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THERAPEUTIC STRATEGIES IN BLOODSTREAM INFECTIONS IN ADULT PATIENTS FROM A RURAL AREA OF MAHARASHTRA, INDIA

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ABSTRACT

A prospective study was undertaken to know the bacteriological profile of bloodstream infections and their antibiotic susceptibility pattern in adult patients from rural area. 5ml of blood was collected from 285 adult patients of septicemia from different wards over a period of two years. Organisms were isolated and identified by biphasic method (BHIA-BHIB).Antimicrobial susceptibility for each isolate was done by using Kirby Bauer disc diffusion method. 136 cases were culture positive. Incidence of bloodstream infection in adults was 47.71%. Gram negative organisms were the most predominant isolates. Most predominant Gram negative isolate was *Klebsiella aerogenes*. Whereas in Gram positive, Staph aureus was the most common organism. Majority of the isolates were sensitive to Ciprofloxacin. Gram negative multidrug resistant organisms were the main cause of bloodstream infection in adults. Therefore great caution is required in selection of antibiotic therapy. Obtaining a precise bacteriological diagnosis before starting antibiotic therapy is important for the success of therapeutic strategy.

Key words: Bloodstream infections, Blood culture, Rural area, Antibiotic therapy.

INTRODUCTION

Septicemia is a life threatening condition associated with high morbidity and mortality. Extensive research has been carried out to find out the different causative agents of septicemia. Most of the workers have observed several shifts in the pattern of predominant microorganisms responsible for septicemia and their antibiotic susceptibilities [1-3]. Blood culture forms an important laboratory investigation in the detection of etiological agents of septicemia.

Obtaining a precise bacteriological diagnosis and antibiogram before starting antimicrobial therapy is of paramount importance for the successful therapy of septicemia. It would reduce mortality from septicemia and improve patient management [4].

Most of the studies conducted in India are related with septicemia in neonates and infants and are from big cities. Reports of bacteriological profile of septicemia in adult patients from rural area are very few.

With this background, the present study was undertaken to know the bacteriological profile of septicemia and their antibiotic susceptibility pattern in adults from rural area surrounding a rural medical college and hospital.

MATERIAL &METHODS

The study material consists of 285 adult patients with clinical diagnosis of septicemia admitted in various wards of rural Medical College and hospital during a

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period of two years.

Immediately after admission, all patients were evaluated through detail history and clinical examination as per the proforma. All clinically diagnosed cases of septicemia were subjected to blood culture studies. Blood culture was performed by biphasic method (brain heart infusion agar and broth) [5]. Blood sample was collected under all aseptic precautions from antecubital vein. 5 ml of blood was withdrawn from the patients. Blood sample was collected before starting antimicrobial therapy. In patients already on antibiotic therapy, blood sample was taken just before the next dose of antimicrobial agents. In all cases, only a single blood sample was collected (one sample per patient) [6]. The inoculated BHIA-BHIB bottles were incubated at 37^{o}C and kept in vertical position. The bottles were observed twice a day and if there was no growth, subculture performed by tilting the bottles so that blood broth flows over the slant. The bottle was again incubated in vertical position.

Growth was made out by turbidity, hemolysis, gas production and formation of discrete colonies on the slant of biphasic medium.

If growth was seen on agar slope, colony morphology was noted and identified by its characters. If turbidity, hemolysis or gas production was seen, bottle was opened with due precaution and a loopful of broth was taken and subculture was done on blood agar plate and MacConkey agar plate. In case of discrete colonies on the slant, colony was picked up, Gram stained smear was prepared and subculture was done on blood agar plate and MacConkey agar plate [7].

After Gram stain information, colony was inoculated in nutrient broth for Gram-positive organisms and in peptone water for Gram–negative organisms. Biochemical reactions were studied [8]. If there was no growth on culture bottles upto 10 days then they were discarded. All the isolates were identified by standard biochemical tests. Antimicrobial susceptibility testing was performed on the isolates by standard conventional (Kirby-Bauer) disc diffusion method [9-11].

RESULTS

Table 1 shows antibiotic sensitivity pattern of Gram positive isolates**,** Maximum Gram positive isolates were sensitive to Cephalexin(93.54%) followed by ciprofloxacin (85.48%). Other sensitive antibiotics were erythromycin and penicillin. Table 2 shows antibiotic sensitivity pattern of Gram negative isolates, Maximum Gram negative isolates were sensitive to ciprofloxacin (85.13%) followed by gentamicin(74.32%) and amikacin (71.62%) . All Gram negative isolates were resistant to co-trimoxazole and ampicillin. Salmonella strains were sensitive to ciprofloxacin (93.75%) and Chloramphenicol (75%). Pseudomonas aeruginosa was sensitive to ciprofloxacin and resistant to Carbenicillin.

Table 1. Showing antibiotic sensitivity pattern of Gram positive isolates

Isolates » / **Antibiotics**	Staph.aureus (n = 43)	Staph.albus (n = 9)	Streptococci (n = 8)	Enterococci (n = 2)	Total (n=62)
Ampicillin	27 (62.79)	5 (55.55)	6 (75)	1 (50)	39 (62.90)
Gentamicin	4 (9.30)	2 (22.22)	1 (12.5)	0	7 (11.29)
Cotrimoxazole	12 (27.90)	1 (11.11)	1 (12.5)	0	14 (22.58)
Ciprofloxacin	39 (90.69)	8 (88.88)	5 (62.5)	1 (50)	53 (85.48)
Cephalexin	41 (95.34)	9 (100)	7 (87.5)	1 (50)	58 (93.54)
Norfloxacin	7 (16.27)	2 (22.22)	0	0	9 (14.51)
Amikacin	5 (11.62)	2 (22.22)	1 (12.5)	-	8 (12.90)
Penicillin	25 (58.13)	8 (88.88)	6 (75)	1 (50)	40 (64.51)
Erythromycin	28 (65.11)	8 (88.88)	5 (62.5)	0	41 (66.12)
Chloramphenicol	12 (27.90)	5 (55.55)	0	-	17 (27.41)

[Figures in the bracket represent percentage]

Table 2. Showing antibiotic sensitivity pattern of Gram negative isolates

Isolates » / Antibiotics	Klebsiella aerogenes (n =23)	Escherichia coli (n =12)	Salmonella species (n = 16)	Pseudomonas aeruginosa (n = 14)	Proteus species (n =9)	Total (n=74)
Ampicillin	5 (21.74)	1 (8.33)	5 (31.25)	3 (21.42)	0	14 (18.91)
Gentamicin	18 (78.26)	11 (91.66)	11 (68.75)	10 (71.42)	5 (55.55)	55 (74.32)
Cotrimoxazole	3 (13.04)	2 (16.66)	1 (6.25)	3 (21.42)	4 (44.44)	13 (17.56)
Ciprofloxacin	18 (78.26)	9 (75)	15 (93.75)	14 (100)	7 (77.77)	63 (85.13)
Cephalexin	5 (21.74)	8 (66.66)	10 (62.5)	5 (35.71)	1 (11.11)	29 (39.18)
Norfloxacin	15 (65.22)	10 (83.33)	9 (56.25)	5 (35.71)	6 (66.66)	45 (60.81)
Amikacin	17 (73.91)	10 (83.33)	10 (62.5)	10 (71.42)	6 (66.66)	53 (71.62)
Penicillin	3 (13.04)	2 (16.66)	6 (37.5)	1 (7.14)	1 (11.11)	13 (17.56)
Erythromycin	7 (30.43)	1 (8.33)	4 (25)	1 (7.14)	0	13 (17.56)
Chloramphenicol	5 (21.74)	11 (91.66)	12 (75)	2 (14.28)	1 (11.11)	31 (41.89)
Polymyxin B	-	-	-	11 (78.57)	8 (88.88)	19 (82.60)
Carbenicillin	-	-	-	7 (50)	4 (44.44)	11 (47.82)

[Figures in the bracket represent percentage]

DISCUSSION

In a developing country like India, infectious diseases continue to cause havoc with high morbidity and mortality, which may present clinically with bacteremia and septicemia.

Septicemia remains a major and challenging clinical problem throughout the world. Rapid identification of the causative organism in septicemia is very important for selecting appropriate antimicrobial agents, avoiding unnecessary treatment of typical contaminants, achieving improved susceptibility to antibiotics, improving the prognosis of patients and decreasing antimicrobial expenditures.

Early diagnosis and appropriate treatment of septicemia can make the difference between life and death. Blood culture is the essential investigation for the management of septicemia. Blood culture is considered as positive when it showed the growth of one or two organisms. Bryan C S reported that patients with positive blood cultures were 12 times more likely to die during hospitalization than patients without positive blood cultures [12, 13].

There is paucity of information on bacteriological profile of septicemia in adult patients from rural area. The present study was carried out to know the bacteriological findings with particular reference septicemia in adult patients from rural area.

In the present study, Blood culture positivity rate was 47.71%. Bhattacharya S had studied the data published in the last 15 years from various centers in India and reported that blood culture positivity rate in different studies ranges from 11.8% to 44%.

In recent years, there has been a trend to use automated methods for processing blood cultures. The advantages of such methods are more rapid detection of positive cultures and a reduction in technologist time requirements. However, these methods require the use of expensive equipment, with the result that their acceptance is limited by economic factors [14]. Based on the results of the present study; a modified improved procedure for blood culture is use of biphasic method. The cost, time and labor involved in biphasic method is considerably less, it can be accepted at the level of rural medical college and hospital.

Various organisms can cause septicemia. The frequency of infection by various organisms varies from one hospital to another and even from year to year in the same hospital.[16] In this study out of 47.71% isolates, Gram negative organisms were predominant (25.96%) followed

by Gram positive organisms (21.75%). The ratio of Gram positive to Gram-negative organism was 1:1·19 [15].

The commonly isolated Gram-negative organisms were Klebsiella aerogenes, Escherichia coli, Pseudomonas aeruginosa and Proteus. Predominant isolation of Gram negative organisms were reported by De *et al*, Joshi, Ghole and Niphadkar, Sharma *et al* and Chayani and Pattnaik [16-20].

The commonly isolated Gram-positive organisms were Staphylococcus aureus, Staphylococcus albus and Streptococcus pneumoniae. The main observation in this study was the higher isolation of Staphylococcus aureus. Out of 48.72% isolates, Staphylococcus aureus (15.70%) was the commonest pathogen. This was similar to the findings of other workers. Predominant isolation of Staphylococcus aureus was reported by Steinberg, Clark and Hackman, Vinchurkar, Shendurnikar and Shukla, Hawker R J and Blereau R P [21-24].

Another significant finding of the present study was the isolation of Salmonella species in 5.12% of cases. An increasing incidence of Salmonella species (6%) has also been reported by Kumar *et al* [25] by blood culture. A close watch needs to be kept on increasing incidence of this organism.

Salmonella infections are frequent throughout the world and are a major health concern particularly to India, being endemic in many parts of India. Salmonellae are responsible for invasive diseases including enteric fever, bacteremia, septicemia and focal sepsis e.g. Meningitis, arthritis, thyroiditis etc.

Staphylococci and Streptococci were predominant pathogens early in the 20th century, but the introduction of antibiotics like penicillin and semisynthetic penicillins led to their decline and Gram-negative infections became prominent [26].

From the above data, it was clear that there was reemergence of Staphylococcus aureus as a major pathogen from cases of septicemia. Life threatening infections caused by Staphylococcus aureus are rapidly increasing in frequency as a result of widespread use of invasive procedures, suboptimal adherence to infection control practices, increasing severity of illness of hospitalized patients, indiscriminate use of multiple antibiotics and increasing prevalence of diabetes mellitus [27].Therefore whenever instituting empiric antibiotic therapy for suspected septicemia, coverage of Staphylococcus aureus must be emphasized.

The treatment guidelines are decided based on either sensitivity or resistance pattern of bacteria tested with a given antimicrobial that vary geographically. Antimicrobial sensitivity pattern of all the isolates were studied by Kirby- Bauer disk susceptibility testing. Cephalexin, ciprofloxacin and erythromycin showed greater sensitivity against Gram-positive isolates. Ciprofloxacin, amikacin and gentamicin showed high sensitivity against Gram-negative isolates. All Gram-negative isolates were resistant to co-trimoxazole and ampicillin. Nema and Chitnis, Ahmed *et al*, and Naik *et al*, had shown similar sensitivity and resistant pattern [28-30].

The pattern of sensitivity for antimicrobial agents of the present study and earlier studies was similar, but susceptibility percentages are different. So it is important that every hospital should monitor its antibiotic sensitivity pattern against the common isolates and that can serve as a basis for empirical therapy in emergency conditions.

Pseudomonas aeruginosa is one of the most virulent organisms which cause problems clinically as a result of its high resistance to antimicrobial agents. In the present study Pseudomonas aeruginosa showed high sensitivity to ciprofloxacin (93.34%) followed by gentamicin (66.66%) and amikacin (66.66%). This does not correlate with the findings of Veenu, Sikka and Arora, Mandal and Mishra, and Arya [31-33]. They had reported a very high resistance to the commonly used antibiotics (ciprofloxacin, gentamicin and amikacin). In this study, ciprofloxacin was found to be the most effective antipseudomonal agent.

Ciprofloxacin is an antibacterial agent with a broad spectrum of activity, effective against both Gram positive and Gram-negative organisms. Therefore, ciprofloxacin can be used for a variety of infections in adults [34]. The changing bacteriological pattern of septicemia warrants the need for an ongoing review of the causative organisms and their antibiotic sensitivity pattern. Area based knowledge of the bacteriological spectrum is essential and keeping in mind the high morbidity and mortality associated with sepsis, a right choice for such empiric therapy is of utmost importance.

Therefore, similar studies like the present one should be conducted regularly to identify the changing trend in the causative agents of septicemia along with their antibiotic sensitivity pattern.

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CONFLICT OF INTEREST

None to declare

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