

# A Prospective Study of Pyogenic Meningitis in Children at Shaikh Zayed Hospital, Lahore

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## SUMMARY

*From October 1993 to September 1994, a total of 3248 patients were admitted in the Paediatrics Department of Shaikh Zayed Hospital, Lahore. Out of these, 41 (1.2%) were diagnosed as pyogenic meningitis. Most cases were seen during the colder months of the year with the peak incidence (2.5%) in the month of January. The causative organisms were identified by Gram-staining, culture and antigen detection by latex agglutination in 38 (92.5%) of 41 cases. In 3 (7.5%) cases, causative organisms were not identified, however, their clinical presentation and CSF findings were compatible with the diagnosis of pyogenic meningitis. The organisms identified were Streptococcus pneumoniae (15=36.5%), Staphylococcus aureus (6=14.6%), Neisseria meningitidis (5=12.1%), Haemophilus influenzae (5=12.1%), Klebsiella pneumoniae (4=9.7%), Escherichia coli (1=2.4%), Streptococcus group B (1=2.4%) and Citrobacter freundii (1=2.4%). Forty six percent of the patients had received antibiotic therapy before their admission.*

## INTRODUCTION

It can be assumed that pyogenic meningitis has been a scourge of mankind since earliest times<sup>1</sup>. In infants and children it remains a serious threat to life despite the availability and use of antibiotics and wide array of supportive measures<sup>2</sup>. The causative organisms of pyogenic meningitis vary for different areas of the world, and seasonally related increase is observed for several organisms. The physician caring for the child should be aware of the organisms prevalent in the vicinity and their antimicrobial sensitivity in order to intimate prompt and appropriate antibiotic therapy<sup>3</sup>. Therefore knowledge about the offending organisms in our part of the world in different ages can help the physician manage the case more easily and appropriately.

The purpose of this study was to estimate the incidence and document the aetiology of pyogenic meningitis in children (below 13 years) admitted in the Paediatrics Department of Shaikh Zayed Hospital, Lahore. The clinical features of childhood meningitis and their age specificity were also noted.

## MATERIAL AND METHODS

All children admitted in the Paediatrics Department from October 1993 to September 1994 with a history and clinical findings suggestive of meningitis were studied prospectively. Cases with antibiotic treatment prior to admission were also included in the study.

The cerebrospinal fluid (CSF) obtained by lumbar puncture was processed within 20 minutes of collection. Analysis of CSF was done for total leukocyte count, differential leukocyte count, sugar and protein estimation, Gram-staining, culture, and antigen detection with latex agglutination. Sediment of the centrifuged CSF specimen was used for culture, Gram-staining and differential leukocyte count. Culture media inoculated include the blood agar, chocolate (heated blood) agar and MacConkey agar. The inoculated plates of blood and chocolate agar were incubated in 5-10% carbon dioxide and MacConkey agar in aerobic atmosphere at 37 °C for 24 hours. All the isolates were identified by standard bacteriological techniques<sup>4</sup>. Antigen detection was

performed with latex agglutination technique with Wellcogen Bacterial Antigen Kit ZL26 (Murex, England). Pyogenic meningitis in this study was defined as the presence of an organism in the CSF, identified by Gram-staining, culture or latex agglutination. Pyogenic meningitis of unknown aetiology was diagnosed if the patient had received antibiotics prior to their admission and/or no organism could be demonstrated in CSF, but the clinical presentation and CSF findings were compatible with the diagnosis of pyogenic meningitis.

## RESULTS

During the study period, 3248 cases were admitted in the Paediatrics Department. Out of these, 724 clinically suspected cases underwent lumbar puncture. After the laboratory examination of CSF, 41 cases were diagnosed as pyogenic meningitis. There were 28 males (68.29%) and 13 females (31.71%) with a ratio of 2.1:1, giving an overall incidence rate of 1.2%. Pyogenic meningitis occurred throughout the year but more cases were seen during the colder months. The peak incidence (2.5%) was noted in the month of January (Fig. 1). Out of 41 cases, 19 (46.34%) had received antibiotic treatment prior to their admission.

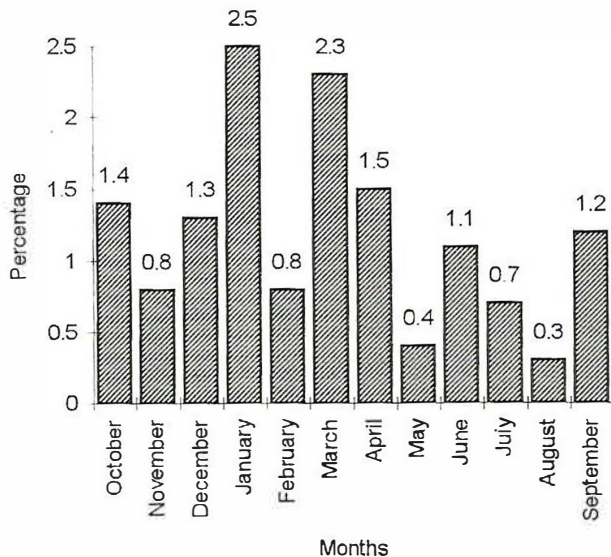


Fig. 1: Monthly incidence of pyogenic meningitis (%).

Age of the patients ranged from 9 days to 11 years. Seven (17.07%) cases were below one month, and 5 (12.19%) were above 72 months of the age. A total of 24 (58.53%) cases were of 12 months or less.

The clinical symptoms and signs were noted down on the day of admission. Most patients presented with fever (38=92.68%), followed by vomiting (23=56.09%), restlessness (21=51.29), convulsions (19=46.34%), reluctance to feed (11=26.82%), headache (7=17.07%) and meningeal signs (12=29.26%). Three patients were unconscious at the time of admission.

The average peripheral blood white cell count for pyogenic meningitis was  $13.11 \pm 3.04 \times 10^9/L$  (range  $8.4-20.4 \times 10^9/L$ ) and 36% of patients had polymorphonuclear leukocytosis exceeding 60%.

The breakdown of the 41 cases of pyogenic meningitis based on CSF findings is shown in Table 1. Sixteen of 26 (63.41%) cases of positive Gram-staining also showed bacterial growth in CSF cultures. However, in three instances Gram-staining was negative but CSF culture revealed the growth of organisms. The latex agglutination was positive in 27 (65.85%) cases. It also demonstrated organisms in 9 cases despite negative culture or Gram-staining. In 3 (7.3%) of 41 cases, causative pathogens were not identified by Gram-staining, culture and latex agglutination test. However, the clinical presentation and CSF findings were compatible with the diagnosis of pyogenic meningitis. All these cases had received antibiotics prior to their admission.

Table 1: Cerebrospinal fluid laboratory findings of patients with pyogenic meningitis (n=41).

Cerebrospinal fluid	Mean $\pm$ SD
WBC (mm <sup>3</sup> )	*1444 $\pm$ 2434
Polymorphonuclear cells (%)	78.24 $\pm$ 12.44
Glucose (mg/dl)	20.53 $\pm$ 10.95
Protein (mg/dl)	156.9 $\pm$ 93.96
Gram-staining positive [n (%)]	26 (63.41)
Culture positive [n (%)]	19 (46.34)
Test latex positive [n (%)]	27 (65.85)

\*One case was excluded (as outlier) which has exceptionally high WBC count ( $17860/mm^3$ ) (n=40).

*Streptococcus pneumoniae* was the most common aetiological agent of pyogenic meningitis in our study, being identified in 15 (36.5%) cases. *Escherichia coli*, *Streptococcus group B* and *Citrobacter freundii*, 1 (2.4%) each were at minimum range. *Klebsiella pneumoniae* was the commonest aetiological agent of neonatal bacterial



**Table 2: Distribution of different aetiological agents according to the age of patient.**

Micro-organisms	<1 month	1-12months	13-24months	25-72months	> 72 months	Total
Citrobacter freundii	-	1	-	-	-	1
E. coli	1	-	-	-	-	1
H. influenzae	1	4	-	-	-	5
Kleb. pneumoniae	3	1	-	-	-	4
N. meningitidis	-	1	-	2	2	5
Staph. aureus	-	3	1	1	1	6
Strep. group B	1	-	-	-	-	1
Strep. pneumoniae	-	6	1	6	2	15
Unknown aetiological agent	1	1	1	-	-	3
<b>Total</b>	<b>7</b>	<b>17</b>	<b>3</b>	<b>9</b>	<b>5</b>	<b>41</b>

meningitis, accounting for 3 (42.8%) of 7 cases of neonatal age. Streptococcus pneumoniae accounting for 15 (44.1%) of 34 cases of the meningitis beyond the neonatal period (Table 2).

When monthly distribution of the organisms were seen, all the organisms in the month of December were Streptococcus pneumoniae (n=4), otherwise there was no difference. Blood culture was performed in all patients and found positive in 3 (7.3%) cases. All the blood cultures were positive in neonates and Klebsiella pneumoniae and E. coli isolated from 2 and 1 cases, respectively.

## DISCUSSION

The incidence of pyogenic meningitis in our study was 1.2% cases per 100 admissions to the paediatrics department.

The results are lower than Olanrewaju et al.<sup>5</sup> and El-Amin et al.<sup>6</sup> who reported 2.8 and 3.2% incidence rate, respectively. However, our results are comparable with Uduman et al.<sup>7</sup> and Azubuike<sup>8</sup> who reported 1.1 and 0.89 incidence rate, respectively.

Most cases of pyogenic meningitis were seen during the colder months of the year with the peak incidence (2.5%) in the month of January. The results are in agreement with Spanos et al.<sup>9</sup>

Out of 41 cases, 28 (68.29%) were males and 13 (31.71%) females with a ratio of 2.1:1. The results are comparable with Abanamy et al.<sup>10</sup> and Zakzouk and El-Sayed<sup>11</sup> who observed 67 and 64% males, respectively. This increase prevalence in males may be due to the location of gene for synthesis of Gamma globulin on X-chromosome and male possesses only one X-chromosome.

In our study 58.5% cases were of 12 months or less. The results are in agreement with the study of Javed<sup>12</sup> who also observed 58% cases of 12 months or less. Fever was the most common clinical finding of our study and was present in 92.6% patients. The results are comparable with the studies of Azubuike<sup>8</sup> and Abanamy et al.<sup>10</sup> who reported fever in 82 and 97% patients, respectively.

The average peripheral blood leukocyte count of patients was  $13.11 \times 10^9/L$ . The results are comparable with Spanos et al.<sup>9</sup> who reported a mean of  $14.6 \times 10^9/L$  peripheral blood leukocyte count.

Most of our patients had CSF leukocytosis with predominant polymorphonuclear cells. The average total leukocyte count was  $1444/mm^3$ . The results are comparable with El-Amin et al.<sup>3</sup> who observed a mean value of 1470 cells/ $mm^3$ . The mean CSF glucose level was 20.53 mg/dl. The results are comparable with the study of Qureshi<sup>13</sup> who observed a mean of 22.4 mg/dl glucose. The mean CSF protein level of our patients was 156.9 mg/dl. The results are comparable with the study of Qureshi<sup>13</sup> and Abanamy et al.<sup>10</sup> who observed a mean value of 155 and 157 mg/dl protein, respectively.

Sixty three percent cases of our study were positive on Gram-staining method. The results are comparable with Akbani et al.<sup>14</sup> who observed 62% positive results on Gram-staining. Cerebrospinal fluid culture was positive in 46.34% cases. The results are comparable with Dasgupta et al.<sup>15</sup> who observed 43.8% positive results on CSF culture. The latex agglutination test detected antigens in 65.85% cases. The results are in agreement with El-Amin et al.<sup>6</sup> who observed 65% positivity with latex agglutination test.

The most common aetiological agent of pyogenic meningitis in our study was *Streptococcus pneumoniae*, accounting for 36.5% cases. The results are comparable with Haqani and Baber<sup>16</sup>, Javed<sup>12</sup>, Akbani et al.<sup>14</sup>, Dasgupta et al.<sup>15</sup> and Qureshi.<sup>13</sup> who also found *Streptococcus pneumoniae* as the most common aetiological agent of their study. Although *Streptococcus pneumoniae* was the most common aetiological agent of the study, especially beyond the neonatal period, but the cases of neonatal meningitis were mostly caused by *Klebsiella pneumoniae*. The results are in agreement with Coovadia et al.<sup>17</sup> who also found *Klebsiella pneumoniae* as the commonest aetiological agent of bacterial meningitis of neonatal age.

In 7.3% cases of our study, no aetiological agent was identified, however, these all patients had symptoms and signs of meningitis and CSF pleocytosis with predominant polymorphonuclear cells. Wood et al.<sup>18</sup>, Goldacre<sup>19</sup> and Abomelha et al.<sup>3</sup> observed 13, 28 and 34% of such cases, respectively. The decreased number of such cases in our study is due to the use of latex agglutination technique for antigen detection.

## CONCLUSION

This study showed 1.2% of incidence rate of pyogenic meningitis in children with higher prevalence of the organisms within the male population. *Streptococcus pneumoniae* appeared as the commonest aetiological agent. This shows that the bacterial spectrum has yet not changed over the last 28 years and *Streptococcus pneumoniae* is still the commonest aetiological agent of pyogenic meningitis in children in our part of the world.

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