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EPIDEMIOLOGICAL AND CLINICAL FEATURES OF MENINGITIS AMONG PEDIATRIC AGE GROUP IN MOSUL PROVINCE

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ABSTRACT

Background: The medical term "meningitis" refers to an inflammation of the meninges, which is the membrane that surrounds the brain and spinal cord. Meningitis is mostly caused by viral, bacterial and fungal infections. The clinical manifestations of viral meningitis may vary depending on age and immunological condition. Objectives: Is to identify the epidemiological and clinical, features of meningitis among children in Mosul city. Methods: A cross section study was conducted from April 2023 to the end of April 2025 in Mosul city at Ibn Sena and Ibn Al Atheer Teaching Hospitals. The questionnaire form was consisted from three parts. Part one for sociodemographic information such as name, age, sex, residency, previous admission, history of contact, and previous use of antibiotic. Part two for patients' clinical signs and symptoms such as; fever, headache, vomiting, convulsion, photophobia, lethargy, diarrhea and meningeal irritation signs. Part three for laboratory results. Results: Among 120 children enrolled in this study, the mean age of the study patients was 5.29 ± 3.31 years. The majority of patients were aged from 4-9 years, from male gender, urban residency. Most of mothers were from secondary educational levels while most of the fathers were from primary educational levels. Positive animal contact was reported among only 44 (36.66%) patients. Furthermore; the majority of patients were received mixed feeding during their first year of life, they were passive smoker, received regular vaccination, and took antibiotics before infection and having history of repeated infection. Only 21 (17.5%) patients had head trauma, 27 (22.5%) patients had positive family history of meningitis. Additionally: the majority of infections occurred during winter season. Fever was the commonest reported compliant among 108 (90%) patients, followed by headache among 89 (74.16%) patients, and lastly bulged fontanel among 21 (17.5) patients. Viral meningitis was prevalent among 71 (59.16%) patients, followed by bacterial meningitis among 38 (31.66%) patients and 11 (9.16%) patients had several causes. Conclusion: The study concluded that viruses caused over half of meningitis in Iraq. More than one-third of affected children receive artificial milk during their first year of life. Meningitis is more predominant during winter season in Iraqi climate. Meningococcal cases and epidemics can be avoided by vaccine, which has been available for over 50 years. Licensed vaccinations are providing varying periods of protection.

KEYWORDS: Pediatrics, Viral, Meningitis, Mosul, Iraq.

1- INTRODUCTION

The medical term "meningitis" refers to an inflammation of the meninges, which is the membrane that surrounds the brain and spinal cord.^[1] Meningitis is mostly caused by viral, bacterial and fungal infections.^[2-3] Annually, viral meningitis causes 26,000 to 42,000 hospitalizations in the US, particularly among children aged 5 to 10 and infants under one year.^[4] Some meningitis cases resolve on their own in a few of weeks, in contrast, other

scenarios could be lethal and need for urgent antibiotic treatment.^[5-7] Although viral meningitis usually presents with signs and symptoms of meningeal irritation as: fever, headache, photophobia, neck stiffness, nausea and vomiting.^[8] However; Younger children may not exhibit such signs and symptoms.^[9]

Viral meningitis is frequent throughout the year in tropical and subtropical climates, with a peak in

temperate regions around summer and fall.^[10] In countries with high immunization rates, viral meningitis is more prevalent than bacterial meningitis.^[11] Vaccines against Haemophilus influenza type B, Streptococcus and Neisseria meningitidis pneumoniae. have significantly reduced instances of bacterial meningitis.^[12] Enteroviruses (Coxsackie or Echovirus) are the leading cause of viral meningitis in all age groups. Children are also commonly infected with parechoviruses.^[13] Meningitis can be caused by many herpesviruses, including HSV 1 and 2, VZV, CMV, Epstein-Barr virus, and human herpesvirus 6.^[14] Additional viral culprits include adenovirus, influenza, parainfluenza, mumps, and lymphocytic choriomeningitis virus (LCMV).^[5] Viruses can enter the meninges via the circulation, retrograde spread from nerve endings, or reactivation from a latent state inside the nervous system.^[15]

The clinical manifestations of viral meningitis may vary depending on age and immunological condition.^[16-17] Neonates with enteroviral meningitis may present similarly to those with bacterial sepsis, along with systemic involvement, including localized neurologic abnormalities, myocarditis, necrotizing enterocolitis, hepatic necrosis, and convulsions.^[18] Moreover; meningitis can also be brought on by a variety of conditions, such as cancer, subarachnoid hemorrhage, and chemical irritation.^[19]

Despite of the effective antibacterial medications are being produced on a yearly basis; bacterial meningitis continues to have a high mortality rate of up to 30%.^[11] *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Neisseria meningitidis*, the three most frequent organisms that cause the illness globally, are responsible for 90% of pediatric bacterial meningitis.^[20]

This study aimed to identify the epidemiological and clinical, features of meningitis among children in Mosul city.

2-PATIENTS AND METHODS

The present prospective descriptive cross-sectional study was carried out in Mosul city at Ibn Sena and Ibn Al Atheer Teaching Hospitals, from beginning of April 2023 to the end of April 2025. After obtaining ethical approval from the ethical committee of Nineveh Health directorate and parents' consent.

The study involved one hundred twenty patients from pediatric age group with confirmed diagnosis of meningitis by CSF culture and PCR.

A questionnaire form was consisted from three parts. Part one for sociodemographic information such as name, age, sex, residency, previous admission, history of contact, and previous use of antibiotic. Part two for patients' clinical signs and symptoms such as; fever, headache, vomiting, convulsion, photophobia, lethargy, diarrhea and meningeal irritation signs. Part three for laboratory results. CSF samples were collected through lumbar puncture and analyzed by laboratory personnel at two specialized hospitals. The analysis included appearance evaluation, total and differential cell counts, glucose and protein level determination, culture, and direct microscopy to detect bacterial or fungal pathogens. The culture medium used included blood, chocolate, and MacConkey agars. All subjects had a complete blood count test.

The results were analyzed by using SPSS version 30. Categorical variables were expressed via frequencies and percentages.

3. RESULTS

Among 120 children enrolled in this study, the mean age of the study patients was 5.29 ± 3.31 years. The majority of patients were aged from 4-9 years, from male gender, urban residency. Moreover; the majority of mothers were from secondary educational levels while the fathers were from primary educational levels. Positive animal contact was reported among only 44 (36.66%) patients. As shown in table 3.1.

 Table 3.1: Demographic data of the study participants.

Variable	Number	Percent
Age:		
- Less than 1 year	31	25.83%
- 1-4 years	33	27.5%
- 5-9 years	37	30.83%
- 10-14 years	19	15.83%
Gender:		
- Male	69	57.5%
- Female	51	42.5%
Residence:		
- Urban	66	55%
- Rural	54	45%
Mother education:		
-Illiterate	31	25.83%
-Primary	36	30%
-Secondary	37	30.83%

-higher education	16	13.34%
Father education:		
-Illiterate	12	10%
-Primary	51	42.5%
-Secondary	34	28.33%
-higher education	23	19.17%
Number of persons per room, mean \pm standard deviation	3.21 ± 1.21	
Animal Contact:		
- Yes	44	36.66%
- No	76	63.34%

Table 3.2 shows distribution of the study participants according to different risks. The majority of patients were received mixed feeding during their first year of life, they were passive smoker, received regular vaccination, and took antibiotics before infection and having history of repeated infection. Only 21 (17.5%) patients had head trauma, 27 (22.5%) patients had meningitis among his/ her family. Lastly; the majority of infections occurred during winter season.

 Table 3.2: Distribution of the study participants according to their risk factors.

Variable	Number	Percent
Type of feeding during first year:		
- Breast feeding	26	21.67%
- Bottle feeding	44	36.67%
- Mixed feeding	50	41.66%
Presence of passive smoking:		
- Present	65	54.16%
- Absent	55	45.84%
Receiving vaccinations regularly:		
-Yes	61	50.83%
-No	59	49.17%
Recurrent infection:		
-Yes	61	50.83%
-No	59	49.17%
History of head trauma:		
-Yes	21	17.5%
-No	99	82.5%
Season of getting meningitis:		
-Winter	108	90%
-Spring	1	0.83%
-Summer	4	3.33%
-Autumn	7	5.84%

Figure 3.1 shows distribution of patients according to their signs and symptoms. Fever was the commonest reported compliant among 108 (90%) patients, followed by headache among 89 (74.16%) patients, and lastly bulged fontanel among 21 (17.5) patients.

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Sign and symptoms of Meningitis

Figure 3.2 shows causes of meningitis among the study participants. Viral meningitis was prevalent among 71 (59.16%) patients, followed by bacterial meningitis

among 38 (31.66%) patients and 11 (9.16%) patients had several causes.



Figure 3.2: Causes of meningitis

4. DISCUSSION

In this study, meningitis was seen more frequently among 5-9 years children, with slight male and urban predominance, this could rise a suggestion that genetic and hormonal differences could be the cause of such difference. Comparable results were obtained from Khalid Hama Salih et al.^[21] More than 30% of the patients' parents were finished their primary school education, which is runs with Zainab Mohamed Mahmmod study findings.^[15]

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The current study found that the mean number of persons per room was more than 3 which is means meningitis can spread more frequently in overcrowded home condition, which is consistent to Aliyu et al^[22] and John Baptise Akanwake et al^[23] studies' findings. Furthermore; about third of the patients participate in this study disclosed positive animal contact, which guide for improving hygiene around the animal and frequently chick high risk population. Hannah E Brindle et al showed near results.^[24]

The majority of patients in this study received artificial milk during their first year of age, which is in line with Igidbashian et al.^[25] additionally; the majority of the patients with meningitis found to be passive smokers, comparable study in the Upper West Region of Ghana found that a significant portion of meningitis cases were passive smokers.^[26] On the other hand; about half of the study patients received their vaccination according to vaccination schedule, Zunaira Javed et al had similar findings.^[27] Additionally; half of the patients enrolled in this study had a history of recurrent infection and 17.5 % had head trauma, which is consistent to Zainab Mohamed Mahmmod study findings.^[15] Lastly; winter is found in this study as the commonest season where the children get meningitis. Tarek Al-Sanouri et al was found that bacterial meningitis was predominantly occurred during winter season.^[28]

Regarding the patient's signs and symptoms, the current results showing that; fever was reported more than other symptoms, followed by headache. This is in parallel to the results of Kroopnick et al.^[29]

Viral meningitis was found in this study to be the commonest cause of meningitis which nearly double the percentage of bacterial meningitis. This could be due to the effectiveness of bacterial meningitis implemented vaccination, Hanan Abdulghafoor Khaleel et al showed similar results.^[30]

According to the study findings; anemia is common in protein energy malnutrition and it was of mild to moderate degree. Anemia and malnutrition can occur with all patterns of feeding and this can be attributed to a number of factors like delayed added food, little or unsatisfactory food intake, severe and repeated infections, or combination of all above factors. Diarrhea is the main cause of malnutrition and anemia especially in bottle fed babies. Improved house hold food security, protecting children through improved food quality and safety, preventing specific micronutrient deficiencies, promoting breast feeding in the first 6 months of life and enhance fruit, vegetables and high iron containing diet at 6 months of age. Can be beneficial for preventing nutritional anemia in children.

5-CONCLUSION

The study concluded that viruses caused over half of illnesses, bacteria caused one-third, and other factors accounted to the other. Additionally, more than one-third of affected children receive artificial milk during their first year of life. Meningitis is more predominant in Iraq during winter season. The majority of patients with meningitis reported fever, headache, vomiting, and poor feeding. Meningococcal cases and epidemics can be avoided by vaccine, which has been available for over 50 years. Licensed vaccinations are providing varying periods of protection.

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Conflict of intertest

About this study, the authors disclose no conflicts of interest.

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