Research Article

Bacteriological profile and antibiogram in various body fluids in a tertiary care hospital in north India: A 6 years observational study

Dimple Kasana[1*], Geeta Purohit[2], Deepthi Nair[3]

[1,3]Senior Microbiologist & Assistant Professor, [2]II[nd] Year PG, Department of Microbiology, Vardhaman Mahavir Medical College and Safdarjung Hospital, New Delhi, INDIA.
Email: deepthinair2@gmail.com

Abstract

Background: Periodic surveillance and monitoring programs are helpful for observing any change in trends, development of empirical approaches and for treatment of serious infections. **Objectives:** To study the changing trends in bacteriological profile and antibiogram in various body fluids (pleural, ascitic fluids), over a period of six years. **Materials and Methods:** In this study, total 3536 body fluid samples were processed according to standard guidelines and analysed in order to assess the changing trends in bacteriological profile and antibiogram. **Results:** Out of 3536 body fluid samples [1895 (53.6%) pleural fluid and 1641 (46.4%) ascitic fluid], total of 299 (15.8%) pleural fluid samples and 224 (13.6%) ascitic fluid samples were culture positive. In pleural fluid isolates, Staphylococcus aureus (51.8%) was most common bacteria followed by Pseudomonas spp. (15.8%), Streptococcus pneumonia (9.3%), Acinetobacter spp. (8.6%), Klebsiella spp. (7.9%), Enterococcus spp. (4.3%), Citrobacter spp. (2.1%). In pleural fluid isolates, antimicrobial resistance profile of Staphylococcus aureus was 72.1%, 30.0%, 46.1%, 10.6%, 36.0%, 40.4% and 21.1% to penicillin, oxacillin, ciprofloxacin, chloramphenicol, clindamycin, erythromycin and gentamicin respectively. No resistance was observed against vancomycin. In ascitic fluid isolates, Escherichia coli (30.7%) was most common pathogen followed by Klebsiella spp. (20.4%) and Staphylococcus aureus (20.4%), Acinetobacter spp. (12.5%), Pseudomonas spp. (5.7%) and Citrobacter spp. (5.7%), Enterococcus spp. (4.5%). In ascitic fluid isolates, antimicrobial resistance profile of most common pathogen i.e. Esherichia coli was 73.7%, 35.6%), 28.3%, 74.5%, 44.1%, 44.1%, 3.5% to cefotaxime, netilmicin, amikacin, ciprofloxacin, piperacillin+tazobactam, cefoperazone+sulbactam, carbapenem. **Conclusions:** Bacteriological profile and antibiogram must be taken into account in formulation of hospital antibiotic policy.
Keywords: Antibiogram, Body fluid, Kirby-Baeur disc diffusion method.

[*]**Address for Correspondence:**
Dr. Deepthi Nair, Room No 515-A, V Floor, Department of Microbiology, VMMC and Safdarjang Hospital, New Delhi-110021. INDIA.
Email: deepthinair2@gmail.com
Received Date: 12/07/2015 Revised Date: 30/08/2015 Accepted Date: 17/09/2015

Access this article online	
Quick Response Code:	Website: www.statperson.com
	DOI: 18 September 2015

INTRODUCTION

In developing nations, including India, infection and antimicrobial resistance are global concern. The World Health Organization and the European Commission have recognized the importance of studying the emergence and the determinants of antibiotic resistance and the need for strategies for its control.[1,2] This antimicrobial resistance often results in increased morbidity, mortality and costs of treatment. Prevention of the emergence and dissemination of resistant organisms and their efficient management is critical for control of hospital infections. In addition, surveillance of antimicrobial susceptibility is necessary to combat the emergence of resistance.[3] For empirical treatment, awareness of local antimicrobial susceptibility pattern and causative bacteria is essential. Moreover for better management of patients and framing the antibiotic policy, the knowledge of likely prevalent strains along with their antimicrobial resistance pattern is essential.[4] Hence, this study was undertaken to evaluate the current status of bacterial profile and their antimicrobial susceptibility pattern from various body fluids (pleural, ascitic fluids) in a tertiary care hospital in North India.

How to site this article: Dimple Kasana, Geeta Purohit, Deepthi Nair. Bacteriological profile and antibiogram in various body fluids in a tertiary care hospital in north India: A 6 years observational study. *International Journal of Recent Trends in Science and Technology.* September 2015; 16(2): 432-435 http://www.statperson.com (accessed 20 September 2015).

MATERIALS AND METHODS

In this study, total 3536 body fluid samples were analyzed over 6 years period to assess the bacteriological profile and their antibiogram.

Samples: This cross-sectional hospital based study was conducted in a tertiary care hospital, New Delhi. Pleural and ascitic fluids submitted for bacteriological culture and sensitivity from July 2009 to June 2015 were included in this study. **Processing of samples:** Gram staining was done directly from the sample. Then these samples were processed for culture and sensitivity by standard methods.[5] All significant isolates were identified by standard procedures and their antimicrobial susceptibility was tested by Kirby Bauer disc diffusion method and interpreted as per Clinical and Laboratory Standards Institute (CLSI) recommendations.[6] Appropriate control strains were used for quality control. The antimicrobials used for the gram positive bacteria were penicillin, oxacillin, ciprofloxacin, chloramphenicol, clindamycin, erythromycin, gentamicin, vancomycin, linezolid. The antimicrobials used for the gram negative bacteria were ceftazidime, ciprofloxacin, netilmicin, amikacin, piperacillin + tazobactum, cefoperazone + sulbactam, Imipenem, Meropenem.

RESULTS

Table 1: Bacterial profile in different body fluid samples

Samples	Culture positivity	Gram positive bacteria			Gram negative bacteria				
		S. aureus	*S. pneumoinae*	*Enterococcus*	*Esch. coli*	*Klebsiella*	*Pseudomonas*	*Acinetobacter*	*Citrobacter*
Pleural fluid (n=1895, 53.6%)	n=299 15.8%	51.8%	9.3%	4.3%	-	7.9%	15.8%	8.6%	2.1%
Ascitic fluid (n=1641, 46.4%)	n=224 13.6%	20.4%	-	4.5%	30.7%	20.4%	5.7%	12.5%	5.7%

Table 2: Antimicrobial resistance profile (%age resistance) of gram positive bacteria

	S. aureus		*Enterococcus*		*S. pneumoinae*	
	Pleural fluid	Ascitic fluid	Pleural fluid	Ascitic fluid	Pleural fluid	Ascitic fluid
Penicillin (10 U)	72.1	75	80	80	6.1	-
Cefoxitin (30 µg)	30	40.1	-	-	-	-
Clindamycin (2 µg)	36	40	-	-	-	-
Erythromycin (15 µg)	40.4	50	-	-	-	-
Ciprofloxacin (5 µg)	46.1	36.1	60	80	3.0	-
Gentamicin (10/120µg)	21.1	27.8	40	40	-	-
Vancomycin (30 µg)	0	0	0	0	0	-
Linezolid (30 µg)	0	0	0	0	-	-
Cotrimoxazole (1.25/23.75 µg)	-	-	-	-	51.5	-
Chloramphenicol (30 µg)	10.6	5.5	20	20	0	

Table 3: Antimicrobial resistance profile (%age resistance) of gram negative bacteria

	Esch. coli		Klebsiella		Pseudomonas		Acinetobacter		Citrobacter	
	PF	AF	PF	AF	PF	AF	PF	AF	PF	AF
Cefotaxime/ceftazidime (30 µg)	-	73.7	63.1	76.6	100	83.3	80.2	90.9	88.9	83.3
Ciprofloxacin (5 µg)	-	74.5	62.8	63.3	86.2	83.3	66.7	63.6	77.8	100
Amikacin (30 µg)	-	28.3	36.8	45.5	82.7	80.0	58.8	63.6	40.5	50.0
Netilmicin (30 µg)	-	35.6	47.4	53.5	89.6	78.6	33.3	40.0	66.7	66.7
Pip-Tazo (100/10µg)	-	44.1	47.4	54.0	84.2	83.8	37.5	38.9	55.5	66.7
Cefo-Sulbactam (75/10µg)	-	44.1	52.6	55.5	86.2	86.2	28.7	35.0	55.5	65.4
Carbapenem (10 µg)	-	3.5	15.8	16.6	58.6	40.4	37.8	42.4	33.3	25.7

Out of 3536 body fluid samples received during July 2009 – June 2015, 1895 (53.6%) samples were of pleural fluid and rest 1641 (46.4%) were of ascitic fluid. Out of all samples, culture positivity was 14.8%. Total of 299 (15.8%) pleural fluid samples and 224 (13.6%) ascitic fluid samples were found to be culture positive. (Table 1) Among bacterial isolates from pleural fluid, 65.5% were gram positive and 34.5% were gram negative bacteria. In pleural fluid isolates, Staphylococcus aureus (51.8%) was most common bacteria followed by Pseudomonas spp. (15.8%), Streptococcus pneumonia (9.3%), Acinetobacter spp. (8.6%), Klebsiella spp. (7.9%), Enterococcus spp. (4.3%), Citrobacter spp. (2.1%). Among bacterial isolates from ascitic fluid, 25% were gram positive and 75% were

gram negative bacteria. In ascitic fluid isolates, Escherichia coli (30.7%) was most common pathogen followed by Klebsiella spp. (20.4%) and Staphylococcus aureus (20.4%), Acinetobacter spp. (12.5%), Pseudomonas spp. (5.7%) and Citrobacter spp. (5.7%), Enterococcus spp. (4.5%). In pleural fluid isolates, antimicrobial resistance profile of Staphylococcus aureus was 72.1%, 30.0%, 46.1%, 10.6%, 36.0%, 40.4% and 21.1% to penicillin, oxacillin, ciprofloxacin, chloramphenicol, clindamycin, erythromycin and gentamicin respectively. No resistance was observed against vancomycin. Resistance of Pseudomonas aeruginosa isolates were for ceftazidime (100%), netilmicin (89.6%), amikacin (82.7%), ciprofloxacin (86.2%), piperacillin+tazobactam (84.2%), cefoperazone+sulbactam (86.2%), carbapenem (58.6%). In ascitic fluid isolates, antimicrobial resistance profile of most common pathogen i.e. Esherichia coli was for cefotaxime (73.7%), netilmicin (35.6%), amikacin (28.3%), ciprofloxacin (74.5%), piperacillin+tazobactam (44.1%), cefoperazone+sulbactam (44.1%), carbapenem (3.5%). Antimicrobial resistance profile of Staphylococcus aureus was 75.0%, 40.1%, 36.1%, 5.5%, 40.0%, 50.0% and 27.8% to penicillin, oxacillin, ciprofloxacin, chloramphenicol, clindamycin, erythromycin and gentamicin respectively. Antimicrobial resistance pattern of both gram positive and gram negative bacteria were described in table 2 and 3 respectively.

DISCUSSION

Despite of the use of antibiotics pleural and ascitic fluid infections are associated with significant morbidity and mortality. The emergence of antibiotic-resistant organisms, the increase in the frequency of nosocomial infections, and increasing number of immune-compromised patients have combined to keep pleural and ascitic fluid infections a common entity.[7] The reported spectrum of microorganisms responsible for body fluid infection is varied, and is modified by introduction of antibiotics, patient specific factors such as surgical procedures, trauma or underlying conditions or by methodological factors namely the proper specimen collection, transport and culture. For these reasons, several studies have found discordant results in the spectrum of pathogens causing these infections.[8] In the present retrospective study conducted at a tertiary care hospital, comprising 1895 pleural fluid samples received in the microbiology laboratory the percentage of positive cultures was 15.8%. Rates of microbiological diagnosis in earlier studies have shown a wide variation. A lower positive culture rates similar to this study has been observed in other Indian studies like that of Mohanty *et al* (15.3%) and western studies like Ferrer *et al* (15.5%).[9,10] The reason for this wide disparity in positivity rates of empyema fluids were attributed to differences in techniques, antibiotic use, or the prevalence of effusions caused by infective processes. Some of the variations are likely explained by the differences in study population.[11] In case of ascitic fluid infections, out of 1641 samples culture positivity was 13.6% which is low as compared to other study.[12] In the present study, Staph. aureus was the predominant pathogen in pleural fluid infections. Prior to the availability of antibiotics, S. pneumoniae and S. pyogens accounted for most of the empyema cases.[13] After the discovery and widespread use of antibiotics in the 1940s, Staph aureus succeeded S. pneumoniae and S. pyogens as the major cause of pleural fluid infection. This is in contrast to many other Indian studies where aerobic gram negative bacilli were isolated as most common pathogen.[9,14] MRSA was reported at the rate of 30.0% in our study. Reported prevalence from different parts of the country varies from 30-85% and so far vancomycin resistance has not been reported barring a single report.[15] In case of ascitic fluid infections, gram negative bacilli, Esch. coli was the most common bacteria isolated (30.7%). Esch coli is the most common pathogen responsible for ascitic fluid infections according to different studies. Antimicrobial resistance pattern of Esch. coli isolates was for cefotaxime (73.7%), netilmicin (35.6%), amikacin (28.3%), ciprofloxacin (74.5%), piperacillin+ tazobactam (44.1%), cefoperazone+ sulbactam (44.1%), carbapenem (3.5%). Such high resistance rate against cefotaxime was also reported in another study but was in contrast to high resistance rate against piperacillin+ tazobactam, cefoperazone+ sulbactam.[16,17] Most of the isolates were sensitive to carbapenems. MRSA was reported at the rate of 40.1% in ascitic fluid infections in our study and reported prevalence from different parts of the country varies from 30-85%.

CONCLUSION

Present study (2009-15) indicates that, microbial etiology of pleural fluid infections is gram positive followed by gram negatives and reverse in case of ascitic fluid infections. High resistance rate is observed to penicillin and about 30-40% to methicillin in Staph aureus isolates, but low rate of resistance is seen for chloramphenicol and no resistance to vancomycin. The antibiotic resistance rate of Esch coli especially for third generation cephalosporins (cefotaxime), ciprofloxacin are high. But most of isolates were sensitive to carbapenems. This pattern must be watched closely and taken into account in formulation of hospital antibiotic policy.

REFERENCES

1. Bronzwaer S LAM, Cars O. Buchholz, Udo Molstad, Sigvard Goettsch, Wim Veldhuijzen, Irene K Kool, Jacob L. Sprenger, Marc JW. Degener, John EA. Emerging Infectious Diseases, CDC 2002; 8: 2.
2. World Health Organization. Report on infectious diseases 2000: overcoming antimicrobial resistance. Available at URL: http://www.who.int/infectious-disease-report/index.html. Accessed September 23, 2000.
3. Stamm W, Grayson ML, Nicolle L, Powell M: WHO Global Strategy for Containment of Antimicrobial Resistance (Document no: WHO/CDS/CSR/DRS/2001.2). Geneva, World Health Organization; 2001.
4. Gagneja D, Goel N, Aggarwal R, Chaudhary U. Indian J Crit Care Med 2011; 15: 164-7.
5. Colle JG, Marr W. Specimen Collection, culture containers and media. In: Mackie and McCartney, Practical Medical Microbiology. Editors: Colle JG, Fraser AG, Marimon BP, Simmon A; 14th edition. New York: Churchill Livingston; 1996; 2: 95-111 and113-129.
6. Clinical and Laboratory Standard Institute Guidelines. Performance Standard for Antimicrobial Susceptibility Testing; Twenty second Informational Supplement. M100-S22; 2012.
7. Alfageme I, Muñoz F, Peña N, Umbría S. Empyema of the thorax in adults. Etiology, microbiologic findings, and management: Chest. 1993; 103(3):839-43.
8. J.M. Porcel, P. Vázquez, M. Vives, A. Nogués, M. Falguera, A. Manonelles: Pleural Space Infections: Microbiologic and Fluid Characteristics in 84 Patients. The Internet Journal of Pulmonary Medicine. 2003; 3.
9. Mohanty S, Kapil A, Das BK. Bacteriology of parapneumonic pleural effusions in an Indian hospital: Trop Doct 1. 2007; 37(4):228-229.
10. Ferrer A, Osset J, Alegre J, Suriñach JM, Crespo E, Fernández de Sevilla T et al, Prospective clinical and microbiological study of pleural effusions. Eur J Clin Microbiol Infect Dis. 1999; 18(4):237-41.
11. Barnes TW, Olson EJ, Morgenthaler TI, Edson RS, Decker PA, Ryu JH. Low yield of microbiologic studies on pleural fluid specimens. Chest. 2005; 127(3):916-21.
12. Purohit PH, Malek SS, Desai KJ, Sadadia M. A study of bacteriological profile of ascitic fluid in suspected clinical cases of spontaneous bacterial peritonitis at a tertiary care hospital in India. Int J Med Sci Public Health. 2005; 4(4):496-501.
13. Acharya PR and Shah KV. Empyema thoracis: A clinical study;Ann Thorac Med. 2007 Jan-Mar; 2(1): 14–17.
14. Gupta S K, Kishan J,Singh S P, Review of one hundred cases of Empyema thoracis; Indian J Chest Dis Allied Sci; 1989;31(1):15-20.
15. Jain S, Banavaliker J N. EMPYEMA THORACIS: Bacteriological analysis of pleural fluid from the largest chest hospital in Delhi. IOSR Journal of Dental and Medical Sciences. 2013; 3:46-51.
16. Sheikhbahaei S, Abdollahi A, Hafezi-Nejad N, Zare E. Patterns of Antimicrobial Resistance in the Causative Organisms of Spontaneous Bacterial Peritonitis: A Single Centre, Six-Year Experience of 1981 Samples. International Journal of Hepatology. 2014. http://dx.doi.org/10.1155/2014/917856
17. Piroth L, Pechinot A, Minello A, Jaulhac B, Patry I, Hadou T et al. Bacterial epidemiology and antimicrobial resistance in ascitic fluid: A 2-year retrospective study. Scandinavian Journal of Infectious Diseases. 2009; 41:11-12.

Source of Support: None Declared
Conflict of Interest: None Declared