STUDY OF THE ISOLATES OF SUSPECTED VAP, PREVALENCE OF THE DIFFERENT ORGANISMS AND MIC PATTERNS IN A TERTIARY CARE HOSPITAL

Swagnik Roy[1], Bibhas Saha Dalal[2], Saurabh Mitra[3], Barun Saha Dalal[4], Rajat Dasgupta[5]

[1]Assistant Professor, Department of Microbiology, KPC Medical College and Hospital, Kolkata.
[2]Assistant Professor, Department of Pathology, ESI-PGIMSR, Joka, Kolkata.
[3]Assistant Professor, Department of Microbiology, KPC Medical College and Hospital, Kolkata.
[4]Professor, Department of Microbiology, KPC Medical College and Hospital, Kolkata.
[5]Tutor, Department of Microbiology, KPC Medical College and Hospital, Kolkata.

ABSTRACT

BACKGROUND

The development of nosocomial infections mostly ventilator-associated pneumonia due to prolonged stay in the ICUs varies grossly in different outcomes including increased morbidity and mortality. The American Thoracic Society (ATS) guidelines recommend that quantitative cultures can be performed on ETA or samples collected either bronchoscopically or non-bronchosopically.[1] More importantly, recent small trials have repeatedly shown that there is no advantage of bronchoscopic cultures over quantitative endotracheal aspirate.[2,3,4]

Detection of causative organisms and their antibiotic MIC determination is absolutely necessary to initiate the specific antibiotic with appropriate dose thereby reducing the adverse effects of inadequate antibiotic treatment on the patient prognosis.

MATERIALS AND METHODS

The prospective study was carried out during the period from August 2012 to January 2015 in Department of Microbiology from the samples those were received as a routine culture from VAP suspected patients from the ICU. There were 373 samples from which 123 were culture positives. Inclusion criteria were all the patients 18 years and more age group who were intubated in mechanical ventilator and others were excluded in the study. Clinical Pulmonary Infection Score (CPIS) was given to each patient included in the study on daily basis. CPIS of greater than six was used as diagnostic criteria for VAP.[5] Clinically diagnosed ventilator-associated pneumonia were observed and clinical parameters were recorded from their medical records and bedside charts. All patients with clinical and radiological signs suggestive of pneumonia on admission. Endotracheal aspirate was collected by using a 22-inch Romsons suction catheter. Chest vibration or percussion for 10 mins. was used. Only 1 ETA sample was collected from each patient and was immediately taken to the laboratory for processing.

RESULTS

Klebsiella pneumonia was isolated 39.02%, Pseudomonas aeruginosa was isolated 17.07%, Acinetobacter baumanni was isolated 30.08%, E. coli 8.10% and E. aerogenes 5.60%.

CONCLUSION

Most of the isolates were from Enterobacteriaceae family and very drug-resistant variety. Antibiotic stewardship was done following this study to control the ventilator-associated pneumonia. Empiric antibiotic protocol was formulated and it was very effective.

KEYWORDS

VAP, Carbapenemase Production, ETA, MIC, ICU, CPIS, CLSI, KPC, ATCC, MBL, ESBL.

HOW TO CITE THIS ARTICLE: Roy S, Dalal BS, Mitra S, et al. Study of the isolates of suspected VAP, prevalence of the different organisms and MIC patterns in a tertiary care hospital. J. Evid. Based Med. Healthc. 2017; 4(9), 505-508. DOI: 10.18410/jebmh/2017/95

BACKGROUND

A considerable proportion of critically ill patients acquire nosocomial infection during their stay in the hospital or after discharge and these nosocomial infections varies considerably in different populations and clinical settings.[6,7,8] The development of nosocomial infections mostly ventilator-associated pneumonia due to prolonged stay in the ICUs varies grossly in different outcomes including increased morbidity and mortality.[9,10]

Ventilator-Associated Pneumonia (VAP) is defined as a lower respiratory tract infection that has occurred in the patient 48 hours after he was intubated or received mechanical ventilation.[11] VAP is the most common nosocomial infection in the critical care units with its incidence range varies from 8 to 28 percent patients.[12,13]

Financial or Other, Competing Interest: None.
Submission 02-12-2016, Peer Review 15-12-2016,
Acceptance 19-01-2017, Published 30-01-2017.
Corresponding Author:
Dr. Swagnik Roy,
#26(N), Nutalpally, Kharad,
Titagarh P.O., Kolkata – 700119.
E-mail: swagnik.roy1442@gmail.com
DOI: 10.18410/jebmh/2017/95

Ventilator-associated pneumonia complicates the course of patients receiving mechanical ventilation though there is major advancement in early detection of the aetiological agent and its susceptibility pattern. In absence of a gold standard, VAP is assumed to be diagnosed more accurately by bronchoscopic sampling, which are mostly blind procedures and is uncommonly associated with complications, especially in patients on ventilator. Gold standard is always bronchoscopy and followed by microbiological quantitative culture. But, due to the invasive nature of the procedure, endotracheal aspirates and quantitative ETA cultures are nowadays done with a threshold of 10^5 to 10^6 bacteria per millilitre of exudates that is considered as optimal for the microbiological confirmation of VAP.[14,15,16]

The American Thoracic Society (ATS) guidelines recommend that quantitative cultures can be performed on ETA or samples collected either bronchoscopically or non-bronchoscopically. More importantly, recent small trials have repeatedly shown that there is no advantage of bronchoscopic cultures over quantitative endotracheal aspirate.

Detection of causative organisms and their antibiotic MIC determination is absolutely necessary to initiate the specific antibiotic with appropriate dose thereby reducing the adverse effects of inadequate antibiotic treatment on the patient prognosis.[17]

The present study is undertaken to know the prevalence of the organisms in critical care unit of a tertiary care hospital, their antimicrobial susceptibility pattern and their MICs from the endotracheal aspirates of the clinically suspected patients of VAP.

MATERIALS AND METHODS

The prospective study was carried out during the period from August 2012 to January 2015 in Department of Microbiology from the samples those were received as a routine culture from VAP suspected patients from the ICU. There were 373 samples from which 123 were culture positives.

Inclusion Criteria

Inclusion criteria were all the patients 18 years and more age group who were intubated in mechanical ventilator and others were excluded in the study. Clinical Pulmonary Infection Score (CPIS) was given to each patient included in the study on daily basis. CPIS of greater than six was used as diagnostic criteria for VAP. Clinically diagnosed ventilator-associated pneumonia were observed and clinical parameters were recorded from their medical records and bedside charts.

Exclusion Criteria

All patients with clinical and radiological signs suggestive of pneumonia on admission.

Collection of Endotracheal Aspirates-

Endotracheal aspirate was collected by using a 22-inch Romsons suction catheter. Chest vibration or percussion for 10 mins. was used. Only 1 ETA sample was collected from each patient and was immediately taken to the laboratory for processing.

Microbiological Processing-

The aspirate specimens showing presence of <10 squamous epithelial cells per low power field or organisms seen under oil immersion in the entire field on Gram stain were considered in the study.[18,19] Samples were vortexed for 1 month and centrifuged at 3000 rpm for 10 mins. for homogenisation. 1 mL of sample was diluted in 10 mL of 0.9% sterile saline solution so that the final achieved log dilutions become 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6}. The samples then were plated on Sheep Blood Agar (SBA), Chocolate Agar (CA) and MacConkey Agar (MA). Then, these plates were incubated overnight at 37°C and chocolate agar plates at 37°C in 5% CO_2 incubator. Threshold quantitative dilution was considered to be 10^{-5} cfu/mL. Growth of any organism below the threshold was assumed to be due to colonisation or contamination. Organisms were identified and the antimicrobial susceptibility tests were determined by MicroScan®siemens in its NBPC 42 panel, PBPC 32 panel and LabPro 4.0 version software was used to assess the results as per CLSI 2015 Guidelines. Escherichia coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853 were used as quality control strains.[20] Isolates showing reduced susceptibility to imipenem were selected for detection of metallo-beta-lactamases (MbL) enzymes by imipenem-EDTA combined disc method.[21] Chi-square test was used to compare proportions of groups.

RESULTS

This prospective study was done in the period of August 2012 to January 2015 in KPC Medical College and Hospital ICU.

The results found are described in Table 1 and Table 2.

Organism	Isolated	Total	Percentage
Klebsiella pneumoniae	5	48	39.02%
Klebsiella pneumoniae (ESBL)	5		
Klebsiella pneumoniae (KPC)	38		
Pseudomonas aeruginosa	3	21	17.07%
Pseudomonas aeruginosa (MBL)	18		
Acinetobacter baumannii (MBL)	37	37	30.08%
E. coli (ESBL)	5	10	8.10%
E. coli (carbapenemase)	5		
Enterobacter aerogenes (KPC)	7	7	5.60%

Table 1

Antibiotics	MIC 50	MIC 90	% Sensitive	% Resistance	Range
Amoxicillin	64	64	0	100	<=8 - >=32
Amoxicillin-Clav	32/16	32/16	10	90	<=8/4 >=32/16
Pip-tazo	64	64	15	85	<=16/4 >=128/4
Cefo Sulbactam	64	64	17	83	<=16 >=64
Cefuroxime	32	32	4	96	<=8 >=32
Cefotaxime	32	32	6	94	<=1 >=4
Ceftazidime	16	16	6	94	<=4 >=16
Cefepime	32	32	10	90	<=1 >=4
Aztreonam	16	16	6	94	<=8 >=32
Imipenem	4	4	15	85	<=4 >=16
Meropenem	4	4	15	85	<=1 >=4
Ertapenem	2	2	15	85	<=1 >=4
Gentamicin	16	16	28	72	<=0.5 >=2
Tobramycin	16	16	28	72	<=4 >=16
Netilmicin	16	16	31	69	<=4 >=16
Amikacin	64	64	33	67	<=16 >=64
Ciprofloxacin	4	4	9	91	<=1 >=4
Ofloxacin	4	4	9	91	<=1 >=4
Levofloxacin	8	8	18	82	<=2 >=8
Moxifloxacin	8	8	18	82	<=2 >=8
Co-trimoxazole	80	80	12	88	<40 >80
Polymyxin B/colistin	1	1	100	0	<2 >4
Tigecycline	1	1	100	0	<2 >8

Table 2

DISCUSSION

There was most of the resistant organisms. Isolation number of Klebsiella pneumoniae was most. Molecular typing was done and blaKPC gene was identified in case of carbapenemase producing Modified Hodge Test positive isolates. In this study, carbapenem resistance was seen mainly among Klebsiella species followed by Acinetobacter and Pseudomonas sp.

The resistance to aminoglycoside antibiotics varied from 67% for amikacin to 72% to tobramycin. A study by Francis RO et al showed that among the samples that were confirmed positive for carbapenem resistance, the rate of resistance for each organism was 29% for Klebsiella pneumoniae, 2.8% for Escherichia coli and 3% for Enterobacter spp.

Modified Hodge test was positive in 38 (80%) out of 48 isolates and blaKPC gene was detected in 30 (64%) isolates.

CONCLUSION

Antibiotic stewardship need to be followed and this study should be repeated to show the effectiveness of antibiotic stewardship. Carbapenem-resistant organisms need to be evaluated by PCR and carbapenem-resistance genes need to be identified.

REFERENCES

[1] American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med 2005;171(4):388-416.

[2] Ruiz M, Torres A, Ewig S, et al. Noninvasive versus invasive microbial investigation in ventilator associated pneumonia: evaluation of outcome. Am J Respir Crit Care Med 2000;162(1):119-125.

[3] Sanchez-Nieto JM, Torres A, Garcia-Cordoba F, et al. Impact of invasive and noninvasive quantitative culture sampling on outcome of ventilator-associated pneumonia: a pilot study. Am J Respir Crit Care Med 1998;157(2):371-376.

[4] Wu CL, Yang D, Wang NY, et al. Quantitative culture of endotracheal aspirates in the diagnosis of ventilator-associated pneumonia in patients with treatment failure. Chest 2002;122(2):662-668.

[5] Pugin J, Auckenthaler R, Mili N, et al. Diagnosis of ventilator-associated pneumonia by bacteriologic analysis of bronchoscopic and nonbronchoscopic blind bronchoalveolar lavage fluid. Am Rev Respir Dis 1991;143(5 Pt 1):1121-1129.

[6] Alberti C, Brun-Buisson C, Burchardi H, et al. Epidemiology of sepsis and infection in ICU patients from an international multicenter cohort study. Intensive Care Medicine 2002;28(2):108-121.

[7] Trilla A. Epidemiology of nosocomial infections in adult intensive care units. Intensive Care Medicine 1994;20(Suppl 3):S1-4.

[8] Fournier PE, Richet H. The epidemiology and control of acinetobacter baumannii in health care facilities. Clinical Infectious Diseases 2006;42(5):692-699.

[9] Fagon JY, Novara A, Stephan F, et al. Mortality attributable to nosocomial infections in the ICU. Infection Control and Hospital Epidemiology 1994;15(7):428-434.

[10] Falagas ME, Bliziotis IA, Siempos II. Attributable mortality of Acinetobacter baumannii infections in critically ill patients: a systematic review of matched

cohort and case-control studies. Critical Care 2006;10(2):R48.
[11] Koenig SM, Truwit JD. Ventilator-associated pneumonia: diagnosis, treatment, and prevention. Clin Microbiol Rev 2006;19(4):637-657.
[12] Chastre J, Fagon JY. Ventilator-associated pneumonia. Am J Respir Crit Care Med 2002;165(7):867-903.
[13] Safdar N, Crnich CJ, Maki DG. The pathogenesis of ventilator-associated pneumonia: its relevance to developing effective strategies for prevention. Respir Care 2005;50(6):739-741.
[14] Cook D, Mandell L. Endotracheal aspiration in the diagnosis of ventilator-associated pneumonia. Chest 2000;117(4):195S-197S.
[15] Fujitani S, Yu VL. Quantitative cultures for diagnosing ventilator-associated pneumonia: a critique. Clin Infect Dis 2006;43(Suppl 2):S106-S113.
[16] Nair S, Sen N, Peter JV, et al. Role of quantitative endotracheal aspirate and cultures as a surveillance and diagnostic tool for ventilator associated pneumonia: a pilot study. Indian J Med Sci 2008;62(8):304-313.
[17] Dey A, Bairy I. Incidence of multidrug-resistant organisms causing ventilator-associated pneumonia in a tertiary care hospital: a nine months' prospective study. Ann Thorac Med 2007;2(2):52-57.
[18] Forbes BA, Sahm DF, Weissfeld AS. Bailey and Scott's diagnostic microbiology. 12th edn. Missouri: Mosby Elsevier 2007:p. 811.
[19] Nagendra S, Bourbeau P, Brecher S, et al. Sampling variability in the microbiological evaluation of expectorated sputa and endotracheal aspirates. J Clin Microbiol 2001;39(6):2344-2347.
[20] Clinical and Laboratory Standards Institute. Performance Standards for Antimicrobial Susceptibility Testing. 21th Informational Supplement (M100-S21). Wayne, Pa: Clinical and Laboratory Standards Institute 2011.
[21] Behera B, Mathur P, Das A, et al. An evaluation of four different phenotypic techniques for detection of metallo-β-lactamase producing pseudomonas aeruginosa. Indian J Med Microbiol 2008;26(3):233-237.