Research Article

Bacterial Profile and Antimicrobial Resistance Pattern of Pus Isolates in Beni-Suef University Hospital from 2008-2014: An Observational Study

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ABSTRACT

The bacterial profile and the antibiotic pattern of the wound infections may change from time to time and place to place. The appearance of antimicrobial drug resistance has made the treatment of these wound infections very difficult. The aim of the study was to identify the prevalent bacterial profile and its resistance rates in our area represented in Beni-Suef University Hospital. Archived pus culture date obtained from Beni-Suef University Hospital 2008-2014 were entered to data base, and then analyzed to identify the bacterial profile and its resistance pattern of the 407growth, *Pseudomonas spp.* was the most common organism isolated (20.9%), followed by MSSA (Methicillin Sensitive *Staphylococcus aureus*) (14.3%), *Escherichia coli* (10.8%), MRSA *(9.1%),* and *Klebsiella* spp.(8.8%) among others. MSSA was found to be highly resistant to penicillin, ampicillin, and erythromycin, while being sensitive to vancomycin. On the other hand, all the Gram-negative bacilli isolated were found to be highly resistant to cephalosporins and fairly showed low resistance towards imipenem, and amikacin. There was a high resistance rate toward different antibiotics and this study give a good guide to the clinicians to propose an empirical treatment for the patients.

Keywords: Pus, bacterial isolates, resistance.

INTRODUCTION

Pus-a whitish yellow liquid- is an amassing for body's immune system produced throughout inflammation due to bacterial or fungal infection, and consisting from protein rich liquid and dead leukocytes[1]. Many studies, done in different areas all over the world, showed the bacterial profile and the antibiogram in their respective areas[2]; and so made an important observation for clinicians who want to prescribe empirical treatment to their patients while laboratory culture reports are awaited[2].

Penicillin- the first antibiotic to be used on a large scale- was first implicated during the World War II[3]. In recent years, antimicrobial resistance to many human pathogenic bacteria is being commonly reported from all over the world[4]. In spite of large number of newly discovered antibiotics in the recent three decades, the situation is alarming specially in the developing countries tries mainly due to of their un-systemic use[5,6].

This study was designed to evaluate the profile of bacteria isolated from pus specimens in our area along with their resistances pattern to different antimicrobial agents.

METHOD

Data collection

Positive pus cultures Data from 2008 to 2014 archived folders, in the Chemical and Clinical Pathology Laboratories of Beni-Suef University Hospital was obtained. The data included the antibiogram of the selected recovered microorganisms to different antibiotics. The data was entered in Microsoft access data base designed by Dr. Sameh Abdel Ghani, called Antimicrobial Sensitivity (MRSA), and this data base included in project of rehabilitation of the Microbiology and Clinical Pathology Unit in Beni-Suef University Hospital, Beni-Suef, Egypt.

Antimicrobial susceptibility testing

The antimicrobial susceptibility testing of different pathogens towards many antibiotics were performed according to the Clinical laboratory Standards Institute (CLSI) [7], disk diffusion test.

Data analysis

The previous data are analyzed using Chi-Square test by SPSS V22.0 (SPSS Inc., Chicago, USA), and all values about the percentage of resistance of common isolated pathogen towards most common used antibiotics in cultured isolated from pus were represented.

RESULTS

A Total of 407 pus sample showing significant growth were included in this study from 2008 to 2014.Of these 279 (68.6%) were Gram negative bacteria and 127 (31.2%) were Gram positive bacteria. There was only one isolated case include *Candida albicans* (Table 1). Positive pus cultures were 58.5% males, and 41.4% females.

Of the isolated 279 Gram negative bacteria, *Pseudomonas spp.* was the most predominant organism (20.9%), followed by *Escherichia coli* (10.8%), *Klebsiella* spp. 8.8%, *Enterobacter* spp. 7.4%, *Actinetobacter* spp. 6.6%, and others. In another hand, of the 127 isolated Gram positive

Isolate	N	%
Gram (-)		
Escherichia coli	44	10.8
Klebsiella spp.	36	8.8
Pseudomonas spp.	85	20.9
Enterobacter spp.	30	7.4
Acinetobacter spp.	27	6.6
Klebsiella oxytoca	13	3.2
Escherichia coli (ESBLs) producer	4	1
Pseudomonas aeruginosa	15	3.7
Proteusspp	10	2.5
Citrobacter spp.	1	.2
Morganella spp.	1	.2
Proteus mirabilis	8	2
Proteus vulgaris	5	1.2
Gram (+)		
MSSA	58	14.3
Enterobacterspp	6	1.5
CoNS	17	4,2
MRSA	37	9.1
Streptococcus spp	2	.5
Staphylococcus spp	1	.2
Streptococcus pneumoniae	2	.5
Streptococcus pyogenes	4	.1
Fungi		
Candida albicans	1	.2

bacteria, MSSA was the most prevalent organism 14.3%, followed by MRSA (Methicillin resistant *Staphylococcus aureus*) (9.1%), and Coagulase Negative *Staphylococcus* (CoNS) (4.2%).

Table 1: Number of organisms and their percentages

The Department wise distribution of pus samples revealed that surgery department was the highest contributors (39.1%), followed by outpatient (19.2%), general internal medicine (15.3%), intensive care unit (6.1%), urinary tract (3.7%) and nose and ear (2.5%) departments (Table 2).

For Gram negative bacteria, *Pseudomonas* spp. showed high resistance towards most antibiotics such as ampicillin, cephalosporins, pipracillin/tazobactam and erythromycin, but showed resistance below 50% towards amikacin, meropenem, and imipenem, 39.7%, 41.3%, and 44.4% respectively (Table 3).

*Escherichia coli*showed low resistance towards piperacillin/tazobactam (11.1%), imipenem (13.3%), levofloxacin (20.8%), amikacin (24.1%), and meropenem (25%), but also showed high resistance towards ampicillin, cephalosporins, aztreonam, and sulphamethoxazole/trimethoprim (Table 3).

Table 2: Department wise contribution of pus samples

Department	Number (%)
Surgery	159(39.1%)
Outpatient	78(19.2%)
General internal medicine	63(15.3%)
Intensive care unit	25(6.1%)
Urinary tract	15(3.7%)
Nose and Ear	10(2.5%)
Oncology	9(2.2%)
Rheumatology	9(2.2%)
Orthopedic	7(1.7%)
Pediatric	6(1.5%)
Premature infant	6(1.5%)
Hemodialysis	4(1%)
Gynecology	4(1%)
Neurology	3(.7%)
Endemic diseases	3(.7%)
Ophthalmology	3(.7%)
Chest	2(.5%)
Cardiothoracic surgery	1(.2%)
Total	407(100%)

Klebsiella spp. showed relatively low resistance towards imipenem (23.1%), amikacin (28.6%), ofloxacin (31.3%), meropenem (35.7%), and levofloxacin (36.4%), on the other handshowed high resistance towards penicillin, ampicillin, cephalosporins, sulphamethoxazole / trimethoprim, ampicillin / sulbactam, amoxicillin / clavulanate, and piperacillin / tazobactam (Table 3).

Enterobacter spp. showed highly resistant rate towards most antibiotics except ofloxacin (39.3%), but showed 50% resistance towards imipenem, amikacin, and meropenem (Table 3).

Acinetobacter also showed relatively high resistance towards most antibiotics.

(Table 3). For Gram positive bacteria, MSSAshowed high resistance towards most antibiotics except vancomycin(0%), and showed 50% resistance or less

towards erythromycin (50%), imipenem (39.6%), meropenem (48.4%), and levofloxacin (48.6%) (Table 4).

MRSA showed relatively low resistance towards meropenem (27.3%), vancomycin, levofloxacin (28.6%) for each, imipenem (31.6%), and piperacillin / tazobactam(33.3%), but there were high resistance towards other antibiotics (Table 4).

CoNS showed high resistance towards most antibiotics except vancomycin (20%), imipenem (33.3%), ofloxacin (36.4%), and levofloxacin (37.5%)(Table 4).

Table 3: Antibiotic resistance of Gram negative isolates

	Pseudomonas spp		*Escherichia coli*		*KLebsiella spp*		*Enterobacter spp*		*Acinitobacter*	
	R%	Total	R%	Total	R%	Total	R%	Total	R%	Total
Penicillin	-	-	70	10	92.3	13	-	-	100	4
Ampicillin	85	20	100	1	88.9	9	92.3	13	100	9
AMC	68.1	69	78.6	28	76.5	17	58.6	29	66.7	12
SAM	73.7	38	71.4	7	85.7	14	100	2	-	-
Imipenem	44.4	72	13.3	15	23.1	13	50	28	42.9	14
Aztreonam	84	25	88.2	17	76.9	13	66.7	3	-	-
Cefotaxime	74.3	70	84	25	57.9	19	69.2	26	91.3	23
Ceftriaxone	79.2	77	95.7	23	63.2	19	82.1	28	85.7	14
Ceftazidime	77.4	62	91.7	12	87.5	8	75	28	86.7	15
Cefipime	59.7	62	100	12	68.8	16	66.7	18	66.7	18
Amikacin	39.7	68	24.1	29	28.6	21	50	26	83.3	6
Gentamycin	-	-	60	15	63.6	11	-	-	50	2
Erythromycin	66.7	18	76.5	17	86.7	15	60	5	45.5	11
STX	50.7	73	66.7	12	84.2	19	52.4	21	66.7	3
Meropenem	41.3	46	25	16	35.7	14	50	4	-	-
PTZ	68.9	61	11.1	9	60	5	55	20	50	4
Levofloxacin	-	-	20.8	29	36.4	11	100	1	71.4	7
Ofloxacin	50	4	50	6	31.3	16	39.3	28	60	10

AMC: Amoxacillin/clavunalate.
SAM: Ampicillin/sulbactam.
SXT: Sulphamethoxazole/trimethoprim.
PTZ: Piperacillin/tazobactam.

DISCUSSION

Wound infection is regarded as the most common nosocomial infection among surgical patients[8]. It has been associated with increased trauma care, prolonged hospitals stay, and treatment[9].

Our observational study was to give a good view to the clinicians a tool about the pus isolates bacterial resistance pattern to help clinicians in planning the empirical treatment.

The present study revealed that Gram negative isolates from pus were more than Gram positive (68.6% : 31.2%). This result is similar to the studies by *Mantravadi et. al.*[10], and *Rao et al*[2]. Both of those studies were done in India.

The present study also showed that the male : female distribution of pus isolates to be 1.42:1 which closely corroborates with the study by *Rao et al*[2], *Pappu et al*[11], and *Jain et al*[12]. Those studies were also done in Similar to previous study *Pseudomonas spp.* was the most common isolate recovered from pus cultures then *MSSA*[13]. However, *Tiwari P. et al*[14], *Lee C.Y. et al*[15] and *Anguzu J.R.*[16] reported that *MSSA* was the most common isolates then Pseudomonas spp. This difference in common isolate in different literatures suggests that clinicians should know the microorganism to suggest a good empirical treatment.

The Department wise distribution of pus samples showed that surgery department was the highest contributors (39.1%), and this result is similar to those by *Rao et al*[2], and *Biradar et al*[17]. That is due to the large number of wound cases in such a department. Pseudomonas spp., isolate from pus cultures, showed high resistance towards most antibiotics such as ampicillin (85%), cephalosporins, and erythromycin (66.7%), showed resistance below 50% towards amikacin, meropenem, and imipenem (39.7%, 41.3%, and 44.4%, respectively). *Biradar et al*[17] reported high resistance rates towards cephalosporins, and

ampicillin, resistance below 50% towards amikacin, and meropenem. In the other hand, Mantravadi et al[10] reported the same for ampicillin and sulphamethoxazole / trimethoprim, but showed low resistance rates towards cephalosporins in comparison with this study.

Table 4: Antibiotic resistance of Gram Positive isolates

	MSSA		MRSA		CONS	
	Resistance%	Total	Resistance%	Total	Resistance%	Total
Penicillin	100	1	100	3	100	4
Ampicillin	90	10	100	5	100	2
Vancomycin	0	13	28.6	7	20	5
AMC	88.4	43	80.6	31	75	8
SAM	-	-	83.3	24	100	8
Impenem	39.6	48	31.6	19	33.3	9
Cefotaxime	93	44	77.8	27	83.3	6
Ceftriaxone	92.9	28	78.3	23	80	5
Ceftazidime	92.9	42	100	2	66.7	9
Cefipime	72.5	40	75	16	66.7	3
Amikacin	-	-	33.3	24	46.7	15
Gentamycin	55.6	18	70.4	27	63.6	11
Erythromycin	50	12	88.9	9	60	5
SXT	66.7	15	78.3	23	100	2
Meropenem	48.4	31	27.3	22	100	1
PTZ	60	30	33.3	3	50	4
Levofloxacin	52.8	36	28.6	28	37.5	8
Ofloxacin	48.6	37	43.8	16	36.4	11

For *Escherichia coli*, the study showed low resistance towards to piperacillin / tazobactam (11.1%), imipenem (13.3%), levofloxacin (20.8%), amikacin (24.1%), and meropenem (25%), but also showed high resistance towards ampicillin, cephalosporins, aztreonam, and sulphamethoxazole / trimethoprim. *Chaudhary et al*[18] reported also high resistance rates of *Escherichia coli* towards cefotaxime, sulphamethoxazole / trimethoprim (SXT), and amoxicillin, but no resistance towards amikacin. *Mantravadi et al*[10] reported results related to our study that *Escherichia coli*showed high resistance to SXT, and cephalosporins, with low resistance towards imipenem, amikacin, and piperacilline / tazobactame, and meropenem.

E. coli and other Enterobacteriaceae are usually susceptible to imipenem and meropenem. The resistance reported for these drugs is disturbingly high and suggestive of a carbapenemase problem. Usually meropenem is more potent than imipenem against gram-negative bacteria[19]. In this study imipenem is more potent than meropenem. This is an unusual finding, and needed to further investigation.

In our study MSSA showed high resistance towards most antibiotics except vancomycin (0%), and showed 50% resistance or less towards erythromycin (50%), imipenem (39.6%), meropenem (48.4%), and levofloxacin (48.6%). Rao et al[2] reported the same resistance for vancomycin with (0%), and resistance towards gentamycin (53.58%). *Chauhan et al* [20] reported resistance towards vancomycin (9.78%), low resistance rates towards gentamycin (14.13%), and high resistance towards ampicillin (80.43%).

MRSA showed relatively low resistance towards meropenem (27.3%), vancomycin (28.6%), levofloxacin (28.6%), imipenem (31.6%), amikacin (33.3%), and piperacilline/tazobactame (33.3%), but there were high resistance towards other antibiotics. Similar to our result study by *Biradar et al* [17] reported high resistance rates towards penicillin (100%), and Erythromycin (53.33%), with no resistance towards vancomycin.

This difference in sensitivity of different microorganism to different antibiotics in the present study in addition to the previously mentioned literatures could be rationalized by the effect of difference in date and place on resistance. It is obvious that the antibiotic pattern and the bacterial profile of the wound infections may change from time to time and place to place. The presence of many antibiotics and their misuse, multidrug-resistant bacteria are emerging, and in our area, there are high resistance rates

towards different antibiotics, and this also reported in study by *Abdelghani et al.*[21].

This paper recommendation to activate the role of antibiotic committee in hospital, and give good empirical guidance and antibiotic stewardship considerations.

Unexpected high levels of resistance to certain drugs, especially the carbapenems. This indicates the occurrence of either some very disturbing resistance mechanisms (which warrant a follow-up study to investigate the resistance mechanisms) or technical problems in the testing. Carbapenem resistance is a huge global concern.

CONCLUSION

Our study gave a good overview to the clinicians about our localpus isolates bacterial resistance pattern. Vancomycin was found to be very effective in eradication of Gram positive bacteria isolates.

It becomes essential to know the prevalent profile and sensitivity pattern to guide the clinicians to start the empirical treatment. Also, it is very important to establish a recommendation or good guidelines to help clinicians suggest empirical treatment.

It has been noticed that the last resort medications of antibiotics have been implicated in empirical treatment of patients and this example why the resistance exceed the normal range towards the first line medications, but vancomycin is stile the last resort for Gram positive bacteria , and is very optimistic although increased usage.

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