ORIGINAL RESEARCH

Antibiotic Resistance Pattern Of Gram Negative Bacilli Isolated From Pus In A Tertiary Care Hospital From Central India

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ABSTRACT

Introduction: Pyogenic infections are either poly microbial or mono microbial**.** To cure the problem, antibiotics are main options. The inadvertent use of antibiotics leads to emergence of drug resistant pathogens, which in turn acts as a great challenge to the health services. It has been observed that the infections caused by Gram negative bacilli are difficult to treat as compared to Gram positives .So the present study was conducted with the aim to determine the present scenario of antibiotic resistance among Gram negative bacilli .

Material and methods: All the pus samples received in the microbiology laboratory, Government Medical College, Nagpur were immediately processed and identified according to standard bacteriological techniques. Antibiotic susceptibility testing was performed.

Results: A total of 214 pus samples were processed, out of which 64.95% were positive for aerobic culture. From these samples, 69.15%Gram negative bacilli were isolated. The most common organism isolated among Gram negative bacilli was E.coli i.e 32.43% followed by klebsiellae spp. i.e 21.62%. All the Gram negative bacilli showed maximum resistance to ampicillin followed by ciprofloxacin, gentamicin and co-trimoxazole.The maximum sensitivity was observed towords imepenem & ticarcillin.The point of concern was that all the isolates were multidrug resistant.

Conclusion: Multidrug resistant organism is a cause of concern which suggests that antibiotic sensitivity testing be carried out on all isolates of wound infections before chemotherapy to avoid emergence of drug resistant strains.

Keywords: Pus, Gram negative organism, antibiotic resistance

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INTRODUCTION

Wound infections are one of the most common hospital acquired infections, and are an important cause of morbidity and account for 70-80% mortality.[1,2] Development of such infections represent delayed healing, cause anxiety and discomfort for patient, longer stays at hospitals and add to cost of healthcare services significantly.[3] Pyogenic infections are characterized by local and systemic inflammation usually with pus formation.[4] Pyogenic infections are either polymicrobial or monomicrobial. An average of 5-6 strains of organisms are often involved in the infections with a mixture of aerobic and anaerobic organisms.[5] Most common organisms observed are *Staphylococcus aureus*, *Klebsiella* sp., *Pseudomonas* sp., *Escherichia coli*, *Proteus* sp., *Enterococci* sp., *Streptococci* sp. and *Staphylococcus epidermidis.*[6] To cure the problem, antibiotics are main options. Selection of an effective antimicrobial agent for a microbial infection requires knowledge of the potential microbial pathogen, an understanding of the pathophysiology of the infectious process and an understanding of the pharmacology and pharmaco kinetics of the intended therapeutic agent.[7]

The inadvertent use of antibiotics leads to emergence of drug resistant pathogens, which in turn acts as a great challenge to the health services. Moreover, highly virulent strains and capacity to adapt quickly to changing environment worsens the situation and draws a matter of concern.[8] Different studies have been conducted across the globe from time to time to assess the bacterial profile and the antibiotic susceptibility pattern in pus samples. This is particularly relevant for the treating physician who needs to start empirical treatment of patient until the lab culture reports are awaited.[9]

It is observed that the infections caused by Gram negative bacilli are difficult to treat as compared to Gram positive organisms. So this study was conducted with the aim to know the present scenario of antibiotic resistance among Gram negative bacilli

isolated from pus.

MATERIAL AND METHODS

The study was conducted in the Department of Microbiology, Government Medical College, Nagpur during a period of six months. All the pus samples received in the microbiology laboratory were immediately inoculated and streaked onto nutrient agar, 5% sheep blood agar and MacConkey agar (Hi-Media, India).[10] Plates were incubated aerobically at 37˚C for 24 hours. Isolated organisms were processed and identified according to standard bacteriological techniques.[11] Antibiotic susceptibility testing was performed by Kirby-Bauer disk diffusion technique.[12] The drugs used were as per the CLSI 2013 guidelines.[13]

RESULTS

A total of 214 pus samples were processed, out of which 139 (64.95%) were positive for aerobic culture. Mixed growth was obtained among 36 (16.82%) samples. From these samples, 148(69.15%) Gram negative bacilli were isolated .

The most common organism isolated among Gram negative bacilli was *E.coli* i.e 32.43% followed by *klebsiella spp.* i.e 21.62% (Table-1). All the Gram negative bacilli showed maximum resistance to ampicillin followed by ciprofloxacin, gentamicin & co-trimoxazole.The bacilli also showed 60 to 70 % resistance to second & third generation cephalosporins. The drugs to which the organisms showed maximum sensitivity were imipenem and ticarcillin. The point of concern was that all the isolates were multidrug resistant (Table-2,3).

The *pseudomonas* & *acinetobacter* showed maximum resistance to cephalosporins. The drugs to which these two isolates showed maximum sensitivity were piperacillin, imipenem and amikacin. About approximately 90% pseudomonas isolates showed multidrug resistance (Table-2,3).

S.no	Organism	Number(%)
1	*E.coli*	48(32.43)
2	*Klebsiella spp.*	32(21.62)
3	*Enterobacter aerogenes*	12(8.10)
4	*Nonfermenter spp.*	10(6.75)
5	*Proteus vulgaris*	10(6.75)
6	*Citrobacter freundii*	04(2.70)
7	*Pseudomonas aerugenosa*	30(20.27)
8	*Acinetobacter baumanii*	02(1.35)
	Total	148(100)

Table-1: Species of Gram negative bacilli isolated from pus samples (n=148)

DISCUSSION

Pus infection patients are subjected to several factors that may be associated with multidrug resistant micr-oorganism carriage such as inappropriate antibiotic treatment, chronic course of the wound and frequent hospital admission.[14] Gram negative bacteria such as *Pseudomonas, Escherichia coli*, *Klebsiella spp* and gram positive cocci such as *Staphylococcus aureus* are the common causative agents of various pyogenic infections. The emerging resistant genes in such bacteria by various mechanisms are a matter of concern

The most common Gram negative isolate obtained in the present study was *E.coli* (32.43%) followed by *klebsiella spp*. (21.62%) which coincides well with Kaup et al[15] who also reported *E.coli* as the most common organism, whereas study by Giacometti et. Al[16] and Sowmya et at[17] on surgical wound infections, reported *Pseudomonas species* as the most common Gram negative bacilli isolated followed by *E.coli*. All the Gram negative bacilli showed maximum resistance to ampicillin followed by ciprofloxacin, gentamicin & co-trimoxazole.The bacilli also showed 60 to 70 % resistance to second and third generation cephalosporins. Such pattern of resistance is also reported by Kaup et al[15] and *Sowmya et al.*[17] The drugs to which the organisms showed maximum sensitivity were imipenem and ticarcillin. The study by G Suguneswari et al.[18] and Balan et al.[19] also reprted maximum sensitivity of gram negative baclii to imipenem and ticarcillin in their study. About approximately 90% pseudomonas isolates and all other Gram negative isolate showed multidrug resistance. This is also reported by Verma et al.[20]

CONCLUSION

Multidrug resistant organism is a cause of concern which suggests that antibiotic sensitivity testing should be carried out on all isolates of wound infection before the initiation of chemotherapy which will help the treating physician for selection of appropriate drugs. Again there is need for the introduction of antimicrobial surveillance programme at regular intervals at every hospital so as to provide proper directions to the treating clinicians for use of suitable antibiotics .

The emergence and proliferation of these highly resistant organisms obtained from specimen of pus are highly threatening given the limited number of antimicrobial agents that are currently available or in the drug development pipelines of the pharmaceutical industry to combat these organisms.

Sr no	Organism	Antibiotic resistance pattern of the enterobacteriacae and nonfermenter(%)											
		A	Ac	CE	CPM	CFZ	CN	CEP	TCC	CO	G	IP	CF
1	*E.coli* (n=48)	45 (93.75)	40 (83.33)	38 (79.16)	38 (79.16)	33 (68`75)	34 (70.83)	35 (72.91)	12 (25)	30 (62.50)	45 (93.75)	3 (6.25)	44 (91.66)
2	*Klebsiella* spp. (n=32)	30 (93.75)	25 (78.12)	20 (62.50)	23 (71.87)	24 (75)	21 (65.62)	21 (65.62)	08 (25)	30 (93.75)	31 (96.87)	2 (6.25)	30(93.75)
3	*Enterobacter aerogens* (n=12)	11 (91.66)	10 (83.33)	08 (66.66)	08 (66.66)	07 (58.330	07 (58.33)	06 (50)	1 (8.33)	12 (100)	12 (100)	00	10 (83.33)
4	*Nonfermenter Spp.*(n=10)	8 (80)	6 (60)	4 (40)	5 (50)	4 (40)	5 (50)	5 (50)	00	10 (100)	09 (90)	00	09 (90)
5	*Proteus vulgaris* (n=10)	9 (90)	07 (70)	4 (40)	4 (40)	5 (50)	5 (50)	4 (40)	00	08 (80)	07 (70)	00	09 (90)
6	*Citrobacter frundii*(n=04)	4 (100)	3 (75)	2 ((50)	3 (75)	2 (50)	2 (50)	2 (50)	2 (50)	3 (75)	3 (75)	00	03(75)

Table-2: Antibiotic resistance pattern of enterobacteriacae and Nonfermenter spp. (Note: A - Ampicillin ,Ac – Amoxycillin , CE – Cefotaxime , CPM - Cefepime ,CFZ – Cefazoline , CN- Cefoxitin CEP – Cefpodoxime , TCC – Ticarcillin , CO – Co- trimoxazole , G – Gentamycin , IP – Imipenem ,CF – ciprofloxacin)

s.no	Organism ↓	Antibiotic Resistance pattern of the organism (%)										
		CFZ	CEP	CPM	PC	TCC	AT	CF	IP	G	TB	AK
1	Ps. aerug(n=30)	26(86.66)	25(83.33)	24(80)	18(60)	25(83.33)	5(16)	28(93.33)	10(33.33)	28(93.33)	28 (93.33)	05 (16)
2	Ac. baum.(n=02)	01 (50)	01 (50)	02 (100)	01 (50)	01 (50)	00	02 (100)	00	02 (100)	02 (100)	01 (50)

Table-3: Antibiotic resistance pattern of enterobacteriacae & Nonfermenter spp. (*Ps. aerug.* - *Pseudomonas aerugenosa, Ac. baum* - *Acinetobacter baumanii*
CFZ – Cefazoline,CEP – Cefpodoxime,PC – Piparacillin , TCC – Tcarcillin , AT – Azithromycin ,CF – Ciprofloxacin , IP – Imipenem , G-Gentamicin ,TB-Tobramycin,AK-Amikacin)

So every effort needs to be made to carefully select antibiotics, balancing the need for a broad spectrum of empiric coverage of potential microorganisms with the need to preserve available antibiotics for when they are absolutely necessary.

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