Due to constantly evolving antimicrobial resistance pattern there is need for constant antimicrobial sensitivity surveillance. There appear to be a paucity of survey from developing countries in general and from the Indian subcontinent in particular. Determination of antibiotic sensitivity pattern in periodic intervals is mandatory in each region for the clinician to be aware of the emergency pathogen that pose a threat to the community, to provide safe and effective empirical therapy, develop rational prescribing practices and make policy decision in a hospital and finally assess the effectiveness of all [5].

MATERIALS AND METHODS:

The study was undertaken over a period of 10 months at the department of Microbiology in a tertiary care hospital, Chennai. Gram negative clinical isolates of out-patients and in-patients who were admitted to different wards and ICU at our hospital were taken for our study. The clinical data was obtained from the respective units and wards of the patients.

Two hundred and twenty gram negative isolates from various clinical specimen like pus (198), urine (167), sputum (93), pleural fluid (40), blood (15), endotracheal secretion (10). Of these 523 samples, 63 (28.6%) were from out-patient, 119 (54%) from in-patient wards and 38 (17.2%) from ICU (Table 1).

Of the 523 isolates, 359 were members of family Enterobacteriaceae and 164 isolates were from non-Enterobacteriaceae. Out of these 191 (36.5%) were E. coli, 103 (19.6%) Klebsiella spp, 26 (49.7%) were Citrobacter spp, 18 (34.4%) were Enterobacter spp, 21 (40.1%) were Proteus spp, 98 (18.7%) were Pseudomonas and 66 (12.6%) were Acinetobacter spp (Table 2).

Table 1: Breakup of various specimens

S. No	Specimen	No. of Samples	Percentage (%)
1	Urine	198	37.9
2	Pus	167	31.9
3	Sputum	93	17.8
4	Body fluids	40	7.6
5	Blood	15	2.9
6	ET Secretion	10	1.9

Table 2: Breakup of organism isolated from patients into various wards

Organism	ICU	IP	OP	Total	Percentage (%)
Escherichia coli	16	93	82	191	36.5
Klebsiella	23	57	23	103	19.6
Citrobacter	6	15	5	26	49.7
Enterobacter	-	11	7	18	34.4
Proteus	-	13	8	21	40.1
Pseudomonas	24	37	37	98	18.7
Acinetobacter	17	21	28	66	12.6
Total	86	247	190	523	

Data included patient demographic details (age, sex), microbial species and antibiotic sensitivity pattern of identified pathogen (Table 3 & 4). The antibiotic susceptibility patterns of the organisms were performed by Kirby-Bauer's disc diffusion method on Mueller-Hinton agar plates [6]. The following antibiotics with their concentration were tested by disc diffusion method. Ampicillin (10µg), Amikacin (30µg), Cefotaxime(30µg), Ceftazidime (30µg), Cefixime (5µg), Cefepime (30µg), Imipenem (10µg), Ciprofloxacin (5µg), Gentamicin (10µg), Cotrimoxazole (25µg), Piperacillin+tazobactam (100/10µg), Tetracycline (30µg). The data obtained were tabulated and analyzed to identify the common causative pathogen and the antibiotics to which the identified organism were sensitive and resistant. The diameter of the zone of inhibition was measured and compared to that of standard strain and the results were interpreted as sensitive, intermediate, resistant based on CLSI guidelines [7].

RESULTS

Among gram negative organisms the sensitivity pattern were as follows: *E. coli* was highly sensitive to Amikacin (87.8%) followed by Piperacillin+Tazobactum (79.7%), Imipenem (78.3%), Cefeperazone+sulbactum (58.1%), Ciprofloxacin (31%), Cefotaxime (25.6%), Ceftazidime (20.2%), Ampicillin (10.8%). *Klebsiella pneumonia* was highly sensitive to Piperacillin+Tazobactum (80%) followed by Imipenem (76%), Amikacin (68%), Cotrimoxazole (48%), Cefeperazone+sulbactum (44%), Ceftazidime (36%), Ampicillin (8%). Pseudomonas was highly sensitive to Amikacin (93.7%) followed by Piperacillin+tazobactum (56.2%), Cotrimoxazole (25%), Ampicillin (15.6%) and Imipenem (6.2%). Enterobacter spp was found highly sensitive to Piperacillin+Tazobactum (100%). (Table 3).

Majority of the gram negative organisms isolated were found to be sensitive to Amikacin, Imipenem, Piperacillin+Tazobactum and Cefeperazone+sulbactum. Most of the gram negative organisms were resistant to ampicillin and cephalosporins. The results of the retrospective study conducted in our tertiary care hospital demonstrates the distribution and their susceptibility pattern to most commonly used oral and parenteral antimicrobial agents [8].

In the present study most of the cultures yielded monomicrobial growth. Isolation rate of polymicrobial growth was around 2% which correlates with various studies where the isolation rate was between 1-10%. Metha *et al* have reported the incidence of gram negative bacilli is 80.96%. In present study the more common gram negative organism was *E. coli* accounting for 36.5%. Incidence of non-fermentors especially Pseudomonas spp. and Acinetobacter spp is rising up and associated with high degree of resistance.

Overall, present result indicate that Amikacin and Imipenem are highly active against gram negative infections which correlates with study done by Nathisuwan *et al* in 2011 [9]. Evaluate the sensitivity

pattern of clinical isolates in each region as to make a rational use of antibiotics.

Table: 3 Antibiogram of gram negative clinical isolates

Antibiotics	***E. coli*** (n = 191)	**Klebsiella** (n = 103)	**Citrobacter** (n =26)	**Enterobacter** (n = 18)	**Proteus** (n = 21)	**Pseudomonas** (n = 98)	**Acinetobacter** (n = 66)
Ampicillin	10.8	8	11.5	17.8	19.5	15.6	-
Cefotaxime	25.6	32	47.9	35.9	37.5	50	-
Ceftazidime	20.2	36	36.7	47.3	42.2	6.2	10.4
Cefeperazone + sulbactum	58.1	44	48	57.8	39.5	43.7	-
Cefepime	60.2	58.2	51.3	41.2	48.3	39.3	-
Imipenem	78.3	76	63.5	59.6	67.2	6.2	-
Ciprofloxacin	31	40	55.1	67.1	50.3	47.8	59.3
Amikacin	87.8	68	49.7	57.3	53.5	93.7	73
Gentamicin	51.2	55.2	55.8	39.5	51.1	93.7	53.5
Cotrimoxazole	-	48	41.2	46.3	9.3	25	19
Piperacillin + tazobactum	79.7	80	66.3	45.9	41.3	56.2	63.4

DISCUSSION:

The family Enterobacteriaceae includes many species of aerobic or facultative anaerobic gram negative, non sporing bacilli. Although these organisms are endogenous flora, several cause disease including out-patient urinary tract infection and outbreak of multidrug resistant nosocomial infection. Twenty species are responsible approximately 50% of all organisms isolated in clinical laboratory. Susceptibility testing should be performed on all clinically significant isolates in this group of organism.

The most prevalent gram negative bacteria found in positive culture were *E. coli* (36.5.2%) followed by Klebsiella (19.6%), Pseudomonas (18.7%), Acinetobacter (12.6%), Citrobacter (49.7%), Enterobacter (34.4%), Proteus (40.1%). Majority of the cultures are monomicrobial and were obtained from adults above the range of 18 years.

In present study age wise distribution of clinical isolates shows that most of the patients were aged between 31-45 years. This is comparable with study of Rashid *et al* [10]. In the present study maximum clinical isolates were from pus (44.5%) followed by urine (25.9%). The results are in line with the studies of Shenoy *et al*. [11].

CONCLUSION

To prevent the spread of the resistant bacteria, it is critically important to have strict antibiotic policies while surveillance program for multidrug resistance organism and infection control procedures needs to be implemented. The antimicrobial agents are losing their efficacy because of the spread of resistant organism due to indiscriminate use of antibiotics, lack of awareness, patient non compliance and unhygienic condition.

Emergence of resistance to carbapenems of Acinetobacter spp. and *Pseudomonas aeruginosa* poses a serious concern. The prolonged use of carbapenems in the treatment of nosocomial infection can favor the development of resistance to these antimicrobials agents. Overuse of *P. aeruginosa*. Cross resistance of Ciprofloxacin and Imipenem has been reported to occur after the treatment with fluoroquinolones.

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