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ANTIMICROBIAL SENSITIVITY PATTERN OF BACTERIAL ISOLATES CAUSING MENINGITIS

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Abstract

Bacterial isolates & their antimicrobial sensitivity pattern of 160 clinically suspected cases of meningitis were studied. Out of 160 clinically suspected cases of meningitis 23 cases were found culture positive. Of the culture positive cases, N. meningitidis was the commonest 09(39.16%) followed by S. pneumoniae 06(26.08%), H. influenzae 05(21.73%), E. coli 02(8.69%) and Acinetobacter spp.01(4.34%). Antibiogram showed that all the isolates were sensitive to Ceftriaxone while almost were resistant to Cotrimoxazole. The isolates were also 100% sensitive to Ciprofloxacin except N. meningitidis which was 88.89% sensitive. Ampicillin, Gentamicin, Chloramphenicol and Pencillin were found variably sensitive against H.influenzae, S. pneumoniae, N. meningitidis. E. coli were 100% sensitive to Ceftriaxone, Ciprofloxacin and Gentamicin, while 100% resistant to Ampicillin, Cotrimaxazole and penicillin. Acinetobactor spp. was also 100% sensitive to Gentamicin, Ceftriaxone, Ciprofloxacin but 100% resistant to Ampicillin and Pencillin.

Introduction

Bacterial meningitis has an unacceptable mortality rate[1]. Despite effective antimicrobial and supportive therapy, mortality rate among neonates remain high, with significant long term sequelae in survivors[2]. Case fatality rates vary with age at the time of illness and species of bacterium causing infection. Bacterial meningitis was uniformly fatal before the antimicrobial era. With the advent of antimicrobial therapy, the overall mortality rate from bacterial meningitis has decreased but still remains alarmingly high[3]. World wide, 3 meningeal pathogens H. influenzae. N. meningitidis and S. pneumoniae account for 75-80% causes of BM[4]. In the United States H. influenzae was the most frequent cause of BM (48.3%), followed by N. meningitidis (19.6%) and S. pneumoniae (13.3%)[5]. The emergence of bacterial resistance, especially penicillin resistant S. pneumoniae has been increasing worldwide, and the reported rates are 41-56% in Southeast Asia and the Far East. In the United States in 1998, the Centre for Disease Control (CDC) conducted a study on 3335 isolates of S. pneumoniae from 8 states and found 10.2% were intermediate resistant to penicillin and 13.6% were highly resistant strains[3]. In the USA most of the N. meningitidis were sensitive to penicillin and cephalosporins while 30-40% H. influenzae type b isolates were resistant to ampicillin but remain sensitive to extended spectrum cephalosporins[6]. The geographic distribution of this resistance is variable, and knowledge of this is important in deciding local empirical antibiotic therapy[3]. As the initial choice of therapy for meningitis in immunocompetent patients is based on the antibiotic susceptibilities of H. influenzae type b, S. pneumoniae, N. meningitidis in the locality, so it is desirable to know the antibiotic susceptibility pattern of prevalent organisms causing meningitis[6]. Data regarding etiology of bacterial meningitis and their anti microbial susceptibility is inadequate in Bangladesh. So, this study has been undertaken to find out the bacterial cause of meningitis and to determine the their sensitivity patterns.

Materials and methods

The study was carried out in the department of Microbiology, Chittagong Medical College, during the period of April 2004 to May 2005. A total of 160 clinically suspected cases of meningitis of all ages were included in the study. The patients were selected from Paediatric and Medicine department of Chittagong Medical College and Chattagram Maa-O-Shishu Hospital. The samples were collected preferably before starting antibiotic or within 24 hours of antibiotic therapy[7].

Culture

Bed side inoculation of CSF was done on blood agar and chocolate agar media, placed in candle jar and

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incubated properly. MacConkey's agar media was inoculated in the laboratory. Isolation and identification of bacteria was done by performing different appropriate tests. Any growth of bacteria was identified by colonial morpholgy, biochemical and serological methods. All the isolates obtained by culture were tested for antimicrobial susceptibility by disc diffusion method against different antimicrobial agents[8].

Methods of antibiotic sensitivity testing[7,8]:
The inoculum used for disc sensitivity was adjusted to Mc Farland standard tube No. 5 where appropriate concentration of organisms was 108 organisms/ml. For H. influenzae and S. pneumoniae, chocolate agar plates were used. Mueller Hinton agar plates were used for other bacteria.. The plates were incubated in candle extinction jar at 37°C for H. influenzae, S. pneumoniae and N. meningitidis. For E.coli the plates were incubated aerobically at 37°C. Diameter of complete zones of inhibition was measured by using a ruler on the underside of the plate in mm. The organisms were tested against Penicillin (P), Ampicillin (Amp),Co-Trimoxazole (Sxt), Chloramphenical (C), Gentamycin(CN), Ceftriaxone(CRO), Ciprofloxacin (CIP).

Interpretation of zone size

Inhibition zones produced by each drug were considered into 3 susceptibility categories namely sensitive(S), intermediate sensitive (IS) and Resistant (R) according to the NCCLS, guide line (1994). Zone of inhibition were compared with standard values (NCCLS, 1994)

Result

A total of 160 clinically suspected meningitis patients were studied. On the basis of Gram's stain, culture, cytological and biochemical findings of CSF, the study patients were categorized into 3 groups. 65 (40.62%) patients were diagnosed as bacterial meningitis, 42 (26.25%) as aseptic meningitis and 53 (33.13%) as non-meningitis control group (Table-I).

Table I : Distribution of study population in different categories (n = 160)

Study groups	No of Patient	Percentage
1. Bacteria M	65	40.62
2. Aseptic M	42	26.25
3. Non meningitis control group	53	33.13
Total	160	100.00

Table-II shows that among 23 culture positive cases, N. meningitidis was the commonest 09(39.16%) followed by S. pneumoniae 06(26.08%), H. influenzae 05(21.73%), E. coli 02(8.69%) and Acinetobacter spp. 01(4.34%).

Table II : Types of organisms isolated from 23 culture + ve cases

Name of bacteria	No of Isolates	Percentage
1. Neisseria meningitidis	09	39.16
2. Streptcoccus pneumoniae	06	26.08
3. Haemophilus influenzae	05	21.73
4. Escherichia coli	02	8.69
5. Acinetobacter spp.	01	4.34
Total	23	100.00

Table -III shows the antibiogram of different bacterial isolates from CSF. H. influenzae were 100% sensitive to Ciprofloxacin and Ceftriaxone followed by penicillin (80%), Gentamycin (80%), Chloramphenicol (60%), Ampicillin (40%), and Cotrimoxazole (20%). S. pneumoniae were 100% sensitive to Ceftriaxone and Ciprofloxacine, 66.67% to Chloramphenicol, 83.33% to Ampicillin, Penicillin, 50% to Gentamycin and 33.33% to Cotrimoxazole. N. meningitidis was 100% sensitive to Penicillin and Ceftriaxone, 88.89% to Ciprofloxacin and Ampicillin, 77.78% to Chloramphenicol, 66.67% to Gentamycin and none was sensitive to Cotrimoxazole. E. coli were 100% sensitive to Ciprofloxacin, Ceftriaxone and Gentamycin, followed by Chloramphenicol (50%) but were 100% resistant to Penicillin, Ampicillin and Cotrimoxazole. Acinetobacter spp. was 100% sensitive to Ciprofloxacin, Ceftriaxone and Gentamycin but was 100% resistant to Penicillin.

Discussion

Bacterial meningitis is a life threatening illness resulting from bacterial infection of meninges Kumar et al. (2004)[2]. Bacterial meningitis has an unacceptable mortality rate and frequency of neurological sequellae Stinga et al. (2003)[1]. Mortality rates vary with age. Despite effective antimicrobial and supportive therapy mortality rates among neonates remain high Kumar et al. (2004)[2]. We have studied 160 CSF samples of clinically suspected meningitis patients. These patients were

Table III : Sensitivity pattern of bacterial isolates from CSF (n=23)

Name of antibacterial agent	Sensitivity pattern	Name of bacterial isolates				
		N. meningitidis 09	S. pneumoniae 06	H. influenzae 05	E. coli 02	Acinetobacter spp. 01
Amp	S	8(88.89)	5(83.33)	2(40)	0	0
	IS	1(11.11)	1(16.67)	3(60)	0	1(100)
	R	0(0)	0(0)	0(0)	2(100)	0
Sxt	S	0(0)	2(33.33)	1(20)	0	0
	IS	0(0)	0(0)	1(20)	0	0
	R	09(100)	4(66.67)	3(60)	2(100)	0
CN	S	6(66.67)	3(50)	4(80)	2(100)	1(100)
	IS	2(22.22)	0	1(20)	0	0
	R	1(11.11)	3(50)	0(0)	0	0
CRO	S	9(100)	6(100)	5(100)	2(100)	1(100)
	IS	0(0)	0	0(0)	0	0
	R	0(0)	0	0(0)	0	0
CL	S	7(77.78)	4(66.67)	3(60)	1(50)	0
	IS	0(0)	1(16.67)	2(40)	1(50)	
	R	2(22.22)	1(16.66)	0(0)	0	0
P	S	9(100)	5(83.33)	4(80)	0	0
	IS	0(0)	1(16.67)	1(20)	0	0
	R	0(0)	0(0)	0	2(100)	1(100)
CIP	S	8(88.89)	6(100)	5(100)	2(100)	1(100)
	IS	1(11.11)	0(0)	0(0)	0	0
	R	0(0)	0(0)	0(0)	0	0

Amp (Ampicillin), P (Penicillin), Sxt (Cotrimoxazole), CIP (Ciprofloxacin), CL (Chloramphenicol), CN (Gentamicin), CRO (Ceftriaxone)
S = Sensitive, IS = Intermediate sensitive, R = Resistant

categorized into 3 groups. 65(40.62%) patients were diagnosed as bacterial meningitis, 42 (26.25%) were aseptic meningitis and 53 (33.13%) were non meningitis control group. Our result was nearer to Dulkarian et al. (1995)[9] and Deivanayagain et al. (1993)[10] but higher than Chowdhury et al. (1992)[11]. This higher rate of detection in the present study may be due to seasonal and geographical variation in the epidemiology of BM and difference in selection criteria of study samples.

In the present study out of 65 BM cases 23(35.38%) were culture positive. This result was closely related with Mustafa et al. (2001) in Turkey[12] who isolated 14 (35%) out of 40 positive BM cases but lower than that of Chowdhury et al. (1992) in Bangladesh[11] who isolated 52(74.29%) out of 70 positive BM cases. This lower rate of isolation in this study may be due to prior exposure of anti microbials. As far as antibiotic sensitivity pattern was concerned N. meningitidis was 100% resistant to cotrimoxazole followed by chloramphenicol (22.22%) but 100% sensitive to ceftriaxone and penicillin, 88.89% to ampicillin and ciprofloxacine. S.pneumoniae showed 66.67% resistance to cotrimoxazole, 50% to gentamycin but it was 100% sensitive to ciprofloxacine and ceftriaxone, 83.33% to penicillin and ampicillin, 66.67% to chloramphenicol. H. influenzae also showed 60% resistance to cotrimoxazole while 100% sensitive to ciprofloxacin and ceftriaxone, 80% to penicillin and gentamycin.

E.coli were 100% resistant to penicillin, ampicillin and cotrimoxazole but 100% sensitive to ciprofloxacin, ceftriaxone and gentamycin. Molyneux et al. (1998) in Malawi[13] found that H. influenzae was 50% resistant to ampicillin and 20% to chloramphenicol. Reis et al. (2002) in Georgia[14] observed that S. pneumoniae was 11% resistant to penicillin and cotrimoxazole. Saha et al. (1997) in Bangladesh[15] found that S. pneumoniae was 47.8% resistant to penicillin, and 64.1% to cotrimoxazole. Shah et al. (2004) in Bangladesh[16] found that H. influenzae was 32.5% resistant to ampicillin, 49.2%cotrimoxazole. Chowdhury et al. (1992) in Bangladesh[11] found that, H. influenzae was 68% sensitive to penicillin, 84.2% to ampicillin ceftriaxone, 94% to chloramphenicol and gentamycin while S. pneumoniae was 14.3% resistant to ampicillin and gentamycin but 100% sensitive to chloramphenicol followed by 92% to ceftriaxone, 85.7% to penicillin. N. meningitidis was 20% resistant to ampicillin but 90% sensitive to penicillin, chloramphenicol, gentamycin and ceftriaxone. Mazed et al. (2002) in Bangladesh[17] observed that H. influenzae were 78.57% resistant to cotrimoxazole but 100% sensitive to ceftriaxone and ciprofloxacin followed by 71.43% to ampicillin, 64.29% to chloramphenicol and 28.57% to gentamycin. S. pneumoniae was 100% sensitive to ceftriaxone, 88.89% to chloramphenicol, 77.78% ampicillin, penicillin and ciprofloxacin, 22.22% to gentamycin but 44.44% were resistant to cotrimoxazole. N. menigitidis was 100% sensitive to ceftriaxone, penicillin, ampicillin, ciprofloxacin and chloramphenicol but 100% resistant to cotrimoxazole and 66.67% to gentamycin. E. coli were 100% sensitive to ceftriaxone, ciprofloxacin, gentamycin and 50% to chloramphericol and cotrimoxazole. In the present study antibiotic sensitivity pattern is slightly different from other studies. Substantial geographic differences in the frequency of resistance of isolates to different antibiotic have been reported by Schlech et al. (1985) in USA[5].

Conclusion

The findings of the present study showed that N. meningitidis, S. pnumoniae and H. influenzae are the prevalent organism causing meningitis in our locality. So empirical therapy should be directed against these microorganisms until culture sensitivity report is available. It also revealed that Ceftriaxone is the most effective drug in treating bacterial meningitis but other commonly used antibiotic may still have role in the treatment of bacterial meningitis. It is envisaged that continuous monitoring about the etiological agent causing meningitis and updated information of their antibiotic susceptibility pattern is required.

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