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List of Abbreviations

| | |
|--------------|--|
| ABM | Acute bacterial meningitis |
| AIDS | Aquired immunodeficiency syndrome |
| ALT | Alanine transaminase |
| AM | Aseptic meningitis |
| ARDs | Acute respiratory distress syndrome |
| AST | Aspartate transaminase |
| AUC | Area under the curve |
| BCG | Bacillus Calmette-Guérin |
| BBB | Blood brain barrier |
| BM | Bacterial meningitis |
| CAT | Computed axial tomography |
| CBC | Complete blood count |
| CD | Crohns disease |
| CP | Chronic pancreatitis |
| CXC-R | Chemokine receptor |
| CIE | Counter immuno-electrophoresis |
| CMV | Cytomegalovirus |
| CNS | Central nervous system |
| CRP | C- reactive protein |
| CSF | Cerebrospinal fluid |
| DIC | Disseminated intravascular coagulation |
| DNA | Deoxyribonucleic acid |
| EBNA | Epstein-Barr nuclear antigen |
| EBV | Epstein-Barr virus |
| ED | Emergency department |
| EDTA | Ethylenediaminetetraacetic acid |
| ELISA | Enzyme Linked Immuno-sorbent Assay |
| ES | Epidemiological study |
| ESR | Erythrocyte sedimentation rate |
| FDA | Food and Drug Administration |
| FN | False negative |
| FP | False positive |
| GBS | Group B streptococci |

| | |
|-------------------------|--|
| GCS | Glasgow coma scale |
| GI | Gastrointestinal |
| Gm/dl | Gram/dice letter |
| Hb | Hemoglobin |
| H. influenzae | Haemophilus influenzae |
| HIB vaccine | Haemophilus influenzae type B vaccine |
| HIV | Human immunodeficiency virus |
| HRP | Horseradish peroxidase |
| HS | Highly significant |
| HSV | Herpes simplex virus |
| IBD | Inflammatory bowel disease |
| IL | Interleukin |
| LCMV | Lymphocytic choriomeningitis virus |
| L. monocytogenes | Listeria monocytogenes |
| LP | Lumbar puncture |
| LPS | Lipopolysaccharides |
| MC | Meningeal carcinomatosis |
| MCP | monocyte chemoattractant protein |
| MCV4 | Quadrivalent meningococcal conjugate vaccine |
| MIC | Minimum inhibitory concentration |
| MIP | Macrophage inflammatory protein |
| MMR | Measle-mumps-rubella |
| MOHP | Ministry of health and population |
| MRI | Magnetic resonance imaging |
| M. tuberculosis | Mycobacterium tuberculosis |
| μL | Mille letter |
| NDL | Non diagnostic line |
| N | Normal |
| ng/ml | Nanogram/mille letter |
| N. meningitides | Neisseria meningitides |
| NS | Non significant |
| P.aeruginosa | Pseudomonas aeruginosa |
| PCR | Polymerase chain reaction |
| ROC | Receiver Operating Characteristic |
| RR | Respiratory rate |
| S | Significant |
| S. aureus | Staphylococcus aureus |
| SD | The standard deviation |
| | Staphylococcus epidermidis |

| | |
|--------------------------------|---|
| S. epidermidis | Significance |
| Sig. | Specious |
| SP | Streptococcus pneumoniae |
| S. pneumoniae | |
| SPSS | Statistical Package for the Social Sciences |
| TBM | Tuberculous meningitis |
| TGB- β | Transforming growth factor beta |
| TLC | Total leukocytic count |
| TMB | Tetramethylbenzidine |
| TMP-SMZ | Trimethoprim-sulfamethoxazole |
| TN | True negative |
| TNF | Tumour necrosis factor |
| TP | True positive |
| UTI | Urinary tract infection |
| VCA | Viral capsule antigen |
| VUR | Vesicoureteral reflux |
| VZV | Varicella-zoster virus |
| WBCs | White blood cells |
| WHO | World health organization |
| Z.N | Ziehl- Neelsen |

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Diagnostic Value of Cerebrospinal Fluid IL-8 in Patients with Acute Meningitis

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

Introduction

Meningitis is common in tropical areas and also in Egypt and has a world-wide distribution (*Adly et al., 1986*). Meningitis is inflammation of the protective membranes covering the brain and spinal cord, known collectively as the meninges. The inflammation may be caused by infection with viruses, bacteria, or other microorganisms, and less commonly by certain drugs (*Ginsberg, 2004*). Most cases are due to infection with viruses (*Attia et al., 1999*). Bacteria, fungi, and parasites are the next most common causes (*Ginsberg, 2004*).

Microorganisms reach the meninges either by direct extension from the ears, nasopharynx, cranial injury or congenital meningeal defect, or by blood-stream spread (*Kumar and Clark, 2002*). Host factors as lack of humoral immunity and lack of integrity of cerebrospinal fluid space may predispose to meningitis (*Saif El-Din and Abdel-Wahab, 1995*). Meningitis can be life-threatening because of the inflammation's proximity to the brain and spinal cord; therefore the condition is classified as a medical emergency (*Sáez-Llorens and McCracken, 2003; Tunkel et al., 2004*).

The most common symptoms of meningitis are headache and neck stiffness associated with fever, confusion or altered consciousness, vomiting, and an inability to tolerate light

(photophobia) (*Van de Beek et al., 2006*). The classic triad of diagnostic signs consists of nuchal rigidity, sudden high fever and altered mental status; In infants up to 6 months of age, bulging of the fontanelle may be present(*Theilen et al., 2008*).

Distinguishing acute, subacute, and chronic meningitis helps to identify the pathogen. Approximately 25% of patients with bacterial meningitis present acutely within 24 hours of onset of symptoms. Other patients with bacterial meningitis and most patients with viral meningitis present with subacute neurologic symptoms developing over 1-7 days. Chronic symptoms lasting longer than 1 week suggest meningitis caused by some viruses (*Lippincott and Wilkins, 2006*).

Meningitis can lead to serious long-term consequences such as deafness, epilepsy, hydrocephalus and cognitive deficits, especially if not treated quickly (*Sáez-Llorens and McCracken, 2003; van de Beek et al., 2006*).

Cerebrospinal fluid (CSF) analysis is the cornerstone and diagnostic test of choice for suspected meningitis. Measure the opening pressure and send the fluid for cell count (and differential count), chemistry (ie, CSF glucose and protein), and microbiology (ie, Gram stain and cultures) (*Razonable, 2007*). However lumbar puncture is often delayed or deferred owing to concern about the risk of cerebral herniation, this risk is thought to be over emphasized (*Scarborough and Thwaites, 2008*).

Meningitis is defined as bacterial according to CSF laboratory findings [(increased protein $> 100\text{mg/dl}$, decreased glucose $< 40\text{mg/dl}$, and leukocyte count $100\text{-}5000/\text{mm}^3$ with polymorph nuclear leukocyte domination $> 80\%$), identification of bacterial agents in Gram staining, and/or positive bacterial culture (*Razonable, 2011*)]. Also, CSF/serum glucose ratio ≤ 0.4 is indicative of bacterial meningitis (*Straus et al., 2006*).

Meningitis is defined as viral if the viral culture, serological testing, pleocytosis, or reverse transcriptase polymerase chain reactions were positive, and the bacterial culture was negative (*Dubos et al., 2008*).

In practice, before definitive CSF bacterial cultures are available, most patients with acute meningitis are treated with broad spectrum antibiotics targeting bacterial meningitis. In general, this does not seriously harm the aseptic meningitis patient; however, it may enhance the local frequency of antibiotic resistance (*Wise et al., 1998*), and cause antibiotic adverse effects, nosocomial infections (*Raymond, 2000*), and high medical costs (*Parasuraman et al., 2001*). Thus, it is not only important to recognize bacterial meningitis patients who promptly need antimicrobial therapy but also aseptic meningitis patients who do not need antibiotics and/or hospital stays (*Huy et al., 2010*).