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WHO Prognostic Scoring Scale in Acute Bacterial Meningitis of Children: A Prospective Study

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Abstract

Background: Acute Bacterial Meningitis (ABM) is one of the most severe infectious diseases in childhood. The global burden of the disease is high. Various factors that determine the outcome of the diseases are age, early diagnosis, early treatment, duration of treatment and type of microorganism. This study aimed to describe clinical and bacteriological profile of ABM and to correlate the WHO prognostic scoring scale and outcome of children with ABM.

Methods: A hospital based prospective study was carried out in Pediatric Medical Units of Mandalay Children's Hospital during February 2009 to February 2010. Total of 62 children (3 months to 12 years) with confirmed ABM were included in the study.

Results: Among 62 cases of ABM, most cases occur in three months to one year age group. The most common presenting features were fever, seizures, lethargy and altered consciousness. Meningeal irritation signs including neck stiffness, positive Kernig and Brudinzski signs were detected in 27.41% to 38.7%. Gram positive and gram negative organisms were detected in 15 cases by CSF gram stain and organisms were isolated in 4 cases by CSF culture. WHO prognostic scoring scale <9 is noted in 61 out of 62 cases of confirmed ABM. Among 61 cases of score <9, 37 cases were alive without sequelae, 21 cases were alive with sequelae and 3 cases expired. Only 1 case had score >9 and the patient expired.

Keywords: Acute bacterial meningitis; WHO prognostic scoring scale; Outcome

Introduction

Acute bacterial meningitis (ABM) is a serious disease of early childhood with high fatality and risk of neurological handicaps. At least 1.2 million cases of meningitis are estimated to occur every year with 135,000 deaths excluding epidemics [1].

Acute bacterial meningitis is seen more in children than adults. It is caused by a variety of microorganisms but *Haemophilus influenzae, Neisseria meningitidis and Streptococcus pneumoniae* are the most common causes of bacterial meningitis in children beyond the neonate period [2].

The specific pathogen causing bacterial meningitis varies around the world. The etiology of bacterial meningitis has changed dramatically in 1990s and is said to change again in the next decade because of introduction of newer vaccines [3].

Mortality and morbidity depend on the infectious agent, the age of the child, the child's general health, and the promptness of diagnosis and treatment. Despite improvements in antibiotic and supportive therapy, death and complication rates remain significant.

Overall mortality for bacterial meningitis is 5-10% and varies according to the causative organism and the patient's age. In neonates, mortality is 15-20%, whereas in older children, it is 3-10%. As many as 30% of children have neurologic sequelae.

Meningitis is a serious emergency in which the microbiological laboratory plays a critical role in the early identification of the causative bacterium and its antibiogram [4]. However, the correct interpretation of the clinical features of ABM still plays a critical role in the management of the disease particularly in the developing world.

There are several predictors of the outcome of meningitis in children. The quick and simple scoring scales, such as the WHO scale can be used as valuable prognostic tool for meningitis in children. WHO prognostic scoring scales in meningitis include 7 parameters (hypotension, tachycardia, tachypnoea, capillary refill time, pediatric coma scale, neck stiffness and petechiae/purpura). A study done in Egypt mentioned that predictors for death or epilepsy events were high WHO meningitis score (≥9), decreased CSF glucose level (<10 mg/dL), more smokers in the family, generalized seizures, infancy (<1 year of age) and working mothers [5].

Method and Material

A hospital based prospective study was conducted in Pediatric Medical Units of Mandalay Children's Hospital from 1st February 2009 to 28th February 2010. Total 268 children over 3 months to 12 years of age who were admitted to Mandalay Children's Hospital with suspected case of meningitis were studied.

Lumbar puncture (LP) was performed in all cases and 62 cases were found to have ABM after CSF examination. Exclusion criteria were children with known case of epilepsy and cerebral palsy. The severity of meningitis was assessed according to WHO meningitis prognostic scoring system using seven parameters (Hypotension, Tachycardia, Tachypnoea, Capillary refill time >3 seconds, Pediatric coma scale <8, No Neck Stiffness, Petechiae/purpura) on admission and before discharge. Children were examined for neurological sequelae on discharge and outcome was recorded. Data were collected by pro-forma on admission and before discharge. Collected data were analyzed by using Epi Info version 6.04d to correlate the WHO

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prognostic scoring scale and outcome of children with ABM.

Results

Among 62 cases of confirmed ABM majority of cases were under 5 years (78%) and male:female ratio was 1:1.41.

The commonest presentations were fever (98.38%), seizures (70.96%), lethargy (64.51%) and altered consciousness (40.32%). Meningeal irritation signs (Kernig sign, Brudzinski sign and Neck Stiffness) were detected in 27.41%, 25.8% and 38.7% of cases respectively. Organisms were detected by Gram stain of CSF in 15 cases and isolated in 4 cases by CSF culture.

Five Gram positive cocci, 5 Gram negative cocci, 2 Gram negative bacilli and 3 Gram negative cocco bacilli were detected by CSF Gram stain in 15 cases. Three CSF cultures were positive for *Neisseria meningitides* and 1 culture was positive for *Pseudomonas aeruginosa*. Both *N. meningitidis* and *Pseudomonas* were sensitive to benzyl Penicillin, chloramphenicol, ceftazidime and amikacin, and resistant to cefotaxime and gentamicin.

WHO prognostic scoring scale <9 is noted in 61 out of 62 cases of confirmed ABM. Among 61 cases of score <9, 37 cases were alive without sequelae, 21 cases were alive with sequelae and 3 cases expired. Only 1 case had score >9 and the patient expired. Mean WHO prognostic score between alive and dead children were statistically significant (p=0.006). Mean difference of WHO prognostic score and outcome of children in 3 groups (death, children with sequelae, children without sequelae) were also statistically significant (p=0.006, 0.006 and 0.009) (Tables 1-3).

Discussion

In this study, the greatest risk of ABM was found in 3 months to 1 year age group. This may be due to lack of immunity to specific pathogens in young age [6]. In other studies done in Myanmar [7,8], the greatest risk was found in 1 month to 5 years age group. In Romania, half of the ABM cases also occurred in children under 1 year age group [9] and the majority of culture confirmed disease (67%) occurred in children less than 1 year of age in Egypt [10].

This study shows that the commonest presentation of ABM in children were lethargy (64.51%), altered consciousness (40.32%), vomiting (33.87%), headache and irritability (12.9%). Meningeal irritation signs including Kernig's sign (27.41%), Brudzinski's sign (25.8%) and neck stiffness (38.7%) were noted. Bulging fontanelle (19.35%) is also found in infancy. The common signs of ABM in children were lethargy (84.52%), irritability (73.81%), neck rigidity (59.52%), full anterior fontanellae (54.76%), change in sensorium (46.43%), positive Kernig's sign (44.05%) and head retraction (36.9%) [11].

The etiology of ABM among children in this study had not been well characterized due to limited laboratory capacity, lack of critical reagents to particular pathogens and the high frequency of patients receiving prior treatment with antibiotics before evaluation. In Myanmar, children over 5 years age group, *N. meningitidis* was found in 60-80% of ABM cases [8,12,13].

In this study, there was increasing resistance to conventionally used antimicrobial agents among the major pathogens. In cases of *N. meningitidis* isolates, there was 100% resistant to cefotaxime, ampicillin and gentamicin but all were susceptible to benzyl penicillin, chloramphenicol, ceftriaxone, ceftazidime and amikacin. The *Pseudomonas* isolate was resistant to cefotaxime and gentamicin but sensitive to ampicillin, benzyl penicillin, chloramphenicol, ceftriaxone, ceftazidime and amikacin.

In this study, WHO prognostic scoring scale <9 was detected in 61 out of 62 cases of confirmed ABM. Among 61 cases of score <9, 37 cases (60.66%) were alive without sequelae, 21 cases (34.43%) were alive with sequelae and 3 cases (4.91%) expired. Only 1 case had score >9 and that patient expired (100%). Outcome of the patients with ABM was more severe with increasing score. Comparing mean score between alive and dead group is statistically significant (p<0.05). According to one way ANOVA test, it is statistically significant among sequelae, non-sequelae and dead group (F=4.12, p<0.05). These findings are compatible with the findings from the study done in Egypt in 2005 [5].

Score	Alive without Sequelae		Alive with Sequelae		Death	
	No.	%	No.	%	No.	%
< 9	37	60.66	21	34.43	3	4.91
≥ 9	0	0	0	0	1	100

Scoring >9 was noted in only one patient and the patient expired.

Table 1: Association between WHO Prognostic Scoring Scales and Outcome of Children with ABM.

Outcome	Number	Mean WHO Prognostic Score	Standard Deviation
Alive	58	1.63	1.58
Death	4	4.25	3.86

t = -2.85, p = 0.006

Comparing mean score between alive and death, p is <0.05, so it is statistically significant between alive and death group.

Table 2: Correlation between Mean WHO Prognostic Score and Mortality of Children with ABM.

Outcome	Mean ± SD	Significant (p)
Non-sequelae	1.72 ± 1.7	0.009
Sequelae	1.5 ± 1.4	0.006
Death	4.25 ± 3.86	0.006

According to one way ANOVA test, F is 4.12 and p is <0.05, it is statistically significant among these 3 groups

Table 3: Correlation between Mean Difference of WHO Prognostic Score and Outcome of Children with ABM.

Conclusion

Majority of the confirmed cases of ABM were under 5 years of age and female preponderance was found. The most common presenting features were fever, seizures, lethargy and altered consciousness. Outcome of the patients with ABM was more severe with increasing WHO prognostic score.

Conflict of Interest

The authors declare that there is no conflict of interests.

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