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Aerobic Bacterial Profile and Antimicrobial Susceptibility Pattern of Pus Isolates in a Tertiary Care Hospital in Hadoti Region

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A B S T R A C T

Pyogenic infections are one of the major complications of surgery and trauma. The emerging drug resistance among microorganism increases both morbidity as well as mortality in association with such infections. Thus, selection of appropriate antibiotics and its rational use plays a key role in prevention as well as treatment of these infections. The indiscriminate use of antibiotics is one of the leading cause of emergence of drug resistant pathogens. Knowledge of etiological agents of infections and their resistance pattern is necessary to stop the continued emergence of resistance. Thus, this study will help the clinician with the tool to provide safe and effective empirical therapy. The aim of the study was to determine the commonly encountered pathogens in pus samples along with their antibiogram. This study was conducted from August 2015 to January 2016 in central lab, MBS hospital kota. Pus samples received for diagnostic microbiology was processed and identified by standard protocols. Antibiotic susceptibility test was done by Kirby Bauer disc diffusion method. Out of 150 pus samples received for culture and sensitivity in the microbiology central laboratory, 120 (80%) cases yielded positive culture while 30 (20%) cases had no growth. Among the 120 culture positive pus samples, 105 yielded pure bacterial isolates and 15 yielded mixed infection. *E. coli* was the most common isolates followed by *Staphylococcus aureus*, *K. pneumoniae, Pseudomonas aeruginosa*, *Enterococcus* spp and Proteus. Among the Gram positive isolates vancomycin, linezolid and tetracycline were the most susceptible drugs whereas among the Gram negative isolates, the most susceptible drugs were meropenem, amikacin and tetracycline. Whereas among nonfermenters most effective drug was polymyxin B followed by piperacillin-tazobactam, amikacin and meropenem. Antimicrobial resistance poses challenge in treating pyogenic infections. So appropriate and rational use of antibiotic is important to avoid emergence of multidrug resistant strains.

Introduction

Pyogenic infections cause severe local inflammation of the site involved, usually with pus formation. Pus is thick, opaque usually yellowish-white fluid which is composed of dead white blood cells, tissue debris and pathogenic bacteria (Koneman *et al.*, 2005). Pyogenic infections may endogenous or exogenous. Any discontinuity of skin due to trauma, burns, bites, minor cuts, crush or laceration injury or gunshot injury, provides a favorable environment for microbial colonization. Surgical site infections with such pyogenic organism are one of the most common types of nosocomial infections. The increased risk of bacterial infections has been further compounded by

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the rising trends of antibiotic resistance. This is particularly true in the case of members of Enterobacteriaceae group like *E. coli* and *Klebsiella*. Inadverdant use of antibiotics leads to emergence of drug resistant pathogens. Moreover, highly virulent strains and their capacity to adapt quickly to changing environment worsens the situation. The knowledge of microorganisms causing infections and their antibiogram to available drugs is of immense value to the rational selection and use of antimicrobial agents and for the development of appropriate prescribing policies (El-Astal, 2005). The present study was designed to evaluate the profile of aerobic pyogenic bacteria along with their susceptibility to antibiotics and aims to bridge the gap in the knowledge and also to provide the clinician with the tools to provide safe and effective empirical therapy.

Materials and Methods

A total number of 150 pus samples received for aerobic culture and sensitivity in Microbiology Central laboratory of MBS Hospital, Kota Rajasthan. Study was conducted on samples received during a period from August 2015 to January 2016.

Received pus samples were processed on Blood Agar, Chocolate Agar, MacConkey's Agar and Nutrient Agar media and incubated at 37° C under aerobic condition in incubator and the organisms were identified by biochemical reactions, Gram stain and motility test as per standard protocols.

The antimicrobial susceptibility testing was done by Kirby Bauer's Disk Diffusion method and interpreted as per Clinical Laboratory Standard Institution (CLSI) guidelines. Standard antibiotics like, ampicillin (10 mcg), amoxyclav (20/10 mcg), piperacillin/tazobactum (100 /10 mcg), vancomycin (30 mcg), ceftriaxone (30 mcg),

cefotaxime (30 mcg), ceftazidime (30 mcg), cefepime (30 mcg), meropenem(10mcg), aztreonam (30 mcg), ciprofloxacin (5 mcg), levofloxacin (5 mcg), clindamycin (2 mcg), gentamicin (10 mcg), amikacin (30 mcg), penicillin (10 units) tetracycline (30mcg), linezolide (30mcg), cotrimazole(25mcg) and erythromycin (15 mcg), polymyxin B (30units) (Tiwari *et al*., 2010) were used (Himedia).

Results and Discussion

Out of 150 pus samples received for culture and sensitivity in the microbiology central laboratory 120 (80%) cases yielded positive culture while 30 (20%) cases had no growth. Among the 120 culture positive pus samples, 105 yielded pure bacterial isolates and 15 yielded mixed infection. The Department wise distribution of pus samples revealed that surgery dept. was the highest contributors (43. 50%), followed by Orthopaedics (30%), Gynae and Obs. (13. 3%), Medicine (9. 17%), Skin (4. 17%) and ENT (3. 33%) department (Table-1).

Among the 120 culture positive pus samples, *Escherichia coli* was 54(45%) *Staphylococcus aureus* was 35 (29. 17%), *Klebsiella pneumoniae* was 21 (17. 5%) *Pseudomonas aeruginosa* was 8 (6. 67%), Proteus sp. was 7 (5. 83%) and *Enterococcus* spp. was 5 (4. 17%) (Table 2).

The Antibiogram of Gram Positive cocci (Table-3) revealed that the Vancomycin (100%) was the most susceptible drug followed by Linezolide (94%) and Tetracycline (85. 7%). Whereas Gram negative bacilli (Table-5) were more susceptible to Meropenem (90. 3%), Amikacin (85%) and Tetracycline (73%).

The non fermenter group (Table 4) was most suspectible to Polymyxin B (87. 5%),

followed by pipercillin tazobactam (62%), Amikacin (62%) and meropenem (62). The present study revealed *E. coli* to be the most commonly occurring pathogen in pus sample (Lee *et al*., 2009; Agnihotri *et al*., 2004) followed by S. aureus (Ghosh *et al*., 2009; Zubair *et al*., 2010; Basu *et al*., 2009). The Department wise distribution of pus samples revealed that surgery dept. was the highest contributors (43. 5%), followed by

Orthopaedics (30%), Gynae and Obs. (11. 76%), Medicine (9. 17%), Skin (4. 17%) and ENT (3. 33%) departments. Similar observation was quoted by Vikas Jain *et al*., (2015). Among 150 samples collected, 120(80%) were positive for aerobic bacterial growth. Biradar *et al.,* (2016) done a similar study and quoted 66.01% of positive aerobic growth.

Table.1 Department wise contribution of pus samples

Serial no.	Department	Number (%)
1.	Surgery	65(43. 5%)
2.	Orthopaedics	45(30. 00%)
3.	Gynae & Obs	20(13. 33%)
4.	Medicine	11(9. 17%)
5.	Skin	5(4. 17%)
	Total	150

Table.2 Organism isolated from culture positive pus samples

Serial No.	Organism	Number (%)
1.	*Escherichia coli*	54 (45%)
2.	*Staphylococcus aureus*	35(29. 17%)
3.	*Klebsiella pneumoniae*e	21 (17. 5%)
4.	*Pseudomonas aeruginosa*	8 (6. 67%)
5.	*Proteus* spp.	7 (5. 83%)
6.	*Enterococcus* spp.	5 (4. 17%)
	Total	120 (100%)

Table. 3 Antibiogram of Gram positive bacteria

Antibiotics	*Staphylococcus aureus*(35)		*Enterococcus* spp(5)	
	Sensitive	Resistance	Sensitive	Resistance
Penicillin	3 (8. 5%)	32(91. 4%)	0	5(100%)
Erythromycin	25 (71. 4%)	10(28. 5%)	4 (80%)	1(20%)
Clindamycin	28 (80%)	8(22. 8%)	3 (60%)	2(40%)
Ciprofloxacin	20 (57. 1%)	15(42. 8%)	3 (60%)	2(40%)
Cotrimazole	17 (48. 5%)	18 (51. 4%)	2 (40%)	3(60%)
Gentamicin	26 (74. 5 %)	9 (25. 7%)	3 (60%)	2(40%)
Linezolid	33 (94. %)	2(5. 7%)	5 (100%)	0
Tetracycline	30 (85. 7%)	5(14. 2%)	2(40%)	3(60%)
Vancomycin	35 (100%)	0	5 (100%)	0

Table.4 Antibiogram of *Pseudomonas aeruginosa*

Antibiotics	Pseudomonas(8) (sensitive)
Ampicillin	1(12. 5%)
Gentamicin	4(50%)
Amoxycalv	4(50%)
Amikacin	5(62. 5%)
Ciprofloxacin	3(37. 5%)
Cepefime	3(37. 5%)
Cetriaxone	2(25%)
Ceftazidime	4(50%)
Aztreonam	3(37. 5%)
Meropenem	5(62. 5%)
Levofloxacin	3(37. 5%)
Pipercillin- tazobactam	5(62. 5%)
Polymyxin B	7(87. 5%)

Table.5 Antibiogram of Enterobacteriaceae

Antibiotic	*Escherichia coli* (54)	*Klebsiella pneumoniae* (21)	Proteus(7)
Ampicillin	3(5%)	2(9. 5%)	3(42. 85%)
Amoxyclav	15(27. 7%)	2(9. 5%)	4(57. 14%)
Cotrimoxazole	35(64. 8%)	11(52. 3%)	6(85. 71%)
Tetracycline	37(68. 51%)	14(66. 6%)	6(85. 71%)
Amikacin	42(77. 7%)	18(85. 7%)	7(100%)
Ciprofloxacin	10(18. 5%)	5(23. 8%)	3(42. 85%)
Gentamicin	35(64. 8%)	13(61. 9%)	3(42. 85%)
Cefepime	11(20%)	4(19%)	2(28. 57%)
Cetriaxone	5(9%)	3(14. 2%)	2(28. 57%)
Cephotaxime	3(5%)	3(14. 2%)	3(42. 85%)
Ceftazidime	5(9%)	5(23. 8%)	2(28. 57%)
Aztreonam	10(18. 5%)	5(23. 8%)	2(28. 57%)
Meropenem	44(81. 4%)	19(90. 4%)	7(100%)

Among the 120 culture positive pus samples, *Escherichia coli* was 54(45%) *Staphylococcus aureus* was 35 (29. 17%), *Klebsiella pneumoniae* was 21 (17. 5%) *Pseudomonas aeruginosa* was 8 (6. 67%), Proteus sp. was 7 (5. 83%) and *Enterococcus* spp. was 5 (4. 17%) Similar results were obtained in study done by Biradar *et al.,* (2010).

Among enterobacteriaceae group E. coli was most common isolate, followed by *Klebsiella pneumoniae*e. Our study correlates to study done by Jain *et al*., (2015) and biradar *et al*., (2010).

The Antibiogram of Gram Positive cocci revealed that, Vancomycin(100%) was the most susceptible drug followed by Linezolide (94%) and Tetracycline (85%). Gram negative Bacilli were more susceptible to Meropenem (90. 3%), Amikacin (85%), Tetracycline (73%), cotrimoxazole (64%); all these observation were in agreement with the

study by Biradar *et al.,* (2010) and Rao *et al*., (2014).

Among nonfermenter group, *Pseudomonas* isolated in our study, 87.5% were susceptible to Polymyxin B, followed by pipercillin tazobactam (62%), Amikacin (62%). Similar results were quoted in study done by Jain *et al*., (2012).

All *Staphylocoocus aureus* isolated were susceptible to Vancomycin and linezolide. Similar findings were found in other studies like Jain *et al.*, (2012); Rao *et al.,* (2014).

Tetracycline was found to be effective for both gram positive and gram negative organism. Among members of enterobacteriaceae, tetracycline and cotrimoxazole were found to be more effective than the cephalosporins group antibiotics showing shift in the susceptibility patterns of organisms for these antibiotics. This study also forecasts the increasing trends in resistance for higher generation cephalosporins which are most commonly employed for almost all type of infections treatment nowadays.

In conclusion, pyogenic infections are the major cause of morbidity since long time. Emerging antibiotic resistance among pyogenic bacteria has a surplus negative impact in treatment of such cases. *Staphylococcus aureus* is still one of the major etiological agents of pyogenic infections. Even though gram negative bacteria outnumbered it. The use of appropriate antibiotics is very crucial in preventing emergence of multidrug resistance in bacteria. Also the pathogen shows susceptibility to certain older drugs. So, we recommend drug holidays for the group of drugs which have become ineffective over a period of time and bringing up the agents to which the organisms are sensitive. The

changing trends in antibiotic sensitivity profile of the isolates need to be monitored on a regular basis as there is limited availability of newer drugs and emergence of resistant bacteria far exceeds the rate of new drug development.

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