

Acute Bacterial Meningitis : Causative Organisms, Clinical Characteristics and Prognosis

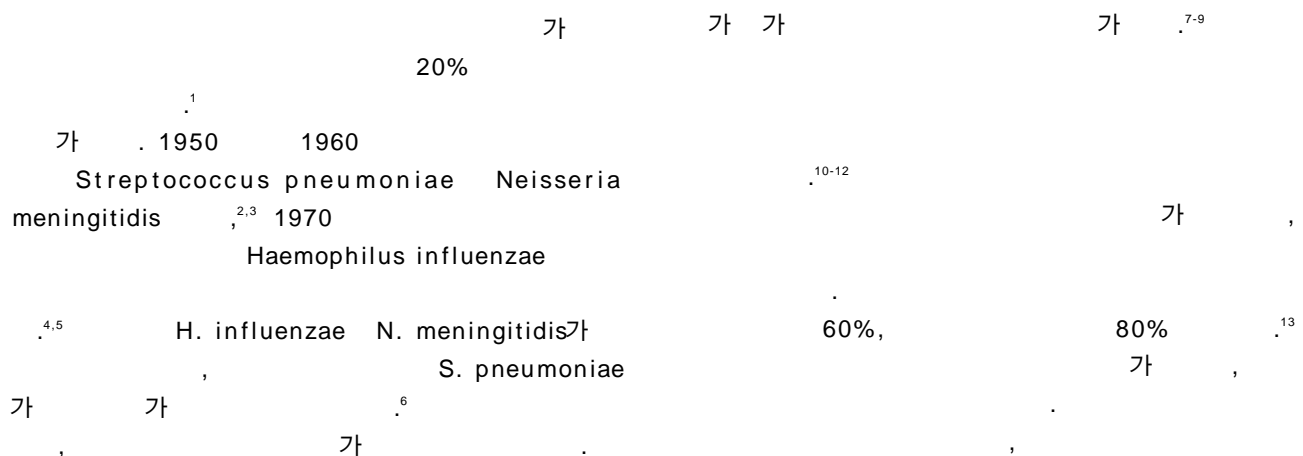
Dong-Chul Park, M.D., Il-Saing Choi, M.D., Ji-Hoe Heo, M.D., Kyoung-Won Lee, M.D.*

Departments of Neurology and Clinical Pathology*, Yonsei University College of Medicine

Background : There is a lack of basic epidemiological information on bacterial meningitis in children and adults in Korea. Therefore, more research is needed to investigate the causative organisms, clinical manifestations, and prognosis in Korean children and adults. **Methods** : We analyzed retrospectively 148 medical records with final diagnosis of bacterial meningitis. The diagnosis of bacterial meningitis was based on culture-positive cases. **Results** : Out of a total 148 patients, 71 were children and 77 were adults. In the children with community acquired meningitis, infection-related meningitis was the most common predisposing factor (23.3%). In adults, otitis media was the most common (21.7%). There were more frequent seizures in children than adults (38.1%, 17.1%, p<0.05). In community-acquired meningitis, Streptococcus pneumoniae was the most common type. However, in nosocomial meningitis, gram-negative bacilli was the most common type. The prognostic factors associated with mortality rate in adults were old age (>50 years), seizure (p<0.05), and mental change (p<0.001). **Conclusions** : Although a causative organism is not documented, we believe that our study will help to properly treat acute bacterial meningitis in children and adults regardless if it is community acquired or nosomial.

J Korean Neurol Assoc 18(5):556~561, 2000

Key Words : Meningitis/Bacterial, Epidemiology, Cross infection



Manuscript received October 25, 1999
Accepted in final form August 4, 2000

* Address for correspondence

Il-Saing Choi, M.D.

Department of Neurology, Yonsei University
College of Medicine, Shinchon-dong, Seodaemun-ku,
C.P.O. Box 8044 Seoul, 120-752, Korea
Tel : +82-2-361-5460 Fax : +82-2-393-0705
E-mail : dcpak@hanmail.net

1993 1 1998 12 6

(16) (15)

1. 148 74 74
1 75 21.8 148
71 77

2. 1) 71 43 가 28
6.2 1 15
36 (50.7%), 35 (49.7%)

1988 14 48 2) 77 41 가 36 가
16 75 36.1
38 (49.4%), 39 (50.6%)

가 S. pneumoniae 15 (36.6%),
19 (44.2%)
gram-negative bacilli가 19 (52.8%), 12
(42.9%) 가 , gram-
negative bacilli Ecsherichia coli, Klebsiella
pneumoniae, Enterobacter, Proteus, Pseudomonas,
Acinetobacter, Serratia, Citrobacter가
gram-negative bacilli(9 , 22.0%), S. aureus(6 ,14.6%)
H. influenzae(7 , 16.3%), Streptococcus(4
, 9.3%) S.

Table 1. Causative organisms in children and adults with bacterial meningitis

	Children		Adults	
	Community (N=43)	Nosocomial (N=28)	Community (N=41)	Nosocomial (N=36)
<i>S. pneumoniae</i>	19(44.2)	3(10.7)	15(36.6)	2(5.6)
Gram-negative bacilli*	4(9.3)	12(42.9)	9(22.0)	19(52.8)
<i>N. meningitidis</i>	3(7.0)	0	0	0
Group B <i>Streptococcus</i>	4(9.3)	4(14.3)	1(2.4)	0
<i>Enterococcus</i>	2(4.7)	1(3.6)	2(4.9)	1(2.8)
<i>S. aureus</i>	3(7.0)	3(10.7)	6(14.6)	9(25.0)
<i>H. influenzae</i>	7(16.3)	0	3(7.3)	1(2.8)
Coagulase-negative <i>Staphylococcus</i>	1(2.3)	5(17.9)	5(12.2)	4(11.1)

() : percentage

*G(-) bacilli : E. coli, K. pneumoniae, Enterobacter, Proteus, Pseudomonas, Acinetobacter, Serratia, Citrobacter

Table 2. Predisposing factors in children and adults with bacterial meningitis

	Children		Adults	
	Community (N=43)	Nosocomial (N=28)	Community (N=41)	Nosocomial (N=36)
Otitis media	9(20.9)	0	13(31.7)	0
Infection-related*	11(25.6)	3(10.7)	5(12.2)	0
Endocarditis	2(4.7)	0	3(7.3)	0
Head trauma	2(4.7)	3(10.7)	3(7.3%)	1(2.8)
Neurosurgery and neurosurgical device	1(2.3)	12(42.8)	2(4.9)	25(69.4)
Altered immune state	6(13.9)	5(17.9)	2(4.9)	7(19.4)
Alcoholism	0	0	1(2.4)	0
Diabetes mellitus	0	0	2(4.9)	0
CSF leak	0	2(7.1)	1(2.4)	0
Unknown	10(23.3)	1(3.6)	4(9.8)	0
More than 2 risks	2(4.7)	2(7.1)	5(12.2)	3(8.3)

() : percentage

*coexisting with pneumonia, urinary tract infection, or sepsis

Table 3. Initial clinical features in children and adults with community-acquired meningitis

	Children (N=43)	Adults(N=41)
Fever	41(95.3)	36(87.8)
Headache	*	30(73.2)
Nausea/vomiting	30(69.8)	31(75.6)
Seizure	16(37.2)	7(17.1)
Mental change	21(48.8)	17(41.5)

() : percentage

* uncheckable

aureus(9 , 25%)가 , (25 , 69.4%) 가
coagulase-negative Staphylococcus(5 , 17.9%)가 가 4 (9.8%)가,
(Table 1). 가 가 가

3. 5 (12.2%), 3 (8.3%)가
(Table 2).

40 , 22 , 20 , 19

4. 84 (41 , 43)

1) (95.3%) , / 41
(69.8%), 16 (37.2%), 21
(48.8%) . 가 /

(11 , 25.6%),
(12 , 42.8%),

(5 , 17.9%) 가 가
가 10 (23.3%), 1

(3.6%) , 2 가
, 2 (4.7%, 7.1%)
(Table 2).

2) 42 18 (42.9%) , 41 14
(34.1%) , 10 ,
(13 , 31.7%)가, 4 , 4 , 4 ,

Table 4. Prognosis in children and adults with bacterial meningitis

	Children		Adults	
	Community (N=43)	Nosocomial (N=28)	Community (N=41)	Nosocomial (N=36)
Good	21(48.8)	16(57.2)	26(63.4)	23(63.9)
Squelae	9(20.9)	6(21.4)	8(19.5)	5(13.9)
Death	13(30.3)	6(21.4)	7(17.1)	8(22.2)

(): percentage

Table 5. Mortality rate according to the pathogens

	Children	Adults	Total
<i>S. pneumoniae</i>	8/22(36.4)	2/17(11.8)	10/39(25.6)
Gram-negative bacilli*	5/16(31.3)	8/28(28.6)	13/44(29.5)
<i>N. meningitidis</i>	0/3	0/0	0/3
Group B <i>Streptococcus</i>	2/8(25)	1/1(100)	3/9(33.3)
<i>Enterococcus</i>	0/3	0/3	0/6
<i>S. aureus</i>	2/6(33.3)	3/15(20.0)	5/21(23.8)
<i>H. influenzae</i>	1/7(14.3)	0/4	1/11(9.1)
Coagulase-negative <i>Staphylococcus</i>	1/6(16.7)	1/9(11.1)	2/15(13.3)

() : percentage

*G(-) bacilli : *E. coli*, *K. pneumoniae*, *Enterobacter*, *Proteus*, *Pseudomonas*, *Acinetobacter*, *Serratia*, *Citrobacter*

3 , 2 , / , (40 mg/dl) (p<0.05), (p<0.05)
/ 가 1 . 10 .
, 4 .

5.

14008 ± 7167

/ μL, 13812 ± 6788 / μL .¹⁵

가 , 200 mmCSF ,⁶

가 . 100/ μL 4999/ μL .¹⁶

가 가 (p<0.05),

60% ~ 70% 80% .

50% 200 mg/dL , 가 . 가

40 mg/dL

60.5%, 48.8% ,

57.1%, 61.1% .

148

6. 39.4%, 46.7%

23% .¹⁶

30.3%가, 21.4%가

17.1%, 22.2%

(Table

가 .¹⁷

4). Table 5 . *S. pneumoniae* (35%), *H. influenzae* (34.3%), *N. meningitidis* (6.4%)⁶ *S. pneumoniae*가 가¹⁸

(p<0.05), 50

(p<0.05), (p<0.05), (p<0.001)

가

gram-negative bacilli가
 22%
 가 가^{4,19}
 N. meningitidis 8.1%가^{6,16}
 S. pneumoniae, H.
 influenzae, gram-negative bacilli , S.
 pneumoniae, gram-negative bacilli ,
 gram-negative
 bacilli
 aureus gram-negative bacilli 가 ,
 gram-negative bacilli ,¹⁹
 S. pneumoniae 가
 30% ,²⁰
 38.1%
 34% ,¹⁹
 가 가 ,
 5% ,¹⁹
 가
 100/μL 5000/μL
 가 가 10% 10000/μL
 가²¹ 가 가²²
 95%
 45 mg/dL , 1000 mg/dL
 가
 59% , 59%
 40 mg/dL ,^{21,23}
 23% , 26.8% ,
 19.5%
 가 , 50

가 , 가 40 mg/dL
 가
 가 40 mg/dL 가 20/μL
 , 300 mg/dL^{19,24}
 , 가 , 가
 가

REFERENCES

1. Park SA, Chun HW, Choi IS. Clinical characteristics of bacterial meningitis. *J Korean Neurol Assoc* 1997;15:1050-1063.
2. Carpenter RR, Petersdorf RG. The clinical spectrum of bacterial meningitis. *Am J Med* 1962;33:262-275.
3. Swartz MN, Dodge PR. Bacterial meningitis-a review of selected aspects. I.General clinical features, special problems and unusual meningeal reactions mimicking bacterial meningitis. *N Engl J Med* 1965;272:725-731.
4. Crane LR, Lerner AM. Non-traumatic gram-negative bacillary meningitis in the Detroit Medical Center, 1964-1974(With special mention of cases due to Escherichia coli). *Medicine* 1978;57:197-209.
5. Schlech WF III, Ward JI, Band JD, Hightower A, Fraser DW, Broome CV. Bacterial meningitis in the united states, 1978 through 1981: the National Bacterial Meningitis Surveillance Study. *JAMA* 1985;253:1749-1754.
6. Kim KH, Sohn YM, Kang JH, Kim KN, Kim JH, Kim CH et al. The causative organisms of bacterial meningitis in Korean children, 1986-1995. *J of Korean Med Sci* 1998;13(1):60-64.
7. Geiseler PJ, Nelson KE, Levin S, Reddy KT, Moses VK. Community acquired purulent meningitis: a review of 1,316 cases during the antibiotic era, 1954-1976. *Rev Infect Dis* 1980;2:725-745.
8. Hooper DC, Pruitt AA, Rubin RH. Central nervous system infection in the chronically immunosuppressed. *Medicine* 1982;61:166-188.
9. Phillips EJ, Simor AE. Bacterial meningitis in children and adults; change in community-acquired disease may affect patient care. *Postgrad Med* 1998;103:102-117.
10. Ashwal S, Tomasi L, Schneider S, Perkin R, Thompson J. Bacterial meningitis in children: pathophysiology and treatment. *Neurology* 1992; 42:739-748.
11. Quagliarello VJ, Scheld WM. Bacterial meningitis: pathogenesis, pathophysiology, and progress. *N Engl J Med* 1992; 327:864-872.
12. Quagliarello VJ, Scheld WM. New perspectives on bacterial meningitis. *Clin Infect Dis* 1993;17:603-610.
13. Marton KI, Gean AD. The spinal tap: a new look at an old test. *Ann Intern Med* 1986;104:840-848.
14. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. *Am J*

- Infect Control* 1998;16:128-140.
15. Park CS, Im BI, Sim JY. Clinical study of meningitis. *Korean Cent J Med* 1973;24:421-427.
 16. Kim SK, Park SH. The characteristics of bacterial meningitis. *J Hanyang Med* 1982;2:121-131.
 17. Quagliarello VJ, Scheld WM. Treatment of bacterial meningitis. *N Engl J Med* 1997;336:708-716.
 18. Park JK, Kim EH, Hwang TY. Clinical study of meningitis in children. *J Korean Pediatr Assoc* 1984;27:554-561.
 19. Durand ML, Calderwood SB, Weber KJ. Acute bacterial meningitis in adults. A review of 493 episodes. *N Engl J Med* 1993;328:21-28.
 20. Pomeroy SL, Holmes SJ, Dodge PR, Feigin RD. Seizures and other neurological sequelae of bacterial meningitis in children. *N Engl J Med* 1990;323:1651-1657.
 21. Spanos A, Harrel FE Jr, Durack DT. Differential diagnosis of acute meningitis: an analysis of the predictive value of initial observation. *JAMA* 1989;262:2700-2709.
 22. Kim HK, Lee WK. Clinical significance of CSF lymphocytosis in acute childhood bacterial meningitis. *J Korean Pediatr Assoc* 1988;31:707-714.
 23. Schuchat A, Robinson K, Wegner JD, Harrison LH, Farley M, Reingold AL, et al. For the Active Surveillance Team. Bacterial meningitis in the United States in 1995. *N Engl J Med* 1997;337:970-976.
 24. Sigurdardottir B, Bjornsson OM, Jonsdottir KE, Erlenddottir H, Gudmundsson S. Acute bacterial meningitis in adults. *Arch Intern Med* 1997;157:425-430.