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Original article

Epidemiological Study of Meningitis at Fayoum Fever Hospital

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Abstract:

Background: Meningitis is a critical infectious disease with various clinical presentations. This study aimed to study the demographic, clinico-etiological and laboratory characteristics of patients with acute meningitis in Alfayoum Fever Hospital. **Methods:** This cohort study encompassed 42 patients with suspected acute meningitis. A retrospective approach was employed to review patient records. Detailed clinical and laboratory investigations, including CSF analysis and radiological assessments, were conducted. Treatment regimens were determined to individual patient needs. **Results:** The study included a diverse range of patients, with ages ranging from 2 months to 72 years. Common clinical symptoms included fever (92.9%), headache (92.9%), irritability (69.0%), and vomiting (54.8%). CSF appearance was predominantly clear in 59.5% patients and turbid in 40.5%. Laboratory findings showed elevated CRP and low CSF/serum glucose ratio in 9 patients. The meningitic patients with no organisms in all CSF examinations were 73.8%, Streptococcus pneumoniae in 21.4% of patients, Staphylococcus aureus in 2.3% of patients and Haemophylus influenza in 2.3% of patients. Outcomes varied, with 26 patients discharged, 7 referred to a tertiary center, 6 were discharged up on request and 3 unfortunate deaths. **Conclusion:** In conclusion, this study at Fayoum Fever Hospital highlights the universal susceptibility to acute meningitis and underscores the importance of ongoing vigilance in diagnosis and management. Diverse patients' residences, seasonal variations, common symptoms, and variable CSF characteristics underscore the complexity of the disease. Varied treatment regimens call for personalized approaches, while a 7.1% mortality rate emphasizes the need for early intervention and comprehensive healthcare strategies.n

Keywords: Epidemiological; Meningitis; Fayoum; Fever Hospital.

Introduction

Despite break throughs in diagnosis, treatment, and vaccination, in 2015, there were 8.7 million reported cases of meningitis worldwide, with 379,000 subsequent deaths [1].

The highest incidence of meningitis worldwide is in an area of sub-Saharan Africa known as "the meningitis belt" stretching from Ethiopia to Senegal [2].

The most common symptoms are fever, headache, and neck stiffness. Other symptoms include confusion or altered consciousness, vomiting, and an inability to tolerate light or loud noises [3].

Risk factors for meningitis include: Chronic medical disorders, extremes of age, under vaccination, immunosuppressed states, living in crowded conditions, travel to endemic areas, presence of ventriculoperitoneal (VP) shunt, bacterial endocarditis, malignancy, IV drug use, sickle cell anemia, splenectomy [4].

Meningitis can be caused by infectious and non-infectious processes (autoimmune disorders, cancer/paraneoplastic syndromes, drug reactions) [4].

The infectious etiologic agents of meningitis include bacteria, viruses, fungi, and less commonly parasites [5].

Most common bacterial causes of meningitis are *Streptococcus pneumoniae*, group B *Streptococcus*, *Neisseria meningitides*, *Haemophilus influenza* and *Listeria monocytogenes* [6].

The most common viral agents of meningitis are non-polio enteroviruses (group B coxsackievirus and echovirus). Other viral causes: mumps, Parechovirus, Herpesviruses (including Epstein Barr virus, Herpes simplex virus, and Varicella-zoster virus), measles, influenza, and arboviruses [7].

Fungal meningitis typically is associated with an immunocompromised host (HIV/AIDS, chronic corticosteroid therapy, and patients with cancer) [8].

Fungi causing meningitis include: Cryptococcus neoformans, Coccidioides immitis, Aspergillus, Candida and Mucormycosis [4].

Meningitis is diagnosed through cerebrospinal fluid (CSF) analysis, which includes white blood cell count, glucose, protein, culture, and in some cases, polymerase chain reaction (PCR). CSF is obtained via a lumbar puncture (LP), and the opening pressure can be measured [9].

The aim of the work was to study the demographic, clinico-etiological and laboratory characteristics of patients with acute meningitis at Fayoum Fever Hospital.

Patients and methods

This was a descriptive retrospective study conducted on 42 patients suspected of acute meningitis. These patients attended AlFayoum Fever Hospital over a two-year period from January 2021 to December 2022.

The study employed retrospective approach to review patients with suspected acute meningitis at AlFayoum Fever Hospital from January 2021 to December 2022.

The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, Hepatology, Gastroenterology and Infectious Diseases Department, Benha University {M.S.42.12.2021}.

It was an online decision sent by REC of MOH after reviewing the data, and it was by acceptance.

Inclusion criteria were both sexes, all age groups age ranged from 2 months to72 years and patients with high onset fever, vomiting, neck stiffness, headache, convulsions, and/or other presenting with clinical picture of meningitis.

Exclusion criteria were files of patients diagnosed as meningitis with incomplete data.

All studied cases were subjected to the following:

(I). Detailed history including personal history, history of present illness, history of meningitis, drug intake and head trauma, contact with a case of meningitis. History of comorbidities, history of other neurological diseases e. Past history of any medical condition or previous hospital admission.

(II). Complete clinical examination: General examination for vital signs including pulse, temperature, blood pressure and respiratory rate. Examination of skin for presence of petechial eruptions or rash. Complete neurological examination with stress on level of consciousness, convulsions, signs of meningeal irritation as (Neck rigidity, kerning's sign, Brudhzinski's sign. Other systems review (Chest, CVS, and abdomen).

(III): Laboratory investigations: Complete blood count, C - reactive protein (CRP). (mg/dl), random blood Sugar (RBS), Liver panel test and kidney function tests

IV: CSF analysis:

CSF was obtained at the time of lumbar puncture under complete aseptic conditions.

A diagnostic lumbar puncture (LP) with CSF sampling: Done on the first day of admission on an urgent base (within 2 hours) under local anesthesia by putting the patient on his side then inserting a needle into the dural sac to collect the CSF. CSF was examined for the opening pressure, gross appearance. A concern regarding LP is that herniation can sometimes occur in meningitis as the consequence of severe cerebral edema or acute hydrocephalus or possible mass lesion. However, a screening head computerized tomography (CT) is not necessary for the majority of patients [(10)]. Patients with clinical risk factors for raised intracerebral pressure with subsequent risk for cerebral herniation had a CT scan of the head prior to LP based upon the 2004 Infectious Diseases Society of America (IDSA) guidelines for the management of meningitis [(11)].

CSF examination including A) Physical examination: Color, aspect and opening pressure. B) Chemical examination: Protein and glucose levels. C) Cell count: Total and differential leukocytic count. D) Gram's stain and culture (microbiological investigation) E)CSF PCR for viruses, bacteria & tuberculosis if available.

(V)Radiological investigations: CT brain if needed and MRI brain if needed.

Statistical analysis

Data management and analysis was performed using Statistical Package for Social Sciences (SPSS) vs. 23. Quantitative variables were presented as mean and standard deviation (SD) and compared between the two groups utilizing unpaired Student's t- test. Categorical data was presented as numbers and percentages. A two tailed P value < 0.05 was considered statistically significant.

Results

The results of this study included different age groups, nearly half of cases were in school age (5-18 years) (45.2%), and followed by pre-school age and adult age group. The mean ± SD of age was 11.1 ± 14.7 years and ranged from 2 months to 72 years. Regarding sex, 18(42.9%) were female, 24(57.1%) were males. The Male: female ratio equals 1.3:1. **(Table 1.Figure 1A).**

According to residence, showed that majority of cases were inhabitants of rural area 71.4%. **Figure 1B)**. Regarding symptoms of the studied patients, most patients complained of fever (92.9%) and headache (92.9%), followed by irritability (69.0%), vomiting (54.8%), altered consciousness (54.8%), neck rigidity (14.3%) and seizures (14.3%). **Figure 2A)**. Distribution in relation to months of admission, 1(2.4%)of patients were admitted in January, 6(14.3%) of patients were admitted in February, 6(14.3%) of patients were admitted in March, 5(11.9%)

of patients admitted in April, No patients were admitted in May, 2(4.8%) of patients were admitted in June, 3(7.1%) of patients were admitted in July, 6(14.3%) of patients were admitted in August, 2 (4.8%) of patients were admitted in September, 6(14.3%) of patients were admitted in October, 4(9.5%) of patients were admitted in November, 1(2.4%) of patients were admitted in December. **Figure 2B.**

CRP was normal in 23.8% patients and elevated in 76.2% patients. RBS was high in 59.5% patients and normal in 40.5% patients. ALT was normal in 92.9% patients and high in 7.1% patients. AST was high 33.3% patients. Kidney functions were elevated in 16.7% patients. TLC were high in 28.6% patients and normal in 52.4% patients. Platelets were normal in 47.6% patients and low in 52.4% patients. 52.4% patients were anemic. **Table 2.**

The CSF/serum glucose ratio was low in 21.4%patients and normal in 47.6% patients. Protein in CFS was high in 88.1% patients and normal in9.5%patients. Neutrophils in CFS were high in all patients. Lymphocytes in CFS were elevated in 31.0% patients and low in 9.5%patients.**Table 3**

Regarding final diagnosis the meningitic patients with no organisms in all CSF examinations were 73.8%, *Strept pneumoniae* in 21.4% of patients, *Staph. aureus* in 2.3% of patients and *Haemophylus influenza* in 2.3% of patients.

As regards treatment, 11(26.1%) of patients received ceftriaxone+ Ampicillin/Subactam, 29(69.1%) of patients received Ceftriaxone+ Ampicillin/Subactam + Acyclovir 1(2.4%) received Ceftriaxone+ Ampicillin/Subactam + Acyclovir + Vancomycin and 1(2.4%) received Ceftriaxone+ Ampicillin/Subactam + Vancomycin. **Table 4**

Regarding outcomes, 3 (7.1%) of patients died, 26(61.9%) of patients were discharged, 7(16.7%) were referred to tertiary hospital, 6(14.3%) were discharged up on request. **Figure 3.**

Table 1: Age and sex distribution of the studied patients

	N	%
Preschool (0-4 years)	17	40.5
School (5-18 years)	19	45.2
Adult (more than 18 years)	6	14.3
Sex distribution		
female	18	42.9%
male	24	57.1%

Table 2: Laboratory investigations of the studied patients:

	Above normal		**Normal**	
	N	**%**	**N**	**%**
CRP (mg/L)	32	76.2%	10	23.8%
RBS (mg/dL)	25	59.5%	17	40.5%
AST (IU/ml)	14	33.3%	28	66.7%
ALT (IU/ml)	3	7.1%	39	92.9%
Creatinine (mg/dl)	7	16.7%	35	83.3%

Blood profile

	Below normal		**Normal**		**Above normal**	
	N	%	N	%	N	%
Plat (c/mm³)	22	52.4%	20	47.6%	0	0.0%
TLC(c/mm³)	8	19.0%	22	52.4%	12	28.6%
Hb (gm/dl)	22	52.4%	20	47.6%	0	0.0%

Table 3: Chemical and microscopic examination of CSF.

	Below normal		Normal		Above normal	
	N	%	N	%	N	%
CSF/serum Glucose (15-40) (mg/dl)	**9**	**21.4%**	**20**	**47.6%**	**13**	**31.0%**
CSF Protein (50-80) (mg/l)	**1**	**2.4%**	**4**	**9.5%**	**37**	**88.1%**
CSF Neutrophils (0-6%) (c/mm³)	**0**	**0.0%**	**0**	**0.0%**	**42**	**100.0%**
CSF Lymphocytes (40-80%) (c/mm³)	**4**	**9.5%**	**25**	**59.5%**	**13**	**31.0%**

Table 4: Merged Diagnosis and Treatment.

Result	Number	%
Final diagnosis		
No organism	**31**	**73.8**
Strept. Pneumonia	**9**	**21.4**
Staph. Aureus	**1**	**2.3**
H influenza B	**1**	**2.3**
Treatment		
Ceftriaxone+ Ampicillin/Sulbactam	**11**	**26.1%**
Ceftriaxone+ Ampicillin/Sulbactam + Acyclovir	**29**	**69.1%**
Ceftriaxone+ Ampicillin/Sulbactam + Acyclovir + Vancomycin	**1**	**2.4%**
Ceftriaxone+ Ampicillin/Sulbactam + Vancomycin	**1**	**2.4%**

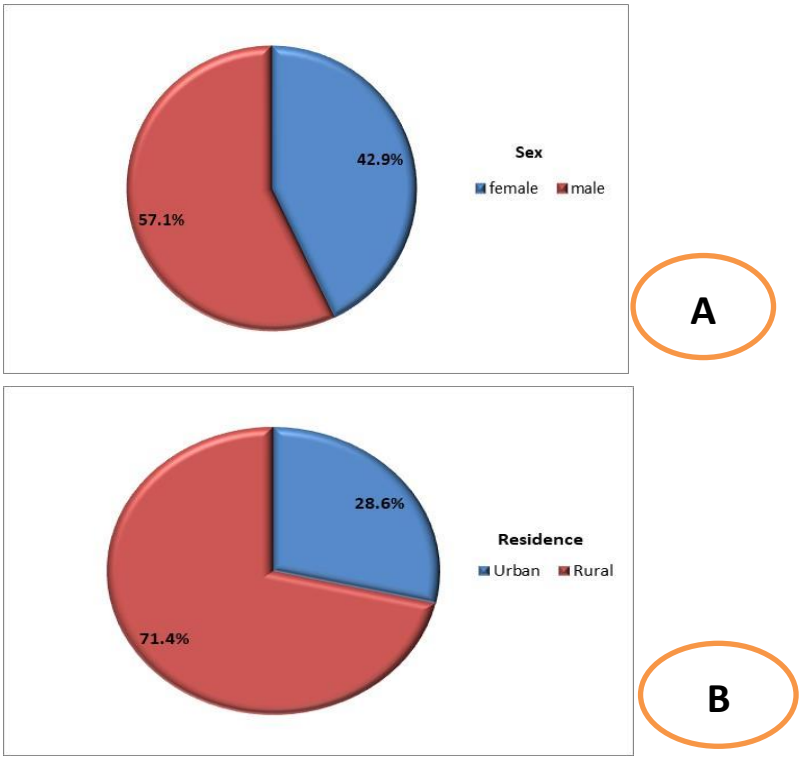

Figure 1: Sex Distribution and Residence of the Studied Patients.

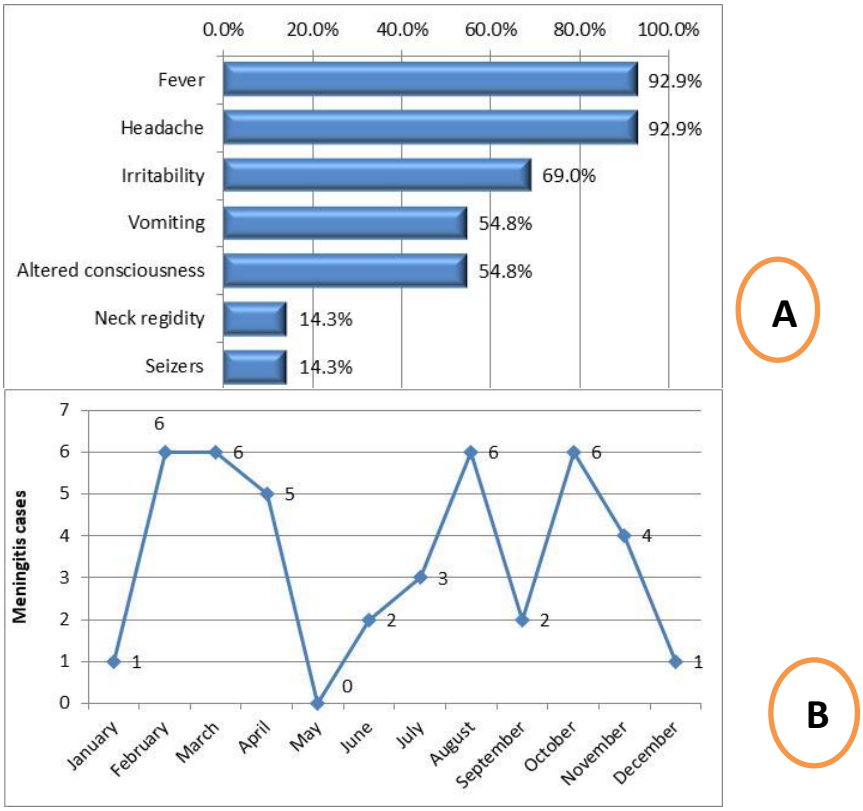

Figure 2: Symptoms of Meningitis Cases and Distribution by Month of Admission.

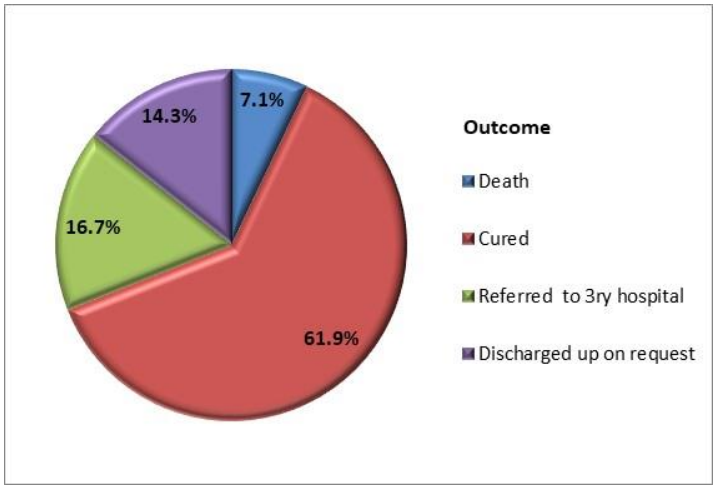

Figure 3: Outcomes in the studied group.

Discussion

Regarding patients' demographics, our findings are in agreement with another study [12] conducted on a total of 24,679 patients with clinical diagnosis of acute meningitis who were enrolled from 144 sentinel hospitals. Among those patients, 4,225 were excluded due to incomplete data, and the remaining 20,454 patients were included for further analysis. It was observed that 7,666 (37.48%) were children <5 years old, 6,506 (31.81%) cases were 5–17 years old, 5,123 (25.05%) were 18–59 years old and 1,159 (5.67%) were ≥60 years old.

The microbiological records of CSF and blood cultures and the medical records of all patients whom were diagnosed as acute bacterial meningitis, were reviewed[13].

There were 274 (65.6%) men and 144 (34.5%) women, aged between 15 and 90 years (mean± SD 45.5±17.2 years).

In consistent with our results, a study [14] included 402 patients with bacterial meningitis. Of these, 231 patients (57.5%) were male, and 169 patients (42.0%) were female with a male to female ratio of 1.37:1.Most patients (330 cases, 82.1%) were ≤2 yr of age and 125 (31.2%) cases were neonates.

Additionally, a multicenter prospective study, 285 viral meningitis patients and 261 viral encephalitis patients were enrolled[15]. This study aimed to characterize the etiology and prognosis of acute viral encephalitis and meningitis in Chinese children. They documented that 197 (69.12%) were males and 88 (30.87%) were females. The male to female ratio of viral meningitis was 1.97:1.

Regarding the residence, a study [16] concluded that higher proportion of patients from rural locations after studying the etiological agents and other associated epidemiological factors contributing to meningitis occurrence and prognosis.

Regarding the distribution in relation to months of admission, a study [15] concluded that the seasonal distribution of viral and meningitis, 10(3.5%)of patients were admitted in January of two years (period of the study) 5(1.75%) patients were admitted in February, 20(7.02%) of patients were admitted in March, about 12(4.2%) of patients admitted in April, about 40(14.04%) of patients were admitted in May, about 38(13.33%) of patients were admitted in June, about 46(16.14%) of patients were admitted in July, about 28 (9.82%) of patients were admitted in August, 35 (12.28%) of patients were admitted in September, 20(7.02%) of patients were admitted in October, 10 (3.5%) of patients were admitted in November, 20(7.02%) of patients were admitted in December.

Regarding symptoms, parallel to our study, a research had [17] demonstrated that fever was a constant reason for consultation[15]. Fever was associated with vomiting in 15 cases (50%) and convulsions in 6 cases (20%). Initial examination showed somnolence (40%), axial hypotonia (44%), bulging fontanel (55%), neck stiffness (29%), and signs of kerning and Brudzinski (7 %).

A study [18] diagnosed a total of 477 children with bacterial meningitis during the period 1975-2010. Their study showed that the most common symptoms during the period 1995-2010 were fever (92%), vomiting (67%), nuchal rigidity (60%), and rashes/petechiae (51%).

In their study, Matulyte, et al., in 2020 [19] aimed to identify the distribution of etiological agents and their relationship with clinical characteristics, treatment and outcomes in this cohort of patients with CABM community-acquired bacterial meningitis. Their retrospective chart review analyzed the causative microorganisms, clinical characteristics, laboratory findings, treatment and outcomes of 159 adults with (CABM). Headache represented 134 (84.3%), Fever ≥38 °C presented in 109 (68.6 %), nausea presented in 88 (55.3%), vertigo presented in 43 (27.0%), seizures presented in 6 (3.8%), hemorrhagic rash 67 (42.1%), neck stiffness presented in 128 (81.0%) and clinical triad presented in 94 (59.1%).

Furthermore, a study [20] done on 90 patients of age 18 years and older who were treated as confirmed or possible cases of acute bacterial meningitis. They noted that the duration of illness before presentation was 4.5 days (SD = 3.6). 88 (97.8%) had headache, 87 (96.7%) had fever, 76 (84.4%) had nuchal rigidity, 70 (77.8%) had vomiting, 50 (55.6%) impaired consciousness, 35 (38.9%) had photophobia, and 20 (22.2%) had seizure.

Regarding CFS appearance, CSF was clear in 25(59.5%) patients and was turbid in 17(40.5%). Contrary, a study [20] showed that in 56 (65.9%) of the patients, purulent CSF was collected of which 52 were visibly turbid. [21] Identify the cause of bacterial meningitis in children >1 month

of age and <5 years of age. They reported that most of the CSF examinations showed cloudy. The most likely explanation for the controversies reported was the different range of age in the studies and the ethnic considerations.

The CSF/serum glucose ratio was low in 21.4%patients and normal in 47.6% patients. Protein in CFS was high in 88.1% patients and normal in9.5%patients. Neutrophils in CFS were high in all patients. Lymphocytes in CFS were elevated in 31.0% patients and low in 9.5%patients.

A study showed significantly higher CSF leukocyte count with marked increase in the polymorphoneuclear leukocyte count in the bacterial meningitis group compared to the viral meningitis group (P<0.001). It also showed increased CSF proteins and decreased CSF sugar in bacterial meningitis group than viral meningitis group [22].

Study [23] confirmed that the most frequent species were Streptococcus pneumoniae and Haemophilus influenzae followed by Neisseria meningitidis with respectively 43%, 40%, and 6% of cases.

As regards treatment, a study [18] proved that all children admitted to a hospital were treated with effective antibiotics; 38% received pencillins/ aminopenicillins and 62% received cephalosporins, third generation in most cases. Other drugs were rarely used (3 patients). Twenty-four (17%) children were treated with steroids; 75% received dexamethasone, 13% hydrocortisone, and 4% budesonide. [24] identified six thousand six hundred sixty-five patients with meningitis or encephalitis. They found that antibiotic therapy was frequent (92.2%) with children younger than 1 year of age with the highest rates (97.7%). Antiviral therapy was less common (31.1%).

Regarding outcomes, compatible to our findings, a study [19] observed that among 159 patients with CABM, 150 (94.3%) patients survived, and 9 (5.7%) patients died. Moreover, a study [18] found that the overall 30-day case fatality rate of bacterial meningitis was 4.4% and remained unchanged during the study period.

Conclusion

In conclusion, this epidemiological study conducted at Alfayoum Fever Hospital offers a comprehensive overview of acute meningitis cases spanning a wide demographic spectrum. The findings reveal the universal susceptibility to this serious condition across age groups and genders, showing the need for continued vigilance in its diagnosis and management.

The study's diverse patient origins across different districts and seasonal variations in admissions highlight the importance of regionally adapted surveillance and preventive measures. Clinical manifestations, as evidenced by common symptoms and variable cerebrospinal fluid characteristics, underscore the complex nature of this disease.

The varied treatment regimens employed underline the necessity for personalized therapeutic approaches. Lastly, the study sheds light on the challenges posed by acute meningitis, with a 7.1% mortality rate serving as a stark reminder of the gravity of this condition, reinforcing the importance of early intervention and comprehensive healthcare strategies in its management.

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