Spectrum of Antimicrobial Sensitivity of Escherichia Coli in Sputum in a Tertiary Medical Centre in Kolkata, West Bengal, 7 Years' Experience

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ABSTRACT

Introduction: E coli though is a normal inhabitant of human gastrointestinal tract but in case of immunocompromized patients it is responsible for producing different type of diseases involving different systems of the body. Due to irrational use of antibiotics this organism demonstrated progressively increasing resistance to different commonly used as well as highly selective antibiotics. Present study tried to demonstrate the spectrum of sensitivity to different antibiotics for E coli from the sputum of the patients.

Material and methods: In this retrospective study sputum was isolated from the 1078 patients suffering from chest infections of K P C Medical College and Hospital, Jadavpur, and Kolkata and was sent to Microbiology department for culture and sensitivity.

Results: Total number of E coli was 48 (4.46%). This organism was highly sensitive to carbapenem group of drugs (72.91%—85.41%), tigicycline (70.83%), polymixin B (68.75%) and colistin (64.58%) and chloramphenicol and amikacin (62.5%), netilmicin (60.41%). Amoxicillin (2.08%), oxacillin (0%), third and fourth generation cephalosporins (0% -- 27.08%), azithromycin (0%), erythromycin (2.08%) demonstrated highest resistance and aminoglycosides except amikacin and netilmicin showed moderate resistance to E coli.

Conclusion: Due to injudicial use of broad spectrum antibiotics there is evidence of increasing resistance of these bacteria to very commonly used as well as highly selective antibiotics. One should do proper investigation prior to start the antibiotics. So it may be a resolution that only after getting proper sensitivity report we can use proper antibiotics. Periodic antimicrobial surveillance in case of hospital acquired infections is needed to update the guidelines on proper choice of organism specific as well as empiric antibiotics and only this can prevent the creeping of resistance to antibiotics to organism.

Keywords: Antimicrobial Sensitivity, E coli. Sputum, Tertiary Medical Centre, Kolkata

INTRODUCTION

Escherichia Coli (E coli) is normal inhabitant if human gastrointestinal tract.[1] But in certain debilitated conditions it becomes virulent and responsible for nosocomial or community acquired infections in gastrointestinal tract in the form of food borne diarrhea, and in other systems in the body, like, respiratory system, genitourinary system, central nervous system, circulatory system etc and ultimately this pathogenic E coli has a serious impact on public health with high economic cost.[2,3,4] The probable factors responsible for development of resistance are Long stay in the hospital, prolonged antibiotic exposure, and inadvertent use of third and fourth generation of cephalosporin, improper method of use of intravenous catheter, long standing of the parent illness, and decreased immunity. Again increased demand for additional health care resources due to increased duration of stay in hospital are also the potential source for acquisition of microorganisms and increase the burden n health care system.[5,6] In recent world of clinical therapeutics β lactamase (ESBL) producing bacteria gives an enormous pressure in treating public health through production of resistance to penicillin and cephasporins.[7,8] E coli produces plasmid mediated or chromosomally mediated β lactamase which is thought to be originated from penicillin binding proteins. Again most common organism responsible for community acquired infection are different hospital acquired infection which is true for E coli infection which is due to origin of infection, epidemiological factors responsible in that region.[5,6,9,10] The resistance to E coli varies in different geographical regions and again in the same region in area to area due to above mentioned factors. So it is the time for all the doctors to formulate the antibiotic policies to control the infections. For this all the doctors to know the spectrum of antibiotic susceptibility to E coli so that proper antibiotic can be selected in proper time to provide proper treatment to the patient to decrease high mortality.[11]

Here this study tried to demonstrate spectrum of antimicrobial sensitivity to Escherichia coli in the sputum of patients admitted in K P C Medical College and Hospital, Jadavpur, Kolkata, and West Bengal with lower respiratory tract infection.

MATERIAL AND METHODS

This was a retrospective study performed jointly Medicine and microbiology department of this Medical College after getting permission from our local ethical committee. Clinical

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specimen, i.e. early morning deeply coughed sputum was collected a universal sterile wide-mouthed container from 1078 patients within twenty four of admission according to standard guideline admitted for lower respiratory tract infection.[12] Prior to collection of sputum oral cavity of the patients were ringed with antiseptic solution twice as it avoids oral contamination of the collected sample. Then with all precautions these were transported to microbiology department with all aseptic precautions without further delay.[12] Then the samples were inoculated with the help of inoculating loop on the blood agar and MacConkey agar plates. Then on the basis morphology of the colony, gram staining, motility studies and biochemical test E coli was identified. Colony morphology was characterized by circular shaped flat, smooth lactose fermenting colony with regular margin. Gram staining demonstrated uniformly stained gram negative non spore forming, non capsulated rods. Hanging drop preparation showed their motility. Biochemical test was performed after inoculation of the colony in nutrient broth at 37° C for two to three hours. They were oxalase and Voges-Proskauer negative, catalase, lysine decarboxylase test, indole and methyl red positive, reduced nitrates to nitrites, fermented lactose, triple sugar iron agar demonstrated slant yellow with gas production.

Then as per recommendation of Clinical Laboratory Standards Institute guidelines antimicrobial susceptibility test was performed by Kirby-Bauer disk diffusion method.[13] Here commercially available antibiotic disks marketed by Hi Media Labs, India were used for testing antimicrobial susceptibility. Following disks containing antibiotics ampicillin, oxacillin, ampicillin, piperacillin-tazobactum, cefoperazone-salbactam, aminoglycosides, cefuroxime, ceftazidime, cefotaxime, cefoxitin, ceftriaxone, cefepime, azithromycin, erythromycin, aztreonam, Imipenem, ertapenem, meropenem, ciprofloxacin, ofloxacilin, levofloxacin, chloramphenicol, tetracycline, tigicycline, clindamycin, vancomycin, teicoplanin, linezolid, polymixin B, colistin and ticaracillin were used.

Procedure: From 18 to 24 hours agar plate isolates of E coli is collected and inoculums containing of 0.5 McFarland standards turbidity was prepared in nutrient broth. Now within 15 minutes a sterile cotton swab was dipped into the nutrient broth containing E coli and rotated several times and pressed firmly against the inside walls of the tube above the fluid level and then streaked over the dried surface of Mueller-Hinton agar strictly aseptically. Again it was streaked two more times over the surface planes at 60° C to confirm even distribution of the inoculums. After 3 to 5 minutes antibiotics containing discs were pressed firmly to ensure complete contact with the surface of the agar. As a result the discs were distributed evenly at a minimum distance of 24 mm from one centre to other centre of the discs. Then the plates were inverted and incubated aerobically at 37° C within fifteen minutes of the above application. After 24 hours diameters of the zones of inhibition were measured by sliding calipers and sensitive, resistant and intermediate sensitivity of the organism were determined.

STATISTICAL ANALYSIS

All the data were analyzed by percentage of sensitivity and then comparisons were done.

RESULTS

Total number of E coli positive culture was 48 amongst total number of patients whose sputum was sent for culture, so the percentage of E coli positivity was 4.46.

This study demonstrated highest sensitivity to carbapenem group (72.91% -- 85.41%), moderate sensitivity to tigicycline (70.83%), polymixin B (68.75%), colistin (64.58%), chloramphenicol and amikacin (62.4%), netilmicin (60.41%) and mild sensitivity to gentamicin (54.16%), Piperacillin-Tazobactum (41.66%). On the other hand clindamycin, teicoplanin, vancomycin, linezolid, oxacillin, azithromycin demonstrated hundred resistances to all the antibiotics and few antibiotics, like, amoxicillin, cefuroxime, cefotaxime, ticaracillin, ceftazidime, ceftriaxone, cefepime, erythromycin, aztreonam showed nearly 90% to 98% resistant to all the antibiotics tested (table-1).

Antibiotics	E Coli	Percentage
Amoxicillin	1	2.08
Oxacillin	0	0
Amoxy-clav	5	10.41
Piperacillin-Tazobactum	20	41.66
Cefoperazone-salbactam	16	20.83
Cefuroxime	3	6.25
Cefotaxime	3	6.25
Cefoxitin	13	27.08
Ceftazidime	4	8.33
Ceftriaxone	4	8.33
Cefepime	1	2.08
Azithromycin	0	0
Erythromycin	1	2.08
Aztreonam	1	2.08
Ertapenem	35	72.91
Imipenem	41	85.41
Meropenem	40	83.33
Gentamicin	26	54.16
Tobramycin	21	43.75
Netilmicin	29	60.41
Amikacin	30	62.5
Ciprofloxacin	8	16.66
Ofloxacin	11	22.91
Levofloxacin	18	37.5
Cotrimoxazole	10	20.83
Chloramphenicol	30	62.5
Tetracycline	15	31.25
Tigicycline	34	70.83
Clindamycin	0	0
Vancomycin	0	0
Teicoplanin	0	0
Linezolid	0	0
Polymyxin B	33	68.75
Colistin	31	64.58
Ticarcillin	3	6.25

Table-1: Antimicrobial sensitivity of E Coli (n=48):

DISCUSSION

Antibiotic discovery is undoubtedly a greatest advance in the era of modern medicine. But due to injudicious use of these weapons the organisms gradually developed resistance which is undoubtedly threatening. Organism specificity in case of sputum and their antibiotic susceptibility has been demonstrated in different studies and proved convincingly in different regions of the World.[14,15,16] Due to rapid change in trends in the antimicrobial sensitivity to different organisms every clinician has to be regularly updated so that he or she can urgently initiates antibiotics in the treatment of nosocomial infection to increase the survival of the affected patient. This present study demonstrated highest susceptibility to carbapenem group (72.91% -- 85.41%) followed by tigicycline (70.83%), polymixin B (68.75%), colistin (64.58%), chloramphenicol and amikacin (62.4%), netilmicin (60.41%), but only 41.66% to Piperacillin-tazobactum. Though study done by Kumar D et al. demonstrated hundred percent sensitivity to carbapenem group like this present study but sensitivity to Piperacillin-tazobactum (87.22%) and cefoperazone-salbactum (76.67%) was very high.[17] On the other Kumar D et al. showed low sensitivity to third generation cephalosporin (cefotaxime 31.11%, ceftazidime 35.55% and ceftriaxone 38.33%) whereas present study demonstrated nearly 90 – 98% resistance to these antibiotics.[17] Banu A et al in their study demonstrated resistance to ampicillin (95.6%), ciprofloxacin (69.5%), co-trimoxazole (65.2%), cefotaxime (30.4%), gentamicin (52.2%), amikacin (39.1%) and netilmicin (26.1%) as these resistances were also shown by other researchers which were nearly similar to this present study.[18,19,20] Again, Banu A et al demonstrated hundred percent sensitivity to carbapenem which was similar to our study.[18] This multi drug resistance may be due to dissemination of plasmid mediated antibiotic resistance among the E coli responsible for hospital acquired infection.[21] Again, resistance of netilmicin was slightly less than gentamicin and amikacin as demonstrated by some researchers which were similar to this present study.[18,19] In the study of Sharma P among the culture positive sputum isolates of E coli was 9.4% where as in this present study isolates of E coli was 4.46%.[22] Study of Sharma P et al. demonstrated significant resistance to Amoxy-clav (100%), fourth generation of cephalosporin (80%), newer Quinolone (67% -- 80%), as well as Aminoglycosides (40%) and sensitivity to carbapenems (80%) and polymixin B (100%) and colistin (100%), this similar results were found in this study where the sensitivity of carbapenem (72.91% -- 85.41%), was more than that of polymixin B (68.75%), and colistin (64.58%).[23] This may be due to injudicious and empiric therapy with the higher generation of antibiotics in the hospitals. So history of infection and previous usage of antibiotics should be the influential factors for understanding the elements of antimicrobial resistance. Again, community and hospital acquired non-bacterial micro-organisms should also be taken into account during selection of antibiotics.[23] Las but not the least periodic antimicrobial surveillance in case of hospital acquired infections is regularly needed to update the guidelines on proper choice of organism specific as well as empiric antibiotics.[24]

CONCLUSION

So, E coli though a normal commensal of human gastrointestinal tract, but in debilitated and immunocompromized compromised condition it becomes virulent and responsible for hospital acquired and community acquired infection. But inadvertent and injudicial use of antibiotics makes them resistant to these commonly used as well as specific higher antibiotics making increased mortality of these patients. So from this present study in can be concluded that regular updatation of the spectrum of antimicrobial sensitivity of E coli is very urgent to provide proper treatment of these patients.

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