International Journal of Science Academic Research
Vol. 03, Issue 10, pp.4539-4546, October, 2022
Available online at http://www.scienceijsar.com

ISSN: 2582-6425

Research Article

MENINGITIS IN CHILDREN OLDER THAN ONE MONTH OF AGE AT BENGHAZI CHILDREN HOSPITAL, 2017- 2018

[1]Monia Emhemed Mohamed Abdulhamed, [2]Zainaeb Elbishari and [3,*]Mohanad Abdulhadi Saleh Lawgali

[1]Department of Pediatric, Faculty of medicine, University of Zawia, Zawia- Libya
[2]MRCPCH UK
[3]Department of Pediatrics, Faculty of Medicine, University of Benghazi, Benghazi, Libya

Received 28th August 2022; **Accepted** 20th September 2022; **Published online** 31st October 2022

Abstract

Aim: This study is designed to analyze the clinical features and diagnosis of meningitis in children older than one month. **Methods:** A retrospective study ,using files of 160 patients diagnosed with meningitis who were admitted at Benghazi Children Hospital during period of two years(1st Jan 2017 to end of December2018) .Data collected were demographic character ,symptoms and signs ,laboratory analysis include blood for ESR,CRP,WBCS , lumber puncture analysis and radiological tests Results : Mean age of cases was 22.8 months(41.9) , and most of cases less than one and half years(63%),male to female ratio was (1.3:1).Meningitis was more common in summer season ,and the most frequent presentation were fever(93%),poor feeding(70%), irritability(66%).However ,signs of meningitis were not present among 70% of cases. Most CSF TLC count (60%) range from 5-100 cells/mm^3, with 75% lymphocyte. 64% of CSF had normal protein and sugar. 93% of CSF cultures showed negative growth. Ultrasound was good and effective method helped in diagnosis of meningitis **Conclusions:** There is no specific symptoms and signs for meningitis ,so this makes the diagnosis a challenging task .Most of CSF culture shows no growth and mortality rate is low (3%). **Recommendations:** Education of mothers about the impact of use antibiotic without prescription from doctors and the benefit of quick transfer of CSF samples to laboratory because most of bacteria can die before evaluation of samples under microscope Improvement of Laboratory services to detect the type of meningitis e.g latex agglutination virology serology and D-glucan. Further study is recommended in this field for evaluation of delayed complication and it is management

Keywords: Meningitis, children, Benghazi, one month older.

INTRODUCTION

Meningitis is an inflammation of the leptomeninges and underlying subarachnoid cerebrospinal fluid .The inflammation may be caused by infection with viruses, bacteria, other micro-organisms, or non-infective causes. Viral meningitis is more common and usually more benign than bacterial meningitis, but all cases of suspected meningitis should be managed as having bacterial meningitis, until proven otherwise. Meningococcal disease is the leading infectious cause of death in early childhood. It presents as bacterial meningitis (15% of cases), septicemia (25%), or as a combination of the two presentations (60%) (1, 2).

Epidemiology

Meningitis is a common infection especially among children and elderly. Viral meningitis is the most common cause of meningitis. However, bacterial meningitis is a serious condition and needs prompt treatment. In the UK, around 2,500 cases of bacterial meningitis every year. Introduction of vaccines against *Meningococcus group c pneumococcus and haemophilus influenzae group b* have led to decrease the incidence of the disease. Bacterial meningitis can lead to serious complications like hearing loss and learning difficulties. So in some hospital multivariable approach like CSF analysis, serum laboratory values, age of the patient and month of presentation is used for confirmation of diagnosis (3, 4, 5, 6).

***Corresponding Author:** *Mohanad Abdulhadi Saleh Lawgali*
Department of Pediatrics, Faculty of Medicine, University of Benghazi, Benghazi, Libya

Causes

The causative organisms of meningitis mainly depend on the age of the patients. For instance, in neonate, the most common cause of meningitis is gram negative organisms. However, in older children, pneumococcus and streptococcus account for the majority of cases. Sometimes the causative organism depends on the general condition of the patients. For example, Streptococcus epidermidis is common among patients with ventriculo-peritoneal shunts, and Cryptococci is prevalent in patients with HIV. Having said that, viral meningitis is the commonest cause of meningitis, and it is a diagnostic dilemma to differentiate from partially treated bacterial meningitis (2, 6).

Clinical presentation of meningitis

The clinical manifestation of meningitis varies, so it makes the diagnosis a challenging task. Most of presentations especially in infants are nonspecific and can be mistaken for other common medical conditions However, there are a number of symptoms and signs make the diagnosis more likely .For instance, fever photophobia, seizure, focal neurological deficits, bulging fontanelle and finally there are three classical signs of meningitis e.g neck stiffness, Kernigs sign and Brudzinskis sign. Viral meningitis is milder illness compared to bacterial meningitis, but sometimes the distinction between two conditions can be very difficult.[2]A study of children aged 16 years or younger with meningococcal disease found that classical signs such as haemorrhagic rash, meningism and impaired consciousness did not tend to appear until after 13 to 22 hours. However, more nonspecific features

such as leg pain, cold hands and feet and abnormal skin color appeared much earlier with a median onset of 7-12 hours. These earlier features are thus very important in early diagnosis and therefore earlier initiation of potentially life-saving treatment (4).

Investigation

Lumber puncture (LP) is performed immediately provided there are no signs of raised intracranial pressure (reduced consciousness, very bad headache, frequent fits) or focal neurology. If there is any doubt of impending brain herniation then a CT scan is usually performed first. Samples of cerebrospinal fluid (CSF) are usually sent for Gram stain, cytology, virology, glucose, protein, culture, Latex agglutination may be performed to detect the presence of bacterial antigens in the CSF. It is quick method of identifying the antigen before the culture is ready even though, it may remain positive even after initiation of antibiotics. CSF polymerase chain reaction (PCR) is effective method if it is available CSF may be normal in the early stages of meningitis so the LP is usually repeated if symptoms and signs persist. In addition to lumber puncture, blood investigation for CBC, ESR, CRP, blood culture, coagulation profile and PCR are helpful for the diagnosis. Chest x- ray if suspected lung abscess, CT scan is usually reserved for those with specific adverse clinical features or when an underlying cause such as mastoiditis is suspected MRI can be extremely useful for detecting and monitoring the complications of meningitis (5,6).

Management

Includes supportive treatment (including fluids, antipyretics, antiemetics), treatment of the causative organism and complications, e.g seizures, raised intracranial pressure. The general principles of management for all viral meningitis include supportive therapy, eg analgesia, antipyretics, nutritional support and hydration. Enteroviral meningitis: usually self-limiting and no specific therapy is required unless there is hypogammaglobulinaemia (immunoglobulins required). Aciclovir is considered beneficial in treating herpetic viral infections but only if given very early in the course of the infection, and evidence for benefit is limited. Intravenous aciclovir should be started immediately if there is any suspicion of herpes simplex encephalitis. Ganciclovir is effective for cytomegalovirus (CMV) infections but, because of toxicity, should be reserved for severe cases with positive CMV culture or when a congenital infection or an AIDS-related infection is likely (7). Intramuscular or intravenous benzylpenicillin should be given before urgent transfer to hospital only if there is suspected meningococcal septicaemia with a non-blanching rash. Benzylpenicillin should not be given if there is a history of anaphylaxis associated with penicillins or if giving antibiotics will delay urgent transfer to hospital. If urgent transfer to hospital is not possible (eg remote locations or adverse weather conditions), antibiotics should be given to any person with suspected bacterial meningitis (2). Management includes supportive treatment with analgesia, antipyretics, nutritional support and hydration. Do not restrict fluids unless there is evidence of raised intracranial pressure or increased antidiuretic hormone (ADH) secretion .The choice of antibiotics and the duration of therapy should be guided by the microbiological diagnosis but initial 'blind' antibiotic therapy must be started immediately. The National Institute for Health and Clinical Excellence recommendation to children >3 months old is for dexamethasone to be given for suspected or confirmed bacterial meningitis as soon as possible. Corticosteroids given to patients of all ages with bacterial meningitis have been shown to reduce hearing loss and neurological sequelae significantly, but there is no evidence that they reduce overall mortality. Choice of antibiotic is usually determined by local guidelines and close liaison with microbiologist (2, 8).

Complications

Immediate: septic shock, including disseminated intravascular coagulation, coma with loss of protective airway reflexes, seizures (30-40% of children, 20-30% of adults), cerebral oedema and raised intracranial pressure, septic arthritis, pericardial effusion, and haemolyticanaemia (*H. influenzae*).

Subdural effusions: reported in 40% of children aged 1-18 months with bacterial meningitis. Risk factors include young age, rapid onset of illness, low peripheral white cell count and high CSF protein. Syndrome of inappropriate antidiuretic hormone secretion (SIADH).Seizures: occur more commonly during the acute stage of the disease**.**

Delayed: decreased hearing or deafness, other cranial nerve dysfunction, multiple seizures, focal paralysis, subdural effusions, hydrocephalus, intellectual deficits, ataxia, blindness, Waterhouse-Friderichsen syndrome, and peripheral gangrene (8).

Prognosis: Patient with sever neurological impairment on presentation or with extremely rapid onset of illness, even if treated immediately, have 50-90% mortality rate and an even higher rate of morbidity. Vaccines have important role in the control and prevention of bacterial meningitis. Vaccines against *N. meningitidis*, *H. influenzae*, and *S. pneumoniae* are currently available, but the protection afforded by each vaccine is specific to each bacterium and restricted to some of the serogroups orserotypes of each bacterium. For example, vaccines are currently available to prevent Hib infections but not those infections due to other serotypes or unencapsulated organisms (i.e. nontypeable *H. influenzae*).

In addition to establishing a diagnosis, an important role for the laboratory, therefore, is to identify the bacteria and serogroups/serotypes that are causing meningitis in a community. In industrialized countries, routine use of polysaccharide-protein Hib conjugate vaccines for immunization of infants has almost eliminated Hib meningitis and other forms of severe Hib disease. Pneumococcal polysaccharide vaccines have been used to prevent disease in the elderly and in persons with chronic illnesses that may impair their natural immunity to pneumococcal disease. Meningococcal polysaccharide vaccines are generally used in response to epidemics and for the prevention of disease in travelers although other uses are currently under investigation (9, 10). Peumococcal meningitis has higher rate of mortality (21%) and morbidity (15%). Meningococcal disease has a better prognosis when meningitis accompanies the septicaemia than if does not the prognosis for viral meningitis is usually excellent, with complete resolution usually within 10 days (10.11). So the aim of this research is to identify the clinical features and diagnostic facilities of meningitis in children older than one month at Benghazi children Hospital in 2017-2018.

Objectives of the study

- To see the common symptoms and signs of meningitis in children.
- Validation of a diagnosis model for differentiating bacterial from viral meningitis.
- To illustrate the rule of CBC, ESR, CRP, CSF parameters in differentiating between viral and bacterial meningitis.
- To know the most common causative organisms, and the misuse of antibiotic in viral meningitis.

MATERIALS AND METHODS

Every child 28 days to 15 years old admitted at Benghazi Children Hospital during the study periods with a diagnosis of acute meningitis was included. In a retrospective study using files of 160 patients (age ranged from one month to fifteen years), 15 patients referred from another hospital after having been diagnosed. A designation of meningitis was assigned if CSF contained ⩾5 WBC /mm3. Patients were not included if they presented one of the following criteria, neonatal age group, known neurosurgical disease, traumatic lumbar puncture. Patients with missing essential data for the application of every clinical decision rule were secondarily excluded. Data collected from files included demographic features (e.g: age, sex residence, nationality, admission month, admission ward, clinical presentation (e.g:- fever, seizure, poor feeding, vomiting ,diarrhea headache, photophobia, skin rash, Flu like illness), finding in clinical examination (irritability, lethargy, meningeal sign), laboratory test:- Blood for WBCS, ESR, CRP, and blood sugar. CSF samples were subjected to laboratory analysis including cell count, glucoselevel, protein level, differential count using methylene blue, gram stain (For cases with high CSF WBCS),cultured on blood chocolate, macconkey agar and were incubated at $37c^0$ aerobically and read after 48 hours. And the result of Radiological images (USS, CT scan) were taken. As well as treatment received.

Statistical analysis

Data were entered and analyzed using SPSS version 18. Descriptive statistic like mean, minimum, maximum, standard deviation were computed. Results presented as frequency and demonstrated in tables and figures.

Limitations

- The files are very poor in recording.
- Limited number of staff working at statistical department ease the data collection.
- Lake of laboratory investigation for proper diagnosis of the disease.

RESULTS

- From a total of 188 patients admitted with diagnosis of meningitis during the study period. 160 were eligible for our study 18 cases excluded from the study due to CSF were traumatic with more than 5\ul RBCS. Other 10 cases with different neurological problem. 90% admitted in medical side, 10% admitted either in ICU, Isolation ward or Gastroenterology (Tab -1). Diagnosis was made from history, clinical examination, and investigation results.

Demographic characteristic

Residence and nationality

- Majority of children were from Benghazi (77.5%).
- Nearly all cases (97.5%) were Libyan.

(Table-1) show the demographic character.

Table 1. Distribution of patients according to demographic characteristic

Characteristic	Number	%
Residence		
Benghazi	123	77
Outside Benghazi	37	23
Nationality		
Libyan	155	97
Non Libyan	5	3
Admission ward		
Medical	144	90
Others	6	10
Total	160	100

Age

- Their age ranged from one month to 15years. With majority of cases 63% less than 18 months of age.
- Mean age of cases was 22.8 months (SD $\pm$ 41.9 months).

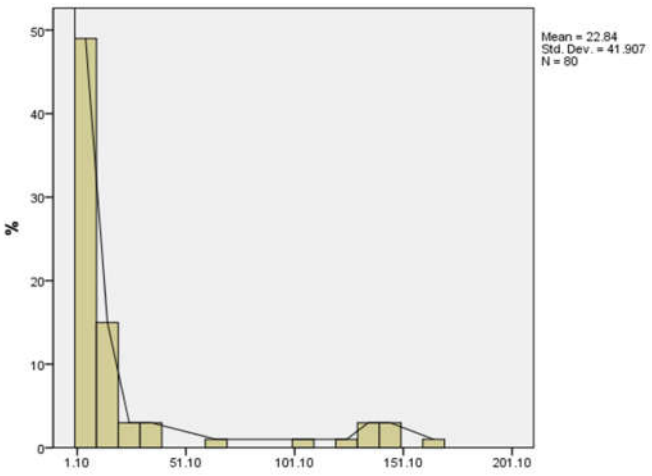

Fig. 1. Illustrate the age of patients included in the study

Gender

- Two third of cases (58%) were males with male to female ratio 1.3:1

Fig- 2 below illustrate the gender of the patients included in the study.

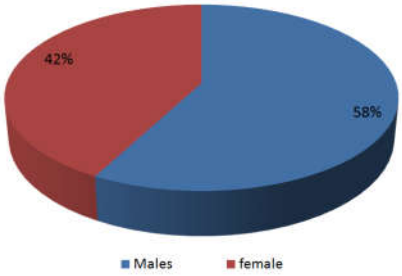

Fig. 2. Distribution of the patients according to gender

Month of admission

We notice that summer time had highest admission rates with peak at August and September followed by October as seen in Table 2. and graph-3.

Table 2. Number of patients according to months of admission

Months	Number	%
January	6	3.7
February	5	3
March	7	4
April	8	5
May	9	5.6
Jun	9	5.6
July	13	8
August	23	14
September	23	14
October	22	13.7
November	17	10.6
December	18	11
Total	160	100

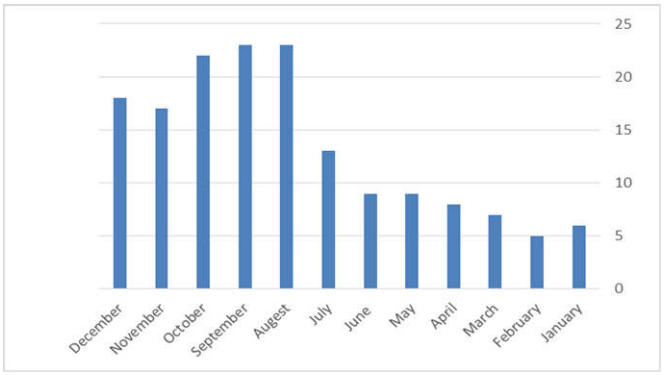

Figure 3. Number of patients according to months of admission

According to presentation

- Fever was more prevalent in meningitis (93%), which ranged from 36 to 40C^0 with means of 38.3± 0.89 C^0. (table2, 3)
- Fever duration ranged from 1-60 days with means 4± 7.5 days.
- More than two third of children (70%), had history of poor feeding.
- Vomiting(41%) and diarrhea(31%) of cases.
- 18% of cases received oral antibiotic before admission.
- One third of cases develop convulsion during their illness with majority of them (60%) get generalized tonic clonic.

Table (3) demonstrate the presentation of case as taken from their history

Table 3. Distribution of patients according to symptoms

Symptoms	Number	%
Fever	148	93
Poor feeding	112	70
Vomiting	66	41
Diarrhea	50	31
Flu like illness & otitis media	66	41
Pneumonia	29	18
Seizer	50	31
Headache	21	13
Photophobia	8	5
UTI	9	6
Skin rash	6	4
Complete vaccination	142	89
Use of oral antibiotic	29	18

Table 4. Distribution of patients according to degree of temperature

Temperature	Number	%
Normal	18	11
Low grad	92	58
High grad	50	31
Total	160	100

Table 5. Distribution of patients according to type of convulsion

Type of seizer	Number	%
Generalized	97	60.8
Partial	35	21.7
Non specified	28	17
Total	160	100

According to Clinical Examination

- Irritability is the most prominent finding in clinical examination present in66 % of them, and 22 % of cases were looking well.
- Signs of meningitis were not manifested among112(70%)of cases. Among patients who presented with sign of meningitis kerning sign, brudziniski and neck stiffness in older children in 16(10 %) of patients. Bulging fontanel in 32(20%) in infant age group.

Table (6) illustrate the finding in clinical examination

Table 6. Distribution of patients according to clinical examination

Clinical examination	Number	%
General condition		
Irritability	105	66
Lethargy	20	12
Well	35	22
Sign of meningitis		
Negative	112	70
Positive	16	10
Bulging of fontanel	32	20
Total	160	100

According to Laboratory Results

- Most CSF WBCS count (62%) ranged from 5-100 cells/mm3, with 75% lymphocyte. 64% of CSF had normal protein and sugar. 93% of CSF cultures showed negative growth
- Blood test done include CBC, ESR, CRP, as well CSF analysis including culture. White blood cell count was elevated in nearly one third of the patients (28.8%). ESR done foe 105 patients with more than half (58%) of them was elevated. CRP done for 88 patients and 62% was high.

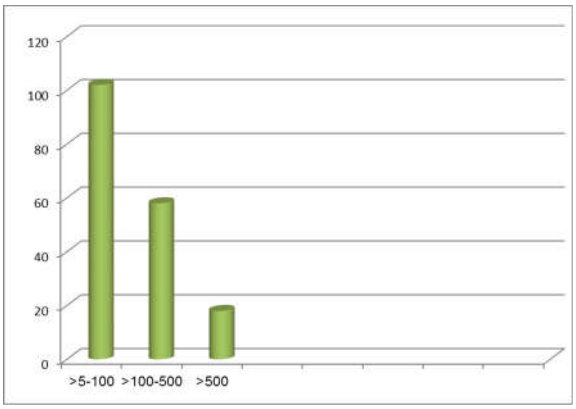

Fig. 4. White blood cell count in SCF

Table 7. Distribution of patients according to CSF parameter

CSF parameter	Number	%
WBCS		
Mainly lymphocyte	120	75
Mainly neutrophil	40	25
Sugar		
Normal	102	64
Low	58	36
Protein		
Normal	102	64
Abnormal	58	36
Culture		
Negative	149	93
positive	11	7

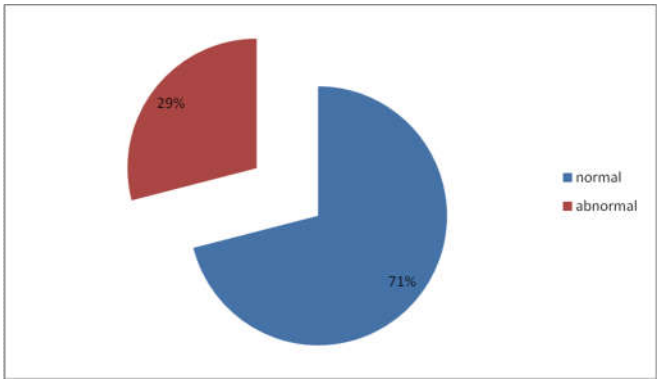

Fig. 5. Distribution of patients according to TLC

Table 8. Distribution of patients according to ESR and CRP

Blood test	Number	%
ESR		
Normal	44	42
High	61	58
Total	105	100
CRP		
Normal	33	38
High	55	62
Total	88	100

Imaging study

- Ultrasound of brain and abdomen were done routinely for all infants with open anterior fontanel (no. 88).
- CT scan was done for those children (no. 7) not improved with antibiotic, recurrent convulsion or had abnormal neurological examination.
- Abnormality findings were, subdural effusion 2, brain edema3,and hydrocephalus 3.

Table 8 - illustrated the result of imaging study.

Table 9. Distribution of patients according to Brain imaging

Type of imaging	Number	%
Ultrasound		
Normal	80	90
Abnormal	8	10
Total	88	100
CT scan		
Normal	3	43
Abnormal	4	57
Total	7	100

According to treatment received and Short term outcome

All of them received antibiotic according to hospital protocols. Out of 160 child,4(3%) cases was died from complication.156 was improved and discharge home.

DISCUSSION

Acute meningitis remains a devastating disease. Clinicians need a low threshold for suspecting meningitis, to undertake appropriate investigations and provide treatment in a timely manner, to minimize the risk of poor outcome in bacterial disease, while limiting unnecessary treatment in viral meningitis (23). This is a retrospective study was undertaken in order to document the common symptoms and signs of meningitis in children, and for validation of a diagnosis model for differentiating bacterial from viral. To know the most common causative organisms, and unnecessary treatment and uses of antibiotic in viral meningitis. This study carried out in 160 patients. 90% were admitted to medical ward which reflect the satisfactory general condition. 10% admitted either in ICU, Isolation ward or Gastroenterology. Diagnosis was made from history, clinical examination, and investigation. Majority of children were from Benghazi (77.5%), and most of them (97.5%) were Libyan .Their age ranged from one month to 15years. With majority of cases 63% less than 18 months of age. And mean age was 22.8 months (SD $\pm$ 41.9 months).

In comparison to the study in Tunisia where most of children under three years of age (12), as well as a study done by Juganariu in Lasi demonstrated that, meningitis ,more common in children between 2-5 years and in males (14). in our study group Meningitis is more common in males 57.5% , with male to female ratio is(1.3:1) this is consonance with other studies where they observed that male children more than females (13,15). It's most prevalent in the spring and summer because that's when the enterovirus, one of the most common causes of meningitis, tends to be circulating in communities (4, 20). We found August, September had highest admission rate, where in England no seasonal variation (16), while in Egypt as well as in other places meningitis more common in Winter (15, 16, 24). Both bacterial and viral meningitis display many common symptoms yet its early symptoms often resemble the flu, respiratory symptoms such as otitis media, pneumonia , that can make it difficult to diagnose Symptoms such as fever, usually manifest suddenly or over the course of several days, severe headache, vomiting, altered consciousness, seizer (25,26) . In one study, 95% of bacterial meningitis patients had at least two symptoms of headache, neck stiffness, fever and altered consciousness. The latter three features were present together in only 44% of cases. Neurological deficits are found in around one-third of patients (26).Similar findings are reported by other studies (25, 27). A rash in suspected meningitis makes N meningitidis more likely. However, 37% of meningococcal meningitis patients have no rash. Varicella and enterovirus can also be associated with a rash (28, 29). In our series of patients , fever was noted in (93%), ranged from 36 to 40C0 with means of 38.3 + 0.89 C0 which is nearly similar to the results of juganariu and Thompson (84%, 94%) respectively (14, 30). So absent of fever does not exclude meningitis especially in younger age group (29) .In current study 11% have normal temperature and 58%,31% have low grade and high grade fever respectively ,and this reflect that not only the high grade fever is dangerous but vise verse. Lastly Fever duration ranged from 1-60 days with means 4$\pm$ 7.5 days. The second frequent symptom is poor feeding reported in (70%) of cases. which is comparable to McKinney study with history of poor feeding in 78.6% of children (31). As vomiting should be considered in the assessment of patients with meningitis our group shows lower percentage compared to other studies (41%).However, in

Lasi study (14) vomiting presented in larger number of cases about 70%. One third of our cases develop convulsion during their illness with majority of them (60.8%) get generalized tonic clonic and cannot say whether it. is common with bacterial or viral meningitis as our laboratory have limited facility . In one series of patients with meningitis in Egypt convulsion was noted with bacterial meningitis in 64.9% (15), while in Tunisia 42.3% of viral meningitis have convulsions (12). There are vaccinations available for some types of bacterial meningitis, specifically pneumococcal and meningococcal. Getting vaccinated for measles, mumps, rubella, and chicken pox may help prevent some of the viruses that can cause viral meningitis (32). 89% of this group complete their vaccination program according to their age. And only 4% develop skin rash. In addition, 11 % of patients did not complete their vaccination program, which increases the probability of both bacterial and viral meningitis like H.influenzae, mumps. And about 18% of cases received oral antibiotic before admission. The first step of diagnosing meningitis is a physical exam, and there are specific indicators: irritability, lethargy, meningeal sign as Brudzinski's, Kernig's sign, and bulging fontanel (33). Irritability in those less than five months is the most prominent finding in clinical examination (27), present in (66 %) of our case , and 22% of children were looking well .Which is comparable with that reported in the literatures where in Irritability manifested in 68% and 74% (30, 31). Signs of meningitis were not manifested among 70% of cases. Among patients who presented with sign of meningitis kerning sign, brudziniski and neck stiffness 10 %. Bulging fontanel in (20%).

In comparable to Lasiand Egypt, the signs of meningitis was manifested in 23.8%, 59% respectively (14.15). In particular meningeal sign in those more than one years when compared with study in Finland was 40% (34). Despite lack of meningeal sign high index of suspicious is essential for evaluation of infant (35). Clinical features alone cannot confirm the diagnosis of meningitis and are poor discriminators for meningitis, so urgent investigations, with prompt testing of CSF and blood can hasten pathogen diagnosis and improve patient management starting with lumbar puncture (36). Cerebrospinal fluid parameters have been combined into tools to help diagnose of bacterial meningitis. One prediction rule accurately distinguished bacterial from viral meningitis Clinical prediction tools (using CSF, laboratory and clinical parameters) have also exhibited high accuracy . A traumatic lumbar puncture (LP) will affect the results by falsely elevating the white cells due to excessive red cells. Elevated CSF protein is suggests bacterial infection (36, 37). Sensitivity decreases by 20% following antibiotic pretreatment. Cerebrospinal fluid sterilization can occur within 2–4 hours of antibiotic administration. Should be performed as soon as possible to maximize pathogen detection (38). There is a difficulty in differentiation between bacterial from non-bacterial meningitis because there is no virology screen in our laboratory .In addition there is no latex agglutination test for confirmation of bacterial meningitis in those receiving antibiotics. So by using differential count, sugar, protein in CSF about 2/3 of case are viral as seen in Belgium (10). In the comparison to Yemen and Egypt show bacterial as a common cause of meningitis (13, 15). Most CSF WBCS count (60%) ranged from 5-100 cells/mm3, with 75% lymphocyte. 64% of CSF had normal protein and sugar. 93% of CSF cultures show negative growth, and this is may be due to factors described above .In addition, 7% show bacterial growth (two cases pseudomonas, two cases staph. Aureus, 3 cases Anaerobe). Many meningitis patients in the UK who have a CSF pleocytosis never have a pathogen identified. Clinicians need to remain vigilant and treat suspected bacterial meningitis promptly (35). In the other hand in Lasi, Egypt and England show other organisms, H.influenzae, Strept. Pneumoniae, N. Meningitidis (14.15, 35).which may reflect the poor ability of our laboratory to detect these organisms. The use of TLC,ESR ,CRP as an indicators of bacterial infections , show TLC is normal in up to 71%, it reflect that normal TLC does not rule out meningitis .The picture of ESR,CPR in this study is not complete ,because these tests are not done for all cases .The correlation between culture positive meningitis and value of ESR, CRP some patient with culture positive ,had low ESR and high CRP indicate the higher value of CRP over the ESR in detection of bacterial infections as in other study ((39, 40). Blood PCR is increasingly important, especially as PCR detects bacteria several days after antibiotic initiation. Blood PCR substantially increases the confirmation in meningococcal disease. Despite these tests, many patients will not have a cause identified for their meningitis (41). Blood biomarkers, such as procalcitonin and C-reactive protein, can help distinguish bacterial from viral meningitis in adults and can be used to help guide treatment if no aetiology is found(42, 43)

In Saudi Arabia the use of procalcitonin is superior over the TLC, ESR.CRP in differentiating bacterial and viral infections (5). Brain imaging is neither obligatory in the management of meningitis, nor a prerequisite to LP. Performing neuroimaging before LP is associated with delays in commencing antibiotics, which in turn can lead to an increase in mortality. An urgent CT scan should be performed if there are Clinical features indicative of a brain shift (44). Ultrasound brain and abdomen was done routinely for all infants with open anterior fontanel (no. 88), Computed Tomography for 7 cases for those not improved with antibiotic, recurrent convulsion or had abnormal neurological examination. 90% were normal and 10% had abnormality in ultrasound and CT scan: hydrocephalus in 3 patients, 3 brain edema and 2 Subdural effusion. In contrast to India where 60% had abnormality detected by USS and CT scan (22). This may reflect the lack of experience in detecting early changes with meningitis, or the USS was done late after starting antibiotic when the inflammatory process subsides. The Royal College of Physicians recommends consultant review for all patients within 14 hours of admission. . Presence of a rash and use of preadmission antibiotics should also be recorded. Management should initially focus on stabilization of patient and according to guidelines for meningitis (41). There is no specific treatment for viral meningitis. Treatment with aciclovir has only been of proven benefit in patient has encephalitic features (10, 45). Treatment for bacterial meningitis is antibiotics, with or without steroids. The choice of antibiotics is a three stage process: an initial empirical decision based on clinical suspicion, review following microscopy results, and review again when culture or PCR results are available (45). All our patients received antibiotic according to local protocols immediately after investigation without differentiation either bacterial or viral. Morbidity is common in bacterial meningitis. It is reported focal neurological deficits in 50% of cases, the commonest being hearing impairment (14%), and 14% of cases exhibited moderate to severe disability at discharge (46). Mortality occurs almost exclusively in bacterial meningitis. Up to 57% in meningococcal sepsis, 30% of pneumococcal and 7% of meningococcal meningitis without sepsis (32, 35). Few

studies have examined outcome in viral meningitis. One recent study, reported one-third of adult varicella meningitis patients (3/9) suffered squeal (48, 49). In other experience, viral meningitis patients can suffer cognitive and psychological squeal (50). Consequently the mortality rate was low 3% reflect the good management policy in Benghazi Children Hospital. In Lasi the mortality rate was 5%, and in Egypt for bacterial and viral meningitis was 10.3%, 3.4% respectively (13, 15**).**

Conclusion

- Peak of Meningitis was under one and half years .It is more common in males and in summer season.
- There are no specific symptoms and signs in diagnosis of meningitis
- Total lymphocyte count has no rule in diagnosis of meningitis.
- Lack of proper investigation in our laboratory, with 7% CSF culture positive (N. meningitidis. H. influenzae, strept. pneumoniae*).* Which not a common organism.
- The indiscriminate use of antibiotic by mothers lead to no growth.
- Poor education of family about vaccination.
- Low mortality rate.
- Cases of meningitis are not followed.
- Ultrasound is simple, noninvasive method help in diagnosis of meningitis and detection of complications.

Recommendation

- Mothers' education about the impact use of antibiotic.
- Quick transfer of CSF samples to laboratory.
- Establishment of more advanced laboratory investigation for proper diagnosis of the disease aslatex agglutination, virology serology, D- glucanand PCR.
- Lastly, all cases of meningitis after discharge should be followed in special clinic to detect delayed complication.

REFERENCES

1. Razonable RR et al, Meningitis, Medscape, Jul 2011.
2. Nelson textbook of pediatric, Ann Nelson Behrman, 2016, 20th edition, United States of America, Saunders Elsevier.
3. Bacterial meningitis and meningococcal septicemia, NICE Clinical Guideline (June 2014).
4. Dagan R, Isaachoson M. epidemiology of pediatric meningitis caused by Haemophilus influenza type b, Streptococcus pneumonia, Neisseria meningiditis in Israel. *J Infect Dis.,* 1994:169:912-6.
5. Nabi G, Khan TA.Bacterial meningitis in children. *Saudi Med J.,* 1992; 13; 348-51.
6. Dredge DC et al, Meningitis in children, Medscape, Jan 2010.
7. Freedman S B, Marrocco A, Pirie J.et al Predictors of bacterial meningitis in the era after Haemophilus influenzae. *Arch Pediatr Adolesc Med.,* 20011551301–1306. [PubMed] [Google Scholar]
8. Oostenbrink R, Moons K G, Twijnstra M J.et al Children with meningeal signs: predicting who needs empiric antibiotic treatment. *Arch Pediatr Adolesc Med.,* 2012-1561189–1194. [PubMed] [Google Scholar]
9. Lacour AG, Zamora SA, Gervaix A. A score Identifying Serious Bacterial Infections in Children with Fever without source. *Pediatr Infect Dis J.,* 2008; 27: 654-6.
10. Wan C et al, Viral Meningitis, Medscape, Mar 2011
11. Dubos F, de la Rocque F, Levy C.et al Distinguishing between aseptic and bacterial meningitis in children: validation of the sensitivity of a decision rule on 890 patients with bacterial meningitis [abstract]. *Arch Pediatr.,* 200613962 [Google Scholar]
12. Chouchane C,Gharbi J,etal.Neuromeningeal enterovirus infection in Tunisia. *Med Mal infect.* 2008 Jan:35(1):33-8.
13. Sallam AK.The etiology and presentation of acute bacterial meningitis in children at Al-Thawrah Hospital,Yemen. *J Ayub Med Coll Abbottabad.* 2013 Oct-Dec:16(4):40-3.
14. Juganariu G,Miftode E,etal. Clinical features and course of bacterial meningitis in children. Rev Med Chir Soc Nat lasi 2012 July-Sep:116(3):722-6.
15. HFM Farag,MM Abdel Fattah,etal. Defining bacterial meningitis and other infections of the central nervous system. *Pediatr Crit Care Med.,* 2010 ; 6 : S14-18
16. De Louvois J, Blackbourn J, Hurley R, et al. Infantile meningitis in England and Wales: A two year study. Archives of Disease in Childhood. 2014;66(5):603–7(16).
17. De canwer HG,Eyken L.Differential diagnosis between viral and bacterial meningitis in children. *Eur J Emerg Med.,* 2007 Dec;14(6);343-7.
18. Nigrovic LE,Malley R.Meta-analysis of bacterial meningitis score validation study in childrens hospital Boston and Harvard Medical school. *Arch Dis Child.* 2012 Sep, 97(9):799-805.doli:10.1136/archdischild. 2012-301798. Epub2012 Jul 4.
19. Lew C,Taha MK,etal.Pediatric meningococcal meningitis in France.Arch Pediatr.2012 Sep:19 Suppr 2:S49-54.dol:10.1016/50929-693x(12)71273-3.
20. Campagne G, Schuchat A.Epidemiology of bacterial meningitis in Niamey,niger. Ped. 2016;77(6):499-508.
21. Valmari P. White blood cell count, erythrocyte sedimentation rate and c-reactive protein in meningitis: magnitude of response related to bacterial species. Infection, 2016 Sep-Oct:12(5):328-30.
22. D Baruah, N Gogoi. Ultrasound evaluation of acute bacterial meningitis and it is sequale in infant in India. 2006;16:4:553-558
23. Liu CC, Chen JS, Linchattel. Bacterial meningitis in infant and children in south Taiwan. *J Formosan Med Assoc.,* 2011; 92:884-8.
24. Turtle L. Jung A. Beeching NJ, et al. An integrated model of care for neurological infections: the first six years of referrals to a specialist service at a university teaching hospital in Northwest England. *BMC Infect Dis.* 2015; 15:387. [PMC free article] [PubMed] [Google Scholar
25. Nigrovic LE, Kuppermann N, Macias CG, et al. Clinical prediction rule for identifying children with cerebrospinal fluid pleocytosis at very low risk of bacterial meningitis. JAMA: the journal of the American Medical Association. 2016; 297(1):52–60.
26. Vamlari P, Peltoln H, et al. Childhood bacterial meningitis: initial symptoms, signs related to age, and reasons for consulting physician. *European Journal of Pediatric,* 2010:146(5):515-8.
27. Walsh-Kelly C, Nelson DB, et al. Clinical predictors of bacterial meningitis versus aseptic meningitis in childhood. *Annals of Emergency Medicine,* 2012:21(8):910-4.
28. Swingler G, Delport S, Hussey G. An audit of the use of antibiotics in presumed viral meningitis in children. *Pediatr Infect Dis J.,* 2012131107–1110. [PubMed] [Google Scholar]

29. Scheifele D, Halperin S, VaudryW et al. Le nombre de casd'infection à Haemophilus influenzae de type b n'ajamaisétéaussi bas -Canada, 2000. RMTC 2011; 27(18):149-50.
30. Thompson MJ, Ninis N, Perera R, et al; Clinical recognition of meningitis in children and adolescents. *Lancet*. 2006 Feb 4; 367(9508):397-403.
31. McKinney W P, Heudebert G R, Harper S A.et al Validation of a clinical prediction rule for the differential diagnosis of acute meningitis. *J Gen Intern Med.,* 2009-94-98–12. [PubMed] [Google Scholar].
32. Black S, Shinefield H, Fireman B, Lewis E, Ray P, Hansen JR, et al. Efficacy, safety and immunogenicity of heptavalent pneumococcal conjugate vaccine in children. Northern California Kaiser Permanente Vaccine Study Center Group. *Pediatr Infect Dis J.,* 2000; 19: 187-95.
33. Harrell F E, Durack D T. Differential diagnosis of acute meningitis: an analysis of the predictive value of initial observations. *JAMA*, 2012- 2622700–2707. [PubMed] [Google Scholar]
34. Feigin R D, McCracken G H, Klein J O. Diagnosis and management of meningitis. *Pediatr Infect Dis J.,* 2013-11785–814. [PubMed] [Google Scholar]
35. McGill F. Heyderman RS. Michael BD, et al. The UK joint specialist societies guideline on the diagnosis and management of acute meningitis and meningococcal sepsis in immunocompetent pateints. *J Infect.,* 2016;72:405–38. [PubMed] [Google Scholar]
36. Greenlee J E. Approach to diagnosis of meningitis: cerebrospinal fluid evaluation. *Infect Dis Clin North Am.,* 20144583–598. [PubMed] [Google Scholar]
37. Clark T, Duffell E, Stuart JM et al. Lumber puncture in the management of adults with suspected bacterial meningitis-a survey of practice. *J Infect.* 2006; 52 : 315-9.
38. 38- Ponka A, Ojala K, Teppo AM, Weber TH. Differential diagnosis of bacterial and aseptic meningitis using cerebrospinal fluid laboratory tests. Infection 2000;11:129-31
39. Castelli GP, Pognani C, Meisner M, Stuani A, Bellomi D, Sgarpi L. C-reactive protein during systemic inflammatory response syndrome, sepsis and organ dysfunction. *Crit Care,* 2004; 8: R234-42.
40. Castelli GP, Pognani C, Meisner M, Stuani A, Bellomi D, Sgarpi L. C-reactive protein during systemic inflammatory response syndrome, sepsis and organ dysfunction. *Crit Care,* 2004; 8: R234-42.
41. Tatara R, Imai H. Serum C-reactive protein in the differential diagnosis of childhood meningitis. *Pediatr Int.,* 200042541–546. [PubMed] [Google Scholar]
42. Thwaites G. Fisher M. Hemingway C, et al. British Infection Society guidelines for the diagnosis and treatment of tuberculosis of the central nervous system in adults and children. *J Infect.,* 2009; 59:167–87. [PubMed] [Google Scholar
43. Mary P, Veinberg F, Couderc R. Acute meningitis, acute phase proteins and procalcitonin. *Ann Biol Clin.,* 2013; 61: 127-37.
44. Gendrel D, Raymond J, Assicot M, Moulin F, Iniguez JL, Lebon P, et al. Measurement of procalcitonin levels in children with bacterial or viral meningitis. *Clin Infect Dis.,* 2000; 24: 1240-2.
45. Hughes DC, Raghavan A, Mordekar SR, et al; Role of imaging in the diagnosis of acute bacterial meningitis and its Postgrad Med J., 2010 Aug;86(1018):478-85
46. Brouwer MC, McIntyre P, de Gans J, et al; Corticosteroids for acute bacterial meningitis. Cochrane Database Syst Rev. 2010 Sep 8;9:CD004405.
47. Jaeger F, Leroy J, Duchene F.et al Validation of a diagnosis model and complication of bacterial and viral meningitis in infants and children under 3.5 years of age. *Eur J Clin Microbiol Infect Dis.,* 200019418–421. [PubMed] [Google Scholar]
48. Baty V, Viel J F, Schuhmacher H.et al Prospective validation of a diagnosis model as an aid to therapeutic decision-making in acute meningitis. *Eur J Clin Microbiol Infect Dis.,* 200019422–426. [PubMed] [Google Scholar].
49. Parasuraman T V, Frenia K, Romero J. Enteroviral meningitis: cost of illness and considerations for the economic evaluation of potential therapies. Pharmacoeconomics 2001193–12. [PubMed] [Google Scholar]
50. Haruda F D. Meningitis—viral versus bacterial. Pediatrics 2013112447–448. [PubMed] [Google Scholar
51. Attia J. Hatala R. Cook DJ. Wong JG. The rational clinical examination. Does this adult patient have acute meningitis? JAMA. 2014;281:175–81. [PubMed] [Google Scholar

****