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Causative Organisms, Clinical Course and Complications of Pyogenic Meningitis in Children

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Abstract

Background **To identify causative organisms of pyogenic meningitis, monitor clinical course and assess complications.**

Methods: **The Study was conducted in Paediatric department of Rawalpindi General Hospital, Rawalpindi, over a period of 1 year. Thirty patients were enrolled in the study. History, complete examination, routine investigations, blood culture and cerebrospinal fluid (CSF) routine examination and culture were performed. Cranial ultrasound and CT scan of brain were performed in selected patients. Treatment was given for ten days, and after discharge patients were followed upto 6 months. Data was entered and analyzed using computer programme SPSS version 10.0.**

Results: **Mean age of patients was 40 ± 39.2 months. Eighteen (60%) were male and 12 (40%) were females. The most common clinical presentation was fever (100 %) with mean duration 3.4 ± 0.7 days. Cerebrospinal fluid culture was positive in 12 (40%) patients. The most common organism isolated was Streptococcus pneumoniae in 7 (23.3%).On follow up 6 (20%) patients had hearing loss. Thirteen (43.3%) patients fully recovered after therapy, 15 (50.0%) recovered with complications while 2 (6.6%) patients expired.**

Conclusion: **The clinical features like loss of consciousness, signs of meningeal irritation (SOMI) and signs of raised intracranial pressure (ICP) are significantly associated with morbidity and mortality. The positive CSF culture, cranial ultrasound and CT scan findings are also associated with morbidity and mortality.**

Introduction

Meningitis is inflammation of the membranes surrounding the brain and spinal cord. It is a life threatening clinical syndrome. Pyogenic meningitis occurs at all ages, but it is commonest in infancy[1]. During neonatal period the main pathogens include group B streptococcus, Escherichia coli, Streptococcus pneumoniae and less commonly Haemophilus influenzae and Listeria monocytogens. After neonatal period Haemophilus influenzae, Streptococcus pneumoniae[2] and Neisseria meningitides[3] predominate, the latter being more common with increasing age[4].

Alterations in host defence due to anatomic defects or immune deficits increase the risk of meningitis from less common pathogens such as Pseudomonas aeruginosa, Staphylococcus aureus, coagulase-negative staphylococci, salmonella and Listeria monocytogens.

A major risk factor for meningitis is the lack of immunity to specific pathogens associated with young age. Additional risks include recent colonization with pathogenic bacteria, close contact, over crowding, poverty and male gender. The mode of transmission is person to person contact through respiratory tract secretions or droplets. Altered immunoglobulin production in response to encapsulated pathogens is another risk factor. CSF leak across a mucocutaneous barrier, lumbosacral dermal sinus and meningomyelocele are associated with an increased risk of meningitis.

Pyogenic meningitis accounts for 3 percent of total admissions. The incidence of pyogenic meningitis is higher in developing countries[5]. It is associated with a high rate of acute complications, mortality and risk of chronic morbidity[6].This serious disease has 8-20 percent mortality, 50 percent neurobehavioral morbidity while relapse rate is 3-4 percent. Neurodevelopmental sequelae may occur in 10-20 percent of the cases.

The onset of acute meningitis has two predominant patterns. There may be sudden onset with rapid progression leading to shock, purpura, disseminated intravascular coagulation (DIC), reduced levels of consciousness and death. The other presentation is presence of nonspecific signs and symptoms followed by signs of meningeal irritation, raised intracranial pressure and seizures. Diagnosis is confirmed by cerebrospinal fluid examination[7]. Antibiotics along with supportive therapy are the mainstay of treatment. Mortality can be reduced by an early recognition and prompt treatment.

The most common neurological sequelae include hearing loss, mental retardation, delayed milestones, speech problem, visual impairment and motor deficit[8]. The poor prognostic indicators include age at onset of illness less than 6 months, occurrence of seizures more than 4 days into therapy, acute complications like coma and focal neurological signs, low CSF glucose and more than 106 CFU bacteria/ml in the CSF [9].

With the above guide lines from the current literature, a study was planned to identify the causative organisms, observe clinical course and follow up of patients aged two months to twelve years with meningitis.

The objective of this study was to identify causative organisms and complications of pyogenic meningitis.

Patients and Methods

This was a descriptive study conducted in Paediatric department of Benazir Bhutto Hospital(BBH), Rawalpindi from October 2005 to September 2006.Thirty patients, from two months to twelve years of age with pyogenic meningitis were enrolled. Neurosurgical conditions (myelomeningocele, neural crest defects etc), known cerebral palsy and cyanotic congenital heart disease and known deafness prior to admission were excluded .

After taking informed consent, detailed history was taken followed by complete examination. Routine investigations including complete blood count and ESR, urine routine examination, urea and creatinine, serum electrolytes, chest X-ray, serum calcium and blood sugar random were carried out. Blood culture and cerebrospinal fluid examination and culture were performed. Cranial ultrasound and CT scan of brain were performed in patients with raised intracranial pressure, papilledema and focal neurological deficits to exclude hydrocephalus, brain abscess and infarction. All the patients were given intravenous ceftriaxone (100 mg/kg/day) for ten days. After discharge, patients were followed upto 6 months. During follow up, they were assessed for vision and hearing loss and development of hydrocephalus. Neurological sequale including motor deficits, nerve palsies and seizures were documented and developmental assessment for developmental delay was performed. All the data was entered into a specially designed proforma. Data was entered and analyzed using computer programme SPSS version 10.0.

Results

Of the thirty patients enrolled in study. eighteen (60%) were male and 12 (40%) were females. Mean age was 40 $\pm$ 39.2 months. Majority of patients (53.33 %) were aged 2 months to 2 years (Table 1).

Table 1: Baseline Characteristics (n=30)

	No. (%age)
Sex	
Male	18 (60.0%)
Female	12 (40.0%)
Age (months)	
Mean $\pm$ SD	40.0 $\pm$ 39.2
Median	24
Range	4 – 132

Table 2: Duration of Symptoms prior to hospitalisation (n=30)

Symptoms	Mean $\pm$SD	Median	Range
Fever (days)	3.4 $\pm$ 0.7	3.0	2 – 5
Fits	1.9 $\pm$ 0.8	2.0	1 – 4
Headache	1.9 $\pm$ 0.7	2.0	1 – 3
Vomiting	2.3 $\pm$ 1.2	2.0	1 – 5

Table 3: Clinical features (n=30)

	No. (%age)
Irritability	18 (60.0%)
Lethargy	20 (66.6%)
Bulging anterior fontanel	8 (26.7%)
GCS	
7	6 (20.0%)
8	5 (16.7%)
9	9 (30.0%)
Signs of meningeal irritation	9 (30.0%)
Signs of raised ICP	3 (10.0%)
Nerve palsy	9 (30.0%)

The most common clinical presentation was fever (100 %) with mean duration 3.4 $\pm$ 0.7 days.

Seizures were present in 19 (63.3%) with mean duration 1.9 ± 0.8 days, vomiting in 20 (66.6%) with mean duration 2.3 ± 1.2 days while loss of conscious level and lethargy was present in 20 (66.6%) patients. Nineteen (63.3%) patients had signs of raised intracranial pressure like papilledema, hypertension and bradycardia.

Table 4: Investigations (n=30)

	No. (%age)
Blood CP	
TLC (high)	9 (30.0)
TLC high with neutropenia	21 (70.0)
ESR (high)	2 (6.7)
CSF cultures	
Negative	18 (60.0)
S. pneumoniae	7 (23.3)
Neisseria meningitidis	3 (10.0)
H. influenzae	2 (6.7)
CT scan	
Suggestive of meningitis	16 (53.3)
Cerebral infarction	4 (13.3)
Subdural effusion	4 (13.3)

Neck stiffness, Kernig and Brudzinski signs were present in 9 (30.0%) patients. Four (13.3%) patients had stroke and subdural effusion. One case of subdural effusion was symptomatic (Table 2 and 3).CSF culture was positive in 12 (40%) patients. The most common organism isolated was Streptococcus pneumoniae in 7 (23.3%), followed by Neisseria meningitides in 3 (10.0%) and Haemophilus influenzae type B in 2 (6.6%) (Table 4).However blood cultures were negative.

Table 5: Complications (n=30)

	No. (%age)
Developmental delay	6 (20.0%)
Epilepsy	4 (13.3%)
Mental retardation	5 (16.7%)
Spasticity	5 (16.7%)
Hearing problem	6 (20.0%)
Visual problem	5 (16.7%)
Speech problem	6 (20.0%)
Behavioural disorder	4 (13.3%)

Table 6: Comparison of Recovered Patients (n=30)

	Complete recovery (n=13)	Recovered with complications (n=15)	p-value
CSF cultures			
Negative	13	5 (33.3%)	0.001
S. pneumoniae	(100.0%)	6 (40.0%)	
Neisseria meningitis	0 (0.0%)	2 (13.2%)	
H. influenzae	0 (0.0%)	2 (13.2%)	
	0 (0.0%)		
Cranial U/S and CT			
Suggestive of meningitis	9 (69.2%)	5 (33.3%)	0.05
Cerebral infarction	0 (0.0%)	4 (26.7%)	
Subdural effusion	1 (7.7%)	3 (20.0%)	

During follow up, 6 (20%) patients had hearing loss, speech problem and developmental delay. Five (16.66%) patients had visual impairment, motor deficit and mental retardation. Four (13.33%) patients developed epilepsy and behavioural problems (Table 5).

Regarding outcome, 13 (43.3%) patients fully recovered after therapy, 15 (50.0%) recovered with complications while 2 (6.6%) patients expired.

The two groups, one with complete recovery (n=13) and the other one with recovery with complications (n=15) were compared for clinical features and the investigations done. The duration of the clinical symptoms like fever, seizures and vomiting were compared and found non-significant. The conscious level, signs of meningeal irritation and signs of intracranial pressure showed a significant association (Table 6).

Comparing the investigations like CSF cultures and CT scan we found a significant association among the fully recovered and the complications groups (Table 6).

Discussion

Pyogenic meningitis is a life threatening clinical syndrome having high morbidity and mortality[11].

Pyogenic meningitis occurs at all ages, but it is commonest in infancy. In a study from India[10], 78 % cases of meningitis were found in children aged less than 1 year. In our study, 53.33 % (n=16) were aged between 2 months and 2 years.

Pyogenic meningitis is more common in males than females. In one study in India[10], more cases of

pyogenic meningitis were found in males than females. In another study in Nigeria[14], 70% were male and 30 % were females. In our study, similar results were obtained, 60 % (n=18) were male and 40 % (n=12) were females.

The most common clinical presentation of pyogenic meningitis is fever[10], seizures, loss of conscious level, vomiting and lethargy. In our study, all patients presented with fever while vomiting, loss of conscious level and lethargy were observed in 20 (66.6%). Seizures and signs of raised intracranial pressure were present in 19 (63.3%). Similar results were found in studies carried out in India[10] and Nigeria[14].

CSF culture is positive in 40 to 60 % of patients with pyogenic meningitis[10]. The most common organism between age 2 months and 12 years is Streptococcus pneumoniae, followed by Neisseria meningitidis and Haemophilus Influenzae. In our study, 12 (40%) patients had positive CSF culture. Streptococcus pneumoniae was isolated from 7 (23.3%) patients, Neisseria meningitidis from 3 (10.0%) and Haemophilus influenzae from 2 (6.6%) patients. These results were similar to a study carried out in India[10] and one in Pakistan[12]. The same results were found in another study carried out in Nigeria[14]. Blood cultures were negative in our study; however blood cultures can be positive in 80-90 % of cases[15].

Nineteen (63.3%) patients had signs of raised intracranial pressure which include papilledema, hypertension and bradycardia. Neck stiffness, Kernig and/or Brudzinski sign were present in 9 (30.0%) patients. Signs of meningeal irritation are not present before 18 months of age[15]. Cranial nerve palsy and bulging fontanelle were found in 9 (30 %) and 8 (26.7%) patients respectively. Four (13.33 %) patients had stroke and subdural effusion.[16]

Appropriate recognition, prompt antibiotic therapy, and supportive care have reduced the mortality to less than 10 %. In our study, 2 (6.66%) patients expired. Similar results were also shown by other studies. In one study[12] in Pakistan, mortality was 10%.

All patients enrolled in our study were followed up for 6 months. The chronic sequelae included hearing loss, mental retardation, speech problem, developmental delay, visual impairment, spasticity, epilepsy and behavioural disorder. In our study, the most common chronic sequelae were hearing loss which is comparable to other studies[10, 13,]. Speech problem and developmental delay were seen in 6 (20%) patients. Visual impairment, spasticity and mental retardation were present in 5 (16.6%) patients and epilepsy and behavioral disorder were observed in 4 (13.3%) patients. These results are similar to studies carried out in India[11] and Pakistan[2].

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