Prevalence of Bacterial Isolates in Endotracheal Tube According to Culture and Sensitivity in Patients of Intensive Care Unit of A Tertiary Medical College and Hospital, Kolkata, West Bengal

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ABSTRACT

Introduction: Hospital acquired infection (HAI) in intensive care units (ICU) are responsible for high morbidities and mortalities worldwide due to emergence of resistant bacteria. This burden is under estimated in developing countries which may be due to improper surveillance, misuse of antibiotics and improper use mechanical devices. Our aim of the study was to detect spectrum of bacterial isolates and their antimicrobial sensitivity in K P C Medical College Hospital, Jadavpur, and Kolkata.

Material and methods: We collected endotracheal tube aspirates from 739 patients of ICU and specimens were processed. After 48 hours of incubation, colonies of bacterial isolates were inoculated in different antimicrobial disc. The results obtained were analyzed in SPSS version 17 software. Value of <0.05 was accepted as significant.

Results: Males were significantly affected than females (p=0.00) by gram negative bacteria, like, klebsiella, acinetobacter, pseudomonas, citrobacter, enterobacter. But cedecea lapagei only affected female patients (2 cases). Incidence of gram negative isolates were highly significant gram positive bacteria (p=0.00). Most of the gram negative bacilli were highly sensitive to polymyxin B, colistin, whereas, extended spectrum beta lactamase (ESBL) and AMPC producing klebsiella were 100% sensitive to carbapenem group, and ESBL producing E coli as well as proteus group demonstrated high sensitivity to both carbapenem and aminoglycoside group of antibiotics.

Conclusion: This wide spectrum of resistance to different antibiotics was mostly due to different iatrogenic factors, like, improper surveillance of the patients, improper and inadvertent use of antibiotics, and unnecessary use of costly and higher generations of antibiotics, use of mechanical devices in improper way and many morbid factors, like, age, diabetes. So, if the above factors can be looked into, the violent antibacterial resistance can be tackled and mortality rate can be lowered. So, we need serious thinking about the administration of antibiotics in case of sepsis and during any invasive procedure and regular ICU fumigation.

Keywords: Endotracheal tube aspirates, culture and sensitivity, gram negative and gram positive bacteria, patients in Kolkata.

INTRODUCTION

Hospital acquired infection (HAI) is most serious and burning problem and responsible for high rate of morbidities and mortalities worldwide.[1] It has been shown that in developed countries 5% to 15% patients in regular wards suffered from HAI and 50% patients in intensive care units (ICU), where as in developing countries this burden is somewhat underestimated which may be due to lack of knowledge of proper surveillance, proper resources and most important, proper guidence.[2] But according to WHO, in 2005the burden in the developing countries were 25%.[3] In ICU, most of the patients suffered from urosepsis, life threatening nosocomial infection, post-surgical infections, lower respiratory infections, sepsis with multi organ dysfunction syndrome, whereas, in the regular wards surgical patients, orthopedic patients suffered from mostly from post surgical problem. In creased susceptibility in these patients are due to their old age, underlying morbid disease, like, diabetes and depressed immunity due to treatment with chemotherapeutic drugs.[4] The modern apparatuses responsible for HAI are endotracheal tube, catheter, and different surgical appliances. So, obviously respiratory tract infections, urinary tract infection, deep ulcerations in the body are the result of the use of the modern instruments.[5-7] Since ICU is mainly responsible for caring of the patients suffered from life threatening infections, constant vigilance and monitoring, support with modern surgical apparatus and life saving medications has to be provided with ultimate aim to give proper relief to the patients. In case of intubated patients, colonization in the respiratory tract is most common.[8] Again, mechanical ventilation is responsible 6 to 10 fold increase the risk of respiratory tract infections.[9,10] In this case tracheal colonization of bacterial isolates may be responsible for added or super infections and at the same time, increases the risk of mortality. Again, due to inadvertent and irrational use of antibiotics, there are increasing emergence of drug resistant bacteria, this in turn, increases the percentage of mortality. So, obviously, it is a new challenge for critical care physicians to treat these patients.[11] These drug resistant bacteria are gram negative bacteria prevalent all over the world.[12-14] So, the aim in our study was to detect the spectrum of bacterial isolates and their antibacterial sensitivity in K P C Medial College and Hospital, Jadavpur, Kolkata in last five years.

MATERIAL AND METHODS

This 7 years' cross sectional study (2009-2015) was carried out after getting clearance from our college Ethical committee.

Criteria of selection

1. Cough with purulent sputum, fever with infiltration in the chest x-ray.
2. Above symptoms and signs not responding to conventional antibiotics.
3. Sepsis with multi-organ dysfunction syndrome and

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infiltration in the lung.

Rejection criteria

1. Poor collection of sample
2. Containers are externally soiled
3. Leakage of the container
4. If the samples collected contain more than 10 squamous epithelial cells per low power field as well as bacteria.

We collected seven hundred and thirty nine endotracheal tube samples very aseptically. All the patients who were admitted in ICU of our hospital were on mechanical ventilation. We collected the data from the enrolled patients in the form of:

Name, age, sex, underlying illness, dates of admission in our hospital, date of endotracheal tube intubation, date of sample collection and detail of antibiotic therapy prior to collection of samples.

Process of collection

The samples were collected using suction catheter introducing through the endotracheal tube up to a distance of approximately 26 cm. Firstly samples were collected without introducing saline. But in few cases, tracheal aspirates were very thick. In that case 2 ml of 0.9% sterile normal saline was introduced to liquefy the secretions and was collected into a container.

Processing of sample

The collected specimen was kept in a sterile container and was sent immediately to microbiology department for culture and sensitivity. This was inoculated in thioglycollate broth and incubated for 24 hours at 37° C. After 24 hours the broth was examined primarily for the evidence of growth of the bacteria by direct gram stain smear. Smear was examined in the low power field (LPF) under oil immersion microscope (X100) for detection of squamous epithelial cells and polymorphonuclear nutrophils (PMN). Same preparation was examined in the high power field microscope under oil immersion (magnification X100) for any presence of bacteria.

Then from the same broth sample was collected using calibrated loop, it was collected and inoculated on the four quadrant streak technique on the blood agar, chocolate agar and McConkey agar. Then these inoculated plates were incubated at 37° C for 24 to 48 hours.

After 48 hours this culture was read by observing the four quadrant growth. It suggests approximate number of colony forming unit per ml. (CFU/ml) of bacteria per ml. The cultures were graded as 1+, 2+, 3+, and 4+ depending upon mild, moderate and severe and very severe growth.

To measure variable biochemical behavior of the bacterial strain, extensive biochemical tests were performed, like, triple sugar iron test(TSI), citrate utilization test, Motility indole Urease test (MIU), oxidase test, Coagulase test, catalase test, DNAse test etc. as per manual methods of general bacteriology by American Society of Microbiology.[15]

The obtained organism was diluted in 2-3 ml of sterile normal saline. Then the sample was swabbed on the antibiotic disc with the sterile cotton swab as per Clinical and Laboratory Standards Institute (CLSI) standard guideline.[16]

Antibiotic disc used from Gram negative bacilli were gentamicin, tobramycin, Netilmicin, amikacin, cefexime, ceftriaxone, ciprofloxacin, ofloxacin, levofloxacin, co-trimoxazole, chloramphenicol, tetracycline, tigicycline, piperacillin-tazobactum, cefoperazone-sulbactam, ceftazidime, imipenem, meropenem, ertapenem, aztreonam, cefotaxime, polymyxin B, colistin. For Gram positive cases, amoxycillin, oxacilin, amoxycilin-clavauronic acid, piperacillin-tazobactum, cefoperazone-sulbactam, cefuroxime, ceftriaxone, cefexime, ceftazidime, azithromycin, erythromycin, ertapenem, meropenem, imipenem, gentamicin, tobramycin, Netilmicin, amikacin, ciprofloxacin, ofloxacin, levofloxacin, co-trimoxazole, chloramphenicol, teicoplanin, tigicycline, clindamycin, vancomycin, tetracycline, linazolid, polymyxin B, colistin disc were used.

The results were analyzed in the following manner –

1. Year-wise predominance of sexes according to culture positivity.
2. Organism-wise significance of sex involvement.
3. Incidence of gram positive and gram negative bacteria.
4. Presence of culture-sensitivity in case bacterial isolates.

STATISTICAL ANALYSIS

Above data were analyzed by statistical software SPSS version 17. A value of $p<0.05$ was accepted as significant. Chi square test was used to find the significant correlation between variables.

RESULTS

In this study, males were significantly affected than the females with respect to all the years (p=0.00). In the year 2011 and 2013 percentages of positivity were higher as compared to other years (17.35% in 2011 and 18.49% in 2013) (Table-1).

Males were significantly infected with Klebsiella group (ESBL producer, ESBL and AMPC producer and non-ESBL and non AMPC producer), all acinetobacter baumannii, citrobacter, enterobacter, ESBL producing E coli, pseudomonas aeruginosa as compared to females (Table-2).

Again, gram negative organisms were significantly involved as compared to gram positive organisms (Gram negative = 429 vs. Gram negative =9, p=0.00) (Table-3).

ESBL producing Klebsiella pneumonie was highly sensitive to piperacillin-tazobactam (52.63%), polymyxin B and colistin (90.69%). Non ESBL and AMPC producer Klebsiella and AMPC producer Klebsiella sensitive to ertapenem, imipenem and meropenem (55.81%, 65.11% and 56.97% respectively), polymyxin B and colistin (90.69%). On the other hand ESBL and AMPC producing Klebsiella were sensitive to ertapenem, imipenem and meropenem (90.90% to 100%) and carbapenemase producing Klebsiella were highly sensitive to polymyxin B and colistin (95.65%). Citrobacter were highly sensitive to chloramphenicol (60%) and polymyxin B and colistin (90%) and enterobacter sensitive to polymyxin B (62.5%) and colistin (68.75%) only. Again, gram positive bacteria staphylococcus were highly sensitive to vancomycin, teicoplanin and linazolid (99.99%), chloramphenicol (88.88%) followed by tetracycline and tigicycline (55.55%). Proteus vulgaris were 100% sensitive to imipenem but 66.66% to all macrolide groups of antibiotics. On the other hand proteus mirabilis were 100% sensitive to cefoperazone-sulbactam and carbapenem groups. Acinetobacter baumannii (both MBL and non MBL producer), pseudomonas aeruginosa (MBL inhibitor) were significantly sensitive to polymyxin B and colistin (97.72%, 97.05% and 100% respectively). On the other hand pseudomonas aeruginosa

(non MBL inhibitor)were highly sensitive to imipenem and meropenem (58.90% and 60.27% respectively) in addition to polymyxin B and colistin (100% sensitive). Again E coli (ESBL producer) were highly sensitive to imipenem group (88.88%) followed by piperacillin, cefoperazone and polymyxin B and colistin (66.66%) and aminoglycoside group of antibiotics (55.55%) whereas, non MBL producer E coli were highly sensitive to polymyxin B and colistin (85.71%). Non lactose fermenting bacilli were moderately sensitive to cephalosporin (58.33%), gentamicin, levofloxacin, vancomycin, teicoplanin, polymyxin B and colistin (50% each). (Table 4a-d)

Incidence of acinetobacter baumannii positivity was highest (145, 33.33%), followed by Klebsiella pneumoniae (139, 31.73%), and pseudomonas pneumoniae (82, 18.72%), whereas, incidence of proteus group and E coli, enterobacter were very low (6, 1.36%, 16, 3.65% respectively). (Table-5).

Years	Total cases (438)	Males (Percentage) (303)	Females (Percentage) (135)	"p" value
2009	54 (12.32%)	39	15	0.00
2010	60 (13.69%)	47	13	0.00
2011	76 (17.35%)	55	21	0.00
2012	50 (11.41%)	37	13	0.00
2013	81 (18.49%)	54	27	0.00
2014	58 (13.24%)	32	26	0.01
2015	62 (14.15%)	39	23	0.00

Table-1: Year –wise male and female distribution of bacterial isolates

DISCUSSION

In our study, the incidence of positivity was 59.26% (438 out of 739 cultures). In the study done by Ghosh B et al. presence of positivity was 50.09% (271 positive case out of 541 total cases).[15] Incidence of positivity in males was 69.17%, which was significant as compared to females (26.25%, p=0.00), which was similar to the study done by Ghosh B et al.[15]

In our study, incidences of prevalent bacteria were acinetobacter baumannii (33.33%), Klebsiella group (31.73%), pseudomonas aeruginosa (18.72%), staphylococcus (2.05%), E coli and enterobacter group (3.65%). So incidence of acinetobacter was highest followed by Klebsiella. But, in the study done by Ghosh

Bacterial isolates (Total 438)	Males	%	Females	%	P value
NLFGNB (12) (2.73%)	8	66.66	4	33.33	0.10
Kleb Pneu (86) (19.63%)	54	62.79	32	37.20	0.00
Citrobacter (10) (2.28%)	9	90	1	10	0.00
Enterobacter (16) (3.65%)	14	87.5	2	12.5	0.00
Staphylococcus (9) (2.05%)	5	55.55	4	44.44	0.63
Pr. Vulgaris (3) (0.68%)	1	33.33	2	66.66	0.41
Pr. Mirabilis (3) (0.68%)	3	100	0	0	Not done
Ac. Baumannii (MBL producer) (44) (10.04%)	31	70.45	13	29.54	0.00
Ps. Aeruginosa (Metallo-beta lactamase inhibitor) (9) (2.05%)	6	66.66	3	33.33	0.15
E Coli (ESBL producer) (9) (2.05%)	8	88.88	1	11.11	0.00
E Coli (7) (1.59%)	4	57.14	3	42.85	0.59
Ac. Baumannii (102) (23.28%)	67	65.68	35	34.31	0.00
Ps. Aeruginosa (73) (16.66%)	54	73.92	19	26.02	0.00
Kleb Pneu. (ESBL producer) (19) (4.33%)	15	78.94	4	21.05	0.00
Kleb Pneu. ESBL and AMPC producer) (11) (2.51%)	8	72.72	3	27.27	0.03
Kleb Pneu (Carbapenamase producer) (23) (5.25%)	16	69.56	7	30.43	0.00
Cedecea Lapages (2) (0.45%)	0	0	2	100	Not done

Table-2: Sex wise distribution of bacterial isolates:

Gram negative organism	Gram positive organism	
NLFGNB (12) (2.73%)	Staphylococcus **(9) (2.05%)**	
Kleb Pneu (86) (19.63%)		
Citrobacter (10) (2.28%)		
Enterobacter (16) (3.65%)		
Kleb Pneu. (ESBL producer) (19) (4.33%)		
Kleb Pneu. ESBL and AMPC producer) (11) (2.51%)		
Kleb Pneu (Carbapenamase producer) (23) (5.25%)		
Pr. Vulgaris (3) (0.68%)		
Pr. Mirabilis (3) (0.68%)		**P value**
Ac. Baumannii (MBL producer) (44) (10.04%)		
Ps. Aeruginosa (Metallo-beta lactamase inhibitor) (9) (2.05%)		
E Coli (ESBL producer) (9) (2.05%)		
Ac. Baumannii (102) (23.28%)		
Ps. Aeruginosa (73) (16.66%)		
Cedecea Lapages (2) (0.45%)		
Total = 429	Total= 9	0.00

Table-3: Comparison between gram positive and gram negative bacteria

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Organism(438)	PEN	AMX	OX	AMC	PIPT	CES	CEF	CFT	CXT
NLFGNB (12)	0	3(25%)	3(25%)	3(25%)	5(41.66%)	0	4(33.33%)	0	1(8.33%)
Kleb Pneu (86)	0	3(3.48%)	0(0%)	10(11.62%)	25(29.06%)	16(18.60%)	7(8.13%)	10(11.62%)	8(9.30%)
Kleb Pneu-ESBL producer (19)	0	0	0	2(10.52%)	10(52.63%)	9(47.36%)	0	0	3(15.78%)
Kleb Pneu- ESBL and AMPC producer (11)	0	0	0	0	2(18.18%)	3(27.27%)	0	0	0
Kleb Pneu- Carbapenamase producer (23)	0	0	0	0	0	0	0	0	0
Citrobacter (10)	0	0	0	0	3(30%)	2(20%)	0	0	0
Enterobacter (16)	0	0	0	0	5(31.25%)	3(18.75%)	1(6.25%)	1(6.25%)	1(6.25%)
Staphylococcus (9)	0	1(11.11%)	2(22.22%)	2(22.22%)	3(33.33%)	0	3(33.33%)	0	0
Proteus Vulgaris (3)	0	0	0	0	1(33.33%)	0	0	0	0
Proteus Mirabilis (3)	0	0	0	0	0	3(100%)	1(33.33%)	0	1(33.33%)
Ac. Baum-MBL prod.(44)	0	0	0	0	5(11.36%)	6(13.63%)	0	0	0
Ac. Baum (102)	0	0	1(0.98%)	15(14.70%)	20(19.60%)	10(9.80%)	1(0.98%)	7(6.86%)	1(0.98%)
Ps. Aeru (MBL inhibitor (9)	0	0	0	0	2(22.22%)	1(11.11%)	0	0	0
Ps. Aeru (73)	0	2(2.73%)	0	2(2.73%)	34(46.57%)	24(32.87%)	1(1.36%)	4(5.47%)	2(2.73%)
E coli-ESBL producer (9)	0	0	0	1(11.11%)	6(66.66%)	6(66.66%)	0	0	4(44.44%)
E coli (7)	0	0	0	2(28.57%)	5(71.42%)	4(57.14%)	1(14.28%)	2(28.57%)	3(42.85%)
Cedecea Lapagei (2)	0	0	0	0	2(100%)	0	0	0	0

Table-4(a): Antibiotic sensitivity of bacterial isolates

Organism(438)	CFZ	CTRX	CFP	AZ	ER	AZT	ERT	IMP	MEP
NLFGNB (12)	2(16.66%)	1(8.33%)	5(41.66%)	4(33.33%)	1(8.33%)	2(16.66%)	5(41.66%)	3(25%)	4(33.33%)
Kleb Pneu (86)	10(11.62%)	9(10.46%)	10(11.62%)	1(1.16%)	0	4(4.65%)	48(55.81%)	56(65.11%)	49(56.97%)
Kleb Pneu-ESBL producer (19)	0	0	0	0	0	0	13(68.42%)	14(73.68%)	14(73.65%)
Kleb Pneu- ESBL and AMPC producer (11)	0	0	0	0	0	0	10(90.90%)	11(100%)	11(100%)
Kleb Pneu- Carbapenamase producer (23)	0	0	0	0	0	0	2(8.69%)	2(8.69%)	2(8.69%)
Citrobacter (10)	0	0	0	0	0	0	5(50%)	5(50%)	5(50%)
Enterobacter (16)	1(6.25%)	1(6.25%)	1(6.25%)	1(6.25%)	0	1(6.25%)	4(25%)	5(31.25%)	5(31.25%)
Staphylococcus (9)	0	3(33.33%)	0	3(33.33%)	1(11.11%)	0	2(22.22%)	2(22.22%)	2(22.22%)
Proteus Vulgaris (3)	0	0	0	0	0	0	0	3(100%)	1(33.33%)
Proteus Mirabilis (3)	0	0	0	0	0	0	3(100%)	3(100%)	3(100%)
Ac. Baum-MBL prod.(44)	0	0	0	0	0	1(2.27%)	1(2.27%)	1(2.27%)	1(2.27%)
Ac. Baum (102)	5(4.90%)	7(6.86%)	7(6.86%)	1(0.98%)	0	3(2.94%)	16(15.68%)	43(42.15%)	40(39.21%)
Ps. Aeru (MBL inhibitor (9)	0	0	0	0	0	1(11.11%)	0	0	0
Ps. Aeru (73)	10(13.69%)	3(4.10%)	6(8.21%)	9(12.32%)	0	45.47%)	9(12.32%)	43(58.90%)	44(60.27%)
E coli-ESBL producer (9)	0	0	0	0	0	0	8(88.88%)	8(88.88%)	8(88.88%)
Ecoli (7)	2(28.57%)	2(28.57%)	2(28.57%)	1(14.28%)	0	0	3(42.85%)	4(57.14%)	4(57.14%)
Cedecea Lapagei (2)	0	0	0	0	0	0	0	0	0

Table-4(b): Antibiotic sensitivity of bacterial isolates:

Organism(438)	GET	TOB	NIT	AMK	CIP	OF	LIV	COT	CHLO
NLFGNB (12)	6(50%)	2(16.66%)	3(25%)	8(66.66%)	7(58.33%)	2(16.66%)	6(50%)	4(33.33%)	3(25%)
Kleb Pneu (86)	25(29.06%)	24(27.90%)	2326.74%)	38(44.15%)	19(22.09%)	12(13.95%)	13(15.11%)	16(18.60%)	10(11.62%)
Kleb Pneu-ESBL producer (19)	7(36.54%)	526.13%)	6(31.57%)	7(36.54%)	4(21.05%)	4(21.05%)	4(21.05%)	1(5.26%)	8(42.10%)
Kleb Pneu- ESBL and AMPC producer (11)	3(27.27%)	2(18.18%)	4(36.36%)	4(36.36%)	0	0	0	1(9.09%)	2(18.18%)
Kleb Pneu- Carbapenamase producer (23)	2(8.69%)	2(8.69%)	2(8.69%)	2(8.69%)	0	0	1(4.34%)	1(4.34%)	3(13.04%)
Citrobacter (10)	1(10%)	1(10%)	2(20%)	1(10%)	0	1(10%)	3(30%)	0	6(60%)
Enterobacter (16)	2(12.5%)	3(18.75%)	5(31.25%)	3(14.75%)	1(6.25%)	1(6.25%)	2(12.5%)	0	3(18.75%)
Staphylococcus (9)	4(44.44%)	333.33%)	4(44.44%)	4(44.44%)	3(33.33%)	4(44.44%)	6(66.66%)	4(44.44%)	8(88.88%)
Proteus Vulgaris (3)	2(66.66%)	2(66.66%)	2(66.66%)	2(66.66%)	0	0	0	0	0
Proteus Mirabilis (3)	0	0	0	0	1(33.33%)	1(33.33%)	1(33.33%)	0	1(33.33%)
Ac. Baum-MBL prod.(44)	4(9.09%)	2(4.54%)	3(6.81%)	2(4.54%)	1(2.27%)	1(2.27%)	3(6.81%)	1(2.27%)	3(6.81%)
Ac. Baum (102)	23(22.54%)	27(26.47%)	19(18.62%)	21(20.58%)	14(13.72%)	8(7.84%)	30(29.41%)	17(16.66%)	14(13.72%)
Ps. Aeru (MBL inhibitor (9)	0	0	0	0	0	0	0	0	0
Ps. Aeru (73)	35(47.94%)	31(42.46%)	27(36.98%)	39(53.42%)	2939.72%)	12(16.43%)	32(43.83%)	10(13.69%)	0
E coli-ESBL producer (9)	5(55.55%)	5(55.55%)	5(55.55%)	5(55.55%)	4(44.44%)	4(44.44%)	5(55.55%)	1(11.11%)	5(55.55%)
Ecoli (7)	3(42.85%)	4(57.14%)	5(71.42%)	3(42.85%)	3(42.85%)	3(42.85%)	4(57.14%)	4(57.14%)	1(14.28%)
Cedecea Lapagei (2)	0	0	0	0	0	0	0	0	0

Table-4(c): Antibiotic sensitivity of bacterial isolates:

Organism(438)	TEI	TIG	CLIN	VAN	TEI	LIZ	POL	COL	TIC
NLFGNB (12)	4(33.33%)	5(41.66%)	3(25%)	6(50%)	6(50%)	5(41.66%)	6(50%)	6(50%)	0
Kleb Pneu (86)	26(30.23%)	49(56.97%)	0	0	2(2.32%)	0	78(90.69%)	78(90.69%)	6(6.97%)
Kleb Pneu-ESBL producer (19)	6(31.57%)	14(73.68%)	0	0	0	0	12(63.15%)	12(63.15%)	4(21.05%)
Kleb Pneu- ESBL and AMPC producer (11)	2(18.18%)	7(63.63%)	0	0	0	0	1(5.78%)	1(5.78%)	1(5.78%)
Kleb Pneu- Carbapenamase producer (23)	4(17.39%)	17(73.91%)	0	0	0	0	22(95.65%)	22(95.65%)	0
Citrobacter (10)	1(10%)	6(60%)	0	0	0	0	9(90%)	9(90%)	0
Enterobacter (16)	4(25%)	6(37.5%)	0	1(6.25%)	1(6.25%)	1(6.25%)	10(62.5%)	11(68.75%)	3(18.75%)
Staphylococcus (9)	5(55.55%)	7(77.77%)	3(33.33%)	9(99.99%)	9(99.99%)	9(99.99%)	0	0	0
Proteus Vulgaris (3)	0	0	0	0	0	0	0	0	0
Proteus Mirabilis (3)	0	0	0	0	0	0	0	0	1(33.33%)
Ac. Baum-MBL prod.(44)	5(11.36%)	30(68.18%)	0	0	0	0	43(97.72%)	43(97.72%)	0
Ac. Baum (102)	18(17.64%)	40(39.21%)	0	0	2(1.96%)	0	99(97.05%)	99(97.05%)	9(8.82%)
Ps. Aeru (MBL inhibitor (9)	0	0	0	0	0	0	9(100%)	9(100%)	0
Ps. Aeru (73)	1(1.36%)	1(1.36%)	0	0	0	0	73(100%)	72(98.63%)	6(8.21%)
E coli-ESBL producer (9)	5(55.55%)	7(77.77%)	0	0	0	0	6(66.66%)	6(66.66%)	1(11.11%)
Ecoli (7)	3(42.85%)	2(28.57%)	0	0	1(14.28%)	0	6(85.71%)	6(85.71%)	0
Cedecea Lapagei (2)	0	0	0	0	0	0	0	0	2(100%)

Table-4(d): Antibiotic sensitivity of bacterial isolates

Bacteria	Total number of positivity	Percentage of positivity(%)
Klebsiella	139	31.73
Acinetobacter baumannii	146	33.33
Pseudomonas aeruginosa	82	18.72
E coli	16	3.65
Proteus	16	1.36
Non lactose fermenting bacilli	12	2.73
Enterobacter	16	3.65
Staphylococcus aureus	9	2.05

Table-5: Percentage of positivity of bacterial isolates:

et al, commonest culture isolates was Klebsiella (36%) followed by staphylococcus (24%) but acinetobacter was only 8% and least common isolates were enterobacter (1%).[15] In our study, the second last commonest bacterial isolates were enterobacter (3.65%) and E coli (3.65%). Again, according to the study by Amini et al. in 2008 – 2009, staphylococcus aureus was the commonest isolate which was contradictory to our study.[6] On the other hand, in the study of D K Azar et al. and Adair et al. enterobacter and pseudomonas aeruginosa were the most common isolates which were partially contrary to our study, because in our study incidence of pseudomonas isolates was 18.72% and enterobacter isolates was 3.65%.[17,18]

In the study of Rahbar et al. in 2006, gram isolates was 75% and Klebsiella pneumoniae 20% and staphylococcus 15.2%. It was similar to our study because this study demonstrated very high incidence of gram negative isolates (97.94%) and klebsiella (31.73%).[19] In the same study incidence of enterobacter was 3% which was similar to the observation found in our study (3.65%). But incidence of staphylococcus aureus isolates was 15.2% in the study of Rahbar et al; this is significant higher than our result (2.05%).[19] In the study in Bangladesh, incidence of acinetobacter was highest (25%) followed by pseudomonas (15%) and klebsiella (10%), which was similar to our study where incidence of bacterial isolates were nearly similar but incidence were very high (acinetobacter 33.33%, klebsiella 31.77% and pseudomonas aeruginosa 18.72%). It has been obvious from the different studies throughout the world that different bacterial isolates are significantly prevalent in different countries which may be due to different factors, like, prevalence of bacterial isolates in the hospital, inadvertent uses of antibiotics, different morbid factors, like, diabetes, use of immunosuppressive therapies, decreased immunity, chronic disease, like, chronic liver disease, interstitial pulmonary fibrosis, bronchial asthma, stroke, malignancies, chronic renal failure. Again, in case of chronic renal failure due to non use or use in low dose of antibiotics which are usually excreted through urine is also a burning factor.

Pseudomonas aeruginosa, a potential opportunistic pathogen is responsible for initiating nosocomial infections in ICU. In our study, these patients demonstrated sensitivity only to polymyxin B and colistin to nearly 100% and moderate sensitivity to carbapenem group of drugs (55% -- 60%), which is similar to the study done by Salma KB et al and Vincent JL et al.[20,21] But in study done by Haque L et al. pseudomonas demonstrated high resistance to cotrimoxazole and moderate resistance to aminoglycoside group of antibiotics.[22]

In our study, enterobacter was highly resistant to all the drugs except moderate sensitivity to polymyxin B and colistin (62.5% and 68.5% respectively) which was similar to the study done by D K Azar and Trautman M et al. where it demoed high resistance to all commonly used drugs.[17,22]

In our study, ESBL producing Klebsiella were moderate to highly sensitive to polymyxin B, colistin and tigicycline (63.15% to 73.68%), ESBL and AMPC producing klebsiella were 90% to 100% sensitive to carbapenem group and carbapenemase producing klebsiella were more than 95% sensitive to polymyxin B and colistin (95.65%). But in the study done by Haque L et al. klebsiella was more than 40% to 60% sensitivity to colistin, ciprofloxacin, amikacin and meropenem.[23]

ESBL producer and non-ESBL producer E coli in our study were moderately sensitive to piperacillin-tazobactam (66.66 and -- 71.42%), cefoperazone-sulbactam (57.24% -- 66.66%), aminoglycoside group (55.55% -- 71.42%), levofloxacin, co-trimoxazole and chloramphenicol (55.55% -- 57.14%), moderate to highly sensitive to carbapenem group (57.14% to 88.88%), polymyxin B and colistin (66.66% in case of ESBL producing E coli and 85.71% in case of non ESBL producing E coli). This is similar to observations done by Haque L et al, where E coli were highly sensitive to aminoglycoside group, colistin, piperacillin, meropenem.[23]

In our study, acinetobacter baumannii was highly sensitive only to polymyxin B and colistin (97% to 98%) and moderately sensitive to tigicycline (68.18%), but only 9% to 20% sensitive to piperacillin and cephoperazone-sulbactum and 20% to 27% sensitive to aminoglycoside group. MBL producing acinetobacter was moderately sensitive to tigicycline (68.18%) and non-MBL producing acinetobacter was 39.21% sensitive to tigicycline. But in the study of Hoque, acinetobacter was 100% sensitive to colistin but 100% resistant ceftriaxone and amikacin. The factors for the development of rapidly emerging highly resistant acinetobacter baumannii are many, like, longer duration of stay in ICU, use of mechanical devices, inadvertent use of broad-spectrum antibiotics, like, fluoroquinolone, carbapenem, third generation cephalosporins.[24]

In our study, cedecea lapagei was only sensitive to ticarcillin; whereas, in a case report of Peretz V, et al. this bacteria was sensitive to fluoroquinolone group, carbapenem group, cotrimoxazole and ceftazidime.[25] Again, in the study of Lopez LAS, three case of cedecea lapagei were sensitive to aminoglycoside group.[26]

CONCLUSIONS

Males were significantly affected by klebsiella group, acinetobacter, pseudomonas, citrobacter, E coli in terms of bacterial isolates as compared to females in our city. Most common bacterial isolates in our city were gram negative, like, acinetobacter baumannii followed by klebsiella and pseudomonas aeruginosa, least common being proteus species. Only one gram positive bacteria were staphylococcus aureus. Most of the gram negative organisms were highly sensitive to polymyxin B and colistin except ESBL and AMPC producing klebsiella, who were nearly 100% sensitive to carbapenem group. In addition proteus group, E coli (ESBL producer) demonstrated high sensitivity to carbapenem group and aminoglycoside group. Prevention of emergence of antibiotic resistant bacteria

can be avoided by prevention of few preventable factors, like, firstly, inadvertent use of antibiotics, secondly, long duration of stay which may be unnecessary in ICU, thirdly, unrestricted use of mechanical use, Regular fumigation of ICU.

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