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A Retrospective Study of Childhood Meningitis and Its Risk Factors in Diyala Province

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Abstract

Background: Viral agents are the primary cause of meningitis, a worldwide public health concern that primarily affects newborns and children. It is self-limiting and goes away in 7–10 days. With 85% of cases, enterovirus is the most prevalent etiologic agent. Summer is the peak season, and warm weather facilitates its spread. Most cases of meningitis occur in people under 30.

Aim: This study intends to assess the risk factor of meningitis in different age groups in Diyala Hospital (the Governorate of Diyala – Iraq) and identify the relation of demographical characteristics with the risk factor.

Methods: A retrospective, cross-sectional design study was conducted from 1st October 2023 until 1st of March 2024. A purposive (non-probability) sample of 118 patients (subjects) was recruited. The data collection has been achieved manually through self-administered paper copies of the questionnaire that were given to the participants by the research team. Data were analyzed through the application of descriptive and inferential statistical approaches using IBM-Statistical Package for Social Science (SPSS) version 26.0.

Results: Of the total of 118 cases involved in the present study, nearly 32% were aged 5–9 years. The major cases were male 56.8%; live in urban areas 58.5%; their mothers and fathers get primary education 41.5% and 39%, respectively. 39.8% of children receive artificial breastfeeding, 22.9% receive breastfeeding, while the remaining get both of them. A regular dose of a vaccine is gotten by 62.7% of children. The highest percentages had fever 84.7% more than any other symptoms, followed by headache 72%, vomiting 61.9%, and poor nutrition 58.5%. Statistically, there is a significant association of CSF results with frequent use of antibiotics before infection at p-value 0.054.

Conclusions: The study found that over half of infections were caused by viruses, about one third by bacteria, and others due to various causes. More than one-third of infected children receive artificial breastfeeding. The highest percentages had fever, headache, vomiting, and poor nutrition.

Keywords: Meningitis, Risk factors, Symptoms, Diyala hospital

1. Introduction

The medical term "meningitis" describes an inflammation of the meninges, the membrane that encloses the brain and spinal cord, which is mostly caused by infections with bacteria, viral, or fungal infections. Viral meningitis causes between 26,000 and 42,000 hospitalizations in the US annually, primarily in children aged 5 to 10 and newborns under 1 year (Wright et al., 2019).

The majority of meningitis cases in the US are brought on by viral infections (Peltola, 2001). However, it can also be caused by fungi, bacteria, and parasites. Some cases of meningitis heal on their own in few weeks. However, other cases may be fatal and require immediate antibiotic care. Younger children may not show signs of meningeal irritation, but viral meningitis usually begins as an initial onset of fever, headache, photophobia, neck stiffness, and frequently nausea and vomiting (Enache-Leonte et al., 2023).

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Viral meningitis is prevalent throughout the year in tropical and subtropical regions, although it is most prevalent in temperate regions during the summer and fall (Wright et al., 2019). With an estimated 3% to 18% of juvenile meningitis being bacterial in origin, viral meningitis is more common than bacterial meningitis in nations with high vaccination rates (Sadarangani et al., 2015). Bacterial meningitis cases have dramatically declined as a result of vaccinations against Haemophilus influenza type B, Streptococcus pneumoniae, and Neisseria meningitidis (Mount and Boyle, 2017). Enteroviruses are the most common cause of viral meningitis across all age groups (Coxsackie or Echovirus groups); children are also frequently infected with parechoviruses. Herpes simplex virus (HSV) 1 and 2, varicella-zoster virus (VZV), cytomegalovirus, Epstein-Barr virus, and human herpesvirus 6 are among the herpes viruses that can cause meningitis. Adenovirus, influenza, parainfluenza, mumps, and the lymphocytic choriomeningitis virus (LCMV) are additional viral culprits (Mijovic and Sadarangani, 2019). The bloodstream, retrograde spread from nerve endings, and reactivation from a dormant condition inside the nervous system are some of the ways viruses can get to the meninges (Enache-Leonte et al., 2023).

Meningitis is caused by an inflammatory reaction that occurs when a virus enters the central nervous system (CNS) and travels through the subarachnoid space (Rohani et al., 2023). Age and immunological state might have an impact on the clinical manifestations of viral meningitis (Irani, 2008). In addition to having systemic involvement, such as hepatic necrosis, myocarditis, necrotizing enterocolitis, convulsions, or focal neurologic abnormalities, neonates with enteroviral meningitis may show similarly to those with bacterial sepsis (Nick Day, 2022). Furthermore, a number of illnesses, including malignancy, subarachnoid hemorrhage, and chemical irritation, can cause meningitis (Mintegi et al., 2020). Despite the high reported prevalence in newborns and children, meningitis can also occur in healthy older children and teenagers. Even though more potent antibacterial drugs are being developed annually, bacterial meningitis still has a significant fatality rate of 2% to 30% (Spiliopoulou et al., 2023). Ninety percent of pediatric cases of bacterial meningitis are caused by Streptococcus pneumoniae, Haemophilus influenzae, and Neisseria meningitidis, the three most common organisms that cause the illness worldwide (Berangi et al., 2019).

The current study focuses on evaluating the risk factors for meningitis across various age groups at Diyala Hospital besides examining how demographic characteristics relate to these risk factors.

2. Method

A retrospective, cross-sectional design study was conducted from 1st October 2023 until 1st of March 2024 to complete the study. The place of study was done in 2 hospitals (Baquba Teaching Hospital, Al Muqdadya Teaching Hospital) in Diyala Governorate. The inclusion criteria comprise all parents who have children with Meningitis disease. The exclusion criteria were that all children had any disease except those that had meningitis. Data collected through direct interview with the subject under study using the following combinations of search terms: demographic variables, risk factors, symptoms of meningitis, causes of meningitis Otherwise, confidentiality was guaranteed for each participant. A purposive (non-probability) sample of 118 patients (subjects) was recruited. The data collection has been achieved manually through self-administered paper copies of the questionnaire that were given to the participants by the research team. Data were analyzed through the application of descriptive and inferential statistical approaches by using IBM-Statistical Package for Social Science (SPSS) version 26.0.

3. Results

Of the 118 cases involved in the present study, nearly 32% were aged 5–9 years. The major cases were male 56.8%; live in urban areas 58.5%; their parents get primary education 41.5% and 39% consequently. A seventy-eight percent with a middle economic level. As regard the number of persons at home, the mean is 8.02 ± 2.858 as demonstrated in Table 1.

Risk factors for meningitis involve several variables. 39.8% of children receive artificial breastfeeding, 22.9% receive breastfeeding, while the remaining get both of them. A regular dose of a vaccine is gotten by 62.7% of children. History of previous upper respiratory tract infection detected in more than half of children involved in the current study (54.2%). Winter is considered the major season where the children get meningitis (108) 91.5%. Most of the cases involved were injured at 1–6 years (55.9%). Table 2 provides the collected data of risk factors.

The highest percentages had fever 84.7% more than any other symptoms, followed by headache 72%, vomiting 61.9%, and poor nutrition 58.5%. Other symptoms include nervous convulsive disorder,

Table 1. Demographic variables.

Demographic variables	N	%
Age Group		
>One year	32	26.9
1–4 years	34	28.6
5–9 years	38	31.9
10–14 years	15	12.6
Gender		
Male	67	56.8
Female	51	43.2
Residency		
Rural	49	41.5
Urban	69	58.5
Mother's education		
Not read and write	18	15.3
read and write	15	12.7
Primary	49	41.5
Intermediate	13	11.0
Secondary	7	5.9
College	16	13.6
Father's education		
Not read and write	10	8.5
read and write	4	3.4
Primary	46	39.0
Intermediate	22	18.6
Secondary	19	16.1
College	17	14.4
No. of person in home	Mean = 8.02 (SD = 2.858)	
No. of rooms in home	Mean = 3.41 (SD = 1.446)	
Economic level		
Weak	15	12.7
Middle	93	78.8
Good	10	8.5
Raising animals indoors		
Yes	44	37.3
No	74	62.7

Table 2. Risk factors.

Variables	No.	%
Breastfeeding type during 1st year		
Breastfeeding	27	22.9
Artificial	47	39.8
Mixed	44	37.3
Presence of passive smoker		
Yes	61	51.7
No	57	48.3
Drinking water		
Tape water	4	3.4
Filtered	113	95.8
Other	1	.8
Receiving vaccinations regularly		
Yes	74	62.7
No	44	37.3
The child gets a cold or runny nose several times a year		
Yes	87	73.7
No	31	26.3
History of previous upper respiratory tract infection		
Yes	64	54.2
No	54	45.8
History of injury or external trauma to the head		
Yes	20	16.9
No	98	83.1
Having a family history of meningitis		
Yes	28	23.7
No	90	76.3
Frequent use of antibiotics before infection		
Yes	74	62.7
No	44	37.3
Time when the child get meningitis		
Summer	1	.8
Winter	108	91.5
Spring	0	.0
Autumn	9	7.6
Mean = 5.81 (SD = 5.125)		
Age when the child injured		
1–6 years	66	55.9
7–12 years	52	44.1

neurological-motor symptoms; stiff neck, and skin rash at 39.8%, 35.6%, 33.1%, and 24.6%, respectively; as shown in Table 3.

Referring to the cerebrospinal fluid test, a majority of cases 94.1% had a positive test whereas 5.9% were negative.as elucidated in Fig. 1.

Fig. 2 elaborates the percentages of the main three causes of meningitis. Specifically, Fig. 2 shows that 56.8% of infections are caused by viruses, 29.7% by bacteria, and the others due to several causes. Statistically, there is a significant association of CSF results with frequent use of antibiotics before infection at p-value 0.054 as depicted in Table 4. On the other hand, there is no significant association with other risk factors such as raising animals indoors, type of breastfeeding during the first year of life, presence of passive smokers, the child getting a cold or runny nose several times a year, history of previous upper respiratory tract infection, having a family history of meningitis, history of injury or external trauma to the head (p-value > 0.05).

Table 3. Symptoms of meningitis.

	Yes		No	
Symptoms of meningitis	No.	%	No.	%
Fever	100	84.7	18	15.3
Breastfeeding or poor nutrition	69	58.5	49	41.5
Nervous convulsive disorder	47	39.8	71	60.2
Vomiting	73	61.9	45	38.1
Swollen fontanel	24	20.3	94	79.7
Headache	85	72.0	33	28.0
Stiff neck	39	33.1	79	66.9
Neurological-motor symptoms	42	35.6	76	64.4
Skin Rash	29	24.6	89	75.4

4. Discussion

The findings of the current study indicated that nearly 32% were aged between 5 to 9 years. The major cases were male 56.8%; live in urban areas 58.5%; their fathers and mothers get primary education of

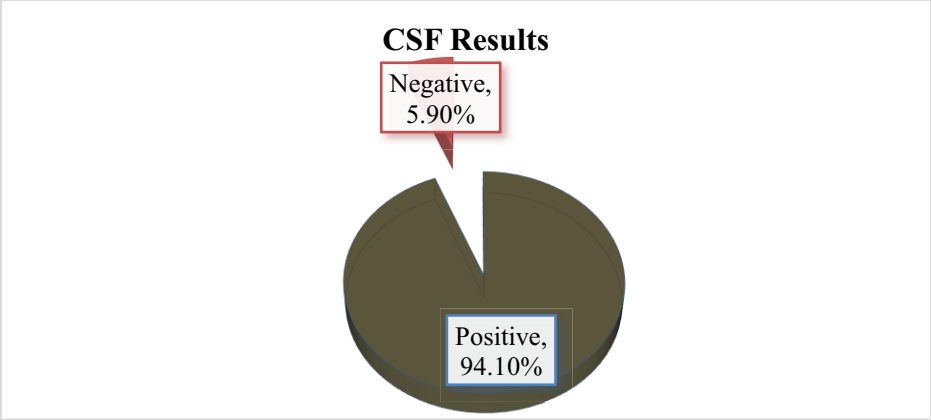

Fig. 1. Results of cerebrospinal fluid test.

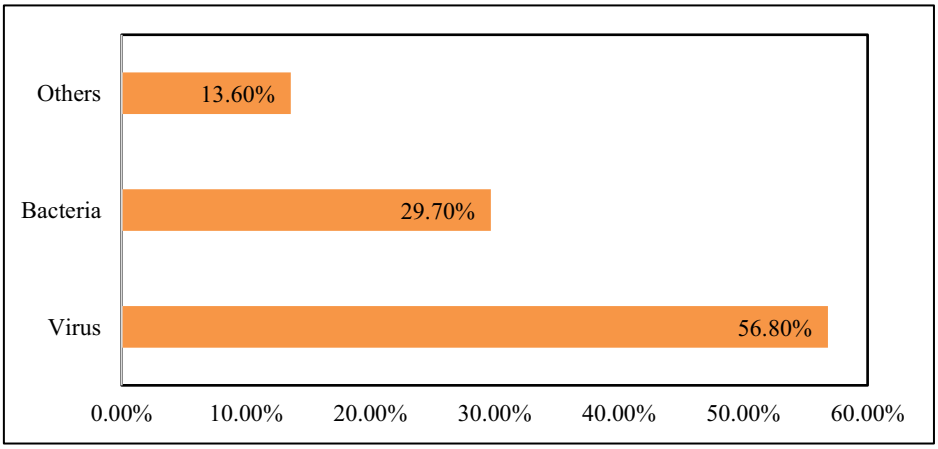

Fig. 2. Causes of meningitis.

41.5% and 39%, respectively. 78% have a middle economic level. The mean number of persons at home is 8.02 ± 2.858. In comparison to some neighboring countries, these are similar to what had been reported in several European countries and the Middle East, like Egypt, Oman, and the United Arab Emirates. Furthermore, winter is considered as the major season where the children get meningitis (108) 91.5%. However, conducted a study and found that the infection is seasonal in temperate climates peaking in the summer and fall—but high all year round in tropical and subtropical climates (Sawyer and Rotbart, 2004).

According to the current results, the highest percentages had fever 84.7% more than any other symptoms, followed by headache 72%. This is in a comparison to the results of Kroopnick et al. (2021) that demonstrated the enteroviral meningitis causes of a significant morbidity, with moderate or high fever despite antipyretics and several days of excruciating headaches that call for the use of opiate analgesia.

The current study also indicated that 51.7% of patients are passive smoker. This is in line with the findings of Imrey, Jackson, and Clin Microbiol (1995 Dec) in the United States, children who were exposed to smoking had a higher incidence of meningitis than children who were not exposed to smoking. The reason for this is that passive smokers have more germs in their throats and nasal passages.

The type of feeding during the first year of life has also been investigated in the current study and showed that 39.8% was artificial. Igidbashian et al. (2020) demonstrated a decrease incidence of meningitis in breast-feeding babies in India.

About 54.2% of the study sample had a history of previous upper respiratory tract infection. In this regard, other studies also highlighted recent upper respiratory tract infection as a vital risk factor for meningitis, like in the USA (Steffen, 2010). This can be clarified by the route of entrance of microorganisms to the brain, as one important route is through

Table 4. Risk factors.

	CSF results				
	Positive		Negative		
Risk factors	No.	%	No.	%	P - value
Raising animals indoors					
Yes	42	37.8	2	28.6	0.623
No	69	62.2	5	71.4	
Type of breastfeeding during first year of life					
Natural	25	22.5	2	28.6	0.348
Artificial	46	41.4	1	14.3	
Mixed	40	36.0	4	57.1	
Presence of passive smokers					
Yes	57	51.4	4	57.1	0.766
No	54	48.6	3	42.9	
Receiving vaccinations regularly					
Yes	70	63.1	4	57.1	0.753
No	41	36.9	3	42.9	
The child gets a cold or runny nose several times a year					
Yes	82	73.9	5	71.4	0.887
No	29	26.1	2	28.6	
History of previous upper respiratory tract infection					
Yes	61	55.0	3	42.9	0.533
No	50	45.0	4	57.1	
History of injury or external trauma to the head					
Yes	17	15.3	3	42.9	0.060
No	94	84.7	4	57.1	
Having a family history of meningitis					
Yes	28	25.2	0	0.0	0.128
No	83	74.8	7	100.0	
Frequent use of antibiotics before infection					
Yes	72	64.9	2	28.6	0.054*
No	39	35.1	5	71.4	

otitis media, mastoiditis, sinusitis, and pneumonia (Bineshfar et al., 2022).

5. Conclusion

The current study emphasized on appraising the risk factors for meningitis along different age groups at Diyala Hospital besides investigating how demographic characteristics relate to these risk factors. The results presented that over half of infections were caused by viruses, about one third by bacteria, and others due to other causes. Also, more than one-third of infected children receive artificial breastfeeding. The highest percentages had fever, headache, vomiting, and poor nutrition. Referring to the obtained results, it can be said that meningococcal cases and outbreaks can be prevented through vaccination, which has been available for over 50 years. Licensed vaccines are serogroup-specific and offer variable durations of protection. It is suggested to treat upper respiratory tract infections, such as sinusitis and otitis media, at the appointed time to mitigate the risk of developed meningitis.

Conflicts of interest

There are no conflicts of interest related to this work.

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