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Spectrum of antimicrobial sensitivity of Klebsiella Pneumoniae in sputum in a tertiary care hospital, Kolkata, West Bengal

Medicine

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ABSTRACT

Aims and objectives: Klebsiella pneumoniae, one of the commonest form of gram negative bacilli responsible for respiratory tract infection in hospitalized patients. Now-a-days due to increased and non-selective use of antibiotics in chambers, primary health center and corporate hospitals there is emergence of multi-drug-resistant organism. As a result mortality of the patients infected with klebsiella pneumoniae has been increased enormously. So the aim of this present study was to demonstrate the spectrum of antimicrobial sensitivity of klebsiella from the sputum sample in the local community. **Material and methods:** From 1078 patient suffering from chest infection in K P C Medical College sputum were collected and cultured in different media. From these isolates different recent biochemical tests were carried out to confirm this particular organism. After confirmation these isolates were inoculated into plates containing different antibiotics. **Results:** Among total collection of 1078 samples of sputum, 216 were non- extended spectrum beta-lactamase (non-ESBL) (males=135, females=81) and 96 were extended spectrum beta-lactamase (ESBL) klebsiella (males=65, females=31). Non-ESBL klebsiella were highly sensitive to polymyxin B and colistin, moderately sensitive to imipenem and meropenem (>80% but <90%) whereas, ESBL producing klebsiella were 60% to 70% sensitive to the above antibiotics. Most of the penicillin, cephalosporin groups, aminoglycoside groups, vancomycin, linazolid, clindamycin and teicoplanin demonstrated nearly hundred percent to nearly 60% resistance to this organism. **Conclusion:** This study demonstrated the emergence of multidrug resistant klebsiella in this community which will be very harmful for the local community. So, our aim should be to make a proper antibiotic use policies and proper preparation of spectrum of antimicrobial sensitivity, so that the patient will receive proper antibiotics and thus emergence of multi-drug-resistant klebsiella can be prevented.

KEYWORDS:

Introduction:

Antibiotic was considered as a most useful therapeutic agent to fight against pathogenic organism. In last three decades antibiotic drug resistance to different pathogenic bacteria is serious health problem for both developed as well as developing countries due to inadvertent, injudicious use and overusese of different antibiotics1. Now-a-days microbes develop resistance to both old and newer antibiotics and this resistance is being transmitted for bacteria to bacteria and thus it produces serious health problem to our community2, 3. In 1883 Friedlander isolated Friedlander's bacillus from the lung of a patient died from pneumonia, later on this bacillus was named as Klebsiella bacillus. This bacillus recently becomes the important pathogen in nosocomial infection worldwide4, 5. Other than pneumonia this bacteria is responsible for ozaena, sinusitis, otitis media, enteritis, appendicitis and cholecystitis. Klebsiella is gram negative, non-motile, facultative anaerobe, it belongs to family of Enterobacteriaceae being most common causative agent responsible for nosocomial as well as hospital acquired infection. So obviously there is emergence of multidrug resistant bacteria due to use of injudicious and overuse of antibiotics in both community and hospital setting which is very difficult to treat with available antibiotics. Now-a-days multidrug resistant strains, like, extended spectrum beta-lactamase (ESBL), strains resistant to cephalosporins has increased the hospital mortality6. This bacterium is responsible for producing community acquired pneumonia mainly in alcoholics, wound infections especially in diabetic, urinary tract infection and sepsis in old and diabetic patients7. This bacterium has several virulence factors, namely, capsular polysaccharides, lipo-polysaccharide (LPS) and iron scavenging systems (siderophores). It is well-known that klebsiella demonstrated variation in resistance to different groups of antibiotics in different geographical area which have to well conversant to control and treat this multidrug resistant organism8. So, in this present study detailed spectrum of antimicrobial sensitivity of Klebsiella and ESBL producing Klebsiella isolated from sputum from a Tertiary Medical care Hospital, Kolkata was demonstrated so that it will help the clinician of this geographical area to treat this bacterium and to prevent mortality.

Materials and methods:

This extensive retrospective study was performed in K P C Medical College & Hospital, Kolkata, and West Bengal only after getting permission from our local ethical committee. Total 1078 sputum samples were collected for culture and sensitivity. These samples were inoculated onto different culture media, like, blood agar, chocolate agar and MacConkey agar and kept them in incubator overnight at 37oC in blood agar and chocolate agar large dome shaped colonies and in MacConkey agar as lactose fermenting colonies. From those growths the material was spreaded on the slide and Gram staining was done. Here it can be describe as Gram negative, short rod shaped organism. Then following biochemical tests were performed, like, sugar fermentation with gas production tests sucrose, mannitol, glucose, lactose, dulcitol, adonitol, esculin and melibiose, Indole test as well as hydrogen sulphide production on TSI agar, oxidase test, catalase test and nitrate test Voges-Proskauer test were carried out. Motility and growth test was carried out in potassium cyanide9. Then antibiotic sensitivity was tested by following methods: With the help of sterile cotton swab streak was done from the growth onto Mueller Hinton agar plate and allowed to dry before applying antibiotic disc. Then the filter paper disks containing adequate amount of antibiotics obtained from commercial company were firmly but gently placed to the plates. Now the plates were kept in room temperature for one hour for allowing the diffusion of the antibiotics into the agar plates. Then these plates were kept in the incubator for 24 hours at 37o C. Antimicrobial activity was demonstrated as an inhibition zone. After 24 hours the diameter of the inhibition zones were measured in millimeters using a scale. Zone of highest sensitivity was regarded as more than 20 mm, moderate sensitivity as more than 17-20 mm and 13 – 17 mm as mild sensitivity as and less than 13 as resistant. This antibiogram for klebsiella pneumoniae, and this was compared with the zones of control strain which is demonstrated in the Kirby-Bauer chart10. Now the result was tabulated and in the result section.

Results:

In case of non-ESBL producer Klebsiella pneumoniae males (n=135) were significantly (p=0.0) involved as compared to females (n=81).Again in case of ESBL producer klebsiella males (n=65) were significantly involved as compared to females (n=31) [Table 1]. In case of Non-ESBL producing klebsiella these bacteria were very highly sensitive to polymyxin B and colistin (>90%), moderately sensitive to imipenem and meropenem (>80% but <90%) mildly sensitive to tigicycline and ertapenem (>60% but <80%) and near completely resistant to oxacillin, erythromycin, vancomycin, clindamycin and linezolid (0%). Again in case ESBL producers, these were only moderately sensitive to tigicycline, imipenem, Ertapenem, meropenem, ((>90% but <90%) and near completely resistant semi-synthetic penicillin, all cephalosporin except erythromycin and

erythromycin, clindamycin, vancomycin, linezolid and teicoplanin (0%).

Table 1: Sex distribution in case antimicrobial sensitivity pattern of Klebsiella pneumoniae in sputum:

Organisms	Males	%	Females	%	P-value
Klebsiella pneumoniae (216)	135	62.5	81	37.5	0.00
ESBL producing Klebsiella pneumoniae (96)	65	67.70	31	32.29	0.00

Table 2: Antimicrobial sensitivity pattern of Klebsiella pneumoniae in sputum:

Antibiotics	Klebsiella Pneumoniae (216)	Percentage	Klebsiella Pneumoniae (ESBL producer) (96)	Percentage
Amoxycillin	2	0.925	0	0
Oxacillin	0	0	0	0
Ampicillin	26	12.037	0	0
PIPT	92	42.592	39	40.625
CES	76	35.185	33	34.375
Cefuroxime	23	10.648	0	0
Cefotaxime	30	13.888	0	0
Cefoxitin	30	13.888	21	21.875
Ceftazedime	35	16.203	0	0
Ceftriaxone	43	19.907	0	0
Cefepime	33	15.277	0	0
Azithromycin	6	2.777	0	0
Erythromycin	0	0	0	0
Aztreonam	22	10.185	0	0
Ertapenem	150	69.444	58	60.416
Imipenem	188	87.037	66	68.75
Meropenem	174	80.555	63	65.625
Gentamicin	96	44.444	35	36.458
Tobramycin	95	43.981	32	33.333
Netilmicin	96	44.444	41	42.708
Amikacin	114	52.777	51	53.125
Ciprofloxacin	74	34.259	14	14.583
Ofloxacin	66	30.555	14	14.583
Levofloxacin	104	48.148	19	19.791
Cotrimoxazole	72	33.333	17	17.708
Chloramphenicol	95	43.981	48	50
Tetracycline	79	36.574	34	35.416
Tigicycline	151	69.907	79	82.291
Clindamycin	0	0	0	0
Vancomycin	0	0	0	0
Teicoplanin	4	1.851	0	0
Linezolid	0	0	0	0
Polymyxin B	201	93.055	61	63.541
Colistin	195	90.277	63	65.625

Discussion:

In the present study, both in case ESBL and non-ESBL producer klebsiella, males were predominantly affected than females (62.5% vs. 37.5% in case of non-ESBL and 67.70% vs. 32.30% in case of ESBL producer). This study was contrary to the study done Shilpa K et al, where there was female preponderance (45.45% in females Vs. 31.57% in males)11. The male preponderance may be due to the following facts that the males are highly exposed to environment, higher amount of morbidity in the form diabetes, chronic obstructive lung disease, asthma etc.

In the study done by Asati R klebsiella was sensitive more than 50% to amikacin, gatifloxacin, chloramphenicol and ciprofloxacin and less than 50% sensitive to polymyxin B10. This is contrary to the present study where non-ESBL producing bacteria were sensitive less than 50% to the above mentioned antibiotics except amikacin which was marginally sensitive and polymyxin B was very highly sensitive (>90%). So these multidrug resistant bacteria are responsible for debilitation followed by death if proper isolation and subsequent sensitivity pattern will not be carried out at very early stage of the disease. It has been demonstrated from the above discussion that klebsiella pneumonia are mainly sensitive to newly emerged drugs, like, ertapenem, imipenem, meropenem, polymyxin B, colistin and tigicycline, because the sufferers were already exposed to the older commonly antibiotics by general practitioners as well as doctors of small village hospitals or by pharmacists.

The present study demonstrated 90% to 100% resistant to ampicillin which may be due to intrinsic resistance offered by chromosomally encoded β-lactamases12.

This present study showed that14.58% and 34.25% ESBL producing and non-ESBL producing klebsiella were sensitive to ciprofloxacin respectively but more than 50% sensitive to amikacin, which was similar to the study done by Shah RK et al13.

Present study demonstrated nearly similar resistance to Tobramycin (56% to 66%) as shown by Shilpa K et al in their study (58%) and also other studies, like, study done by Shukla I et al11, 14. This also may be due to intrinsic resistance produced by chromosomally encoded and plasmid mediated β-lactamases enzymes. This resistance may also be due to chromosomally encoded as well as plasmid mediated metallo-β-lactamases. Other proposed mechanisms of penicillin resistance are presence of penicillin-binding protein 2a which is encoded by mecA2 and gene responsible is bleZ encoding β-lactamase15.

Inadvertent use, overuse, empiririal prescription of drugs usually leads to development of multi-drug resistance and emergence of several virulence factors in the strains of klebsiella which will threat to the community. So, regular antimicrobial sensitivity and its updated data are very essential to prevent the development of multi-drug resistant organism16.

Conclusion:

Males were commonly affected by klebsiella infection. Both ESBL producing and non-ESBL producing klebsiella pneumoniae were resistance to all cephalosporin, aminoglycoside group of antibiotics, penicillin groups and vancomycin, clindamycin, teicoplanin and linazolid. As a result, this organism is responsible for prolonged hospitalization, increased in-hospital mortality. These organism were mostly sensitive to polymyxin B, colistin and carbepenem group of antibiotics which were very costly. So, very urgently local antibiotic policies should be formulated according to different geographical areas to prevent emergence of multidrug resistant organism.

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