ROLE OF CEREBROSPINAL FLUID WHITE BLOOD CELL COUNT IN EARLY DIAGNOSIS OF ACUTE BACTERIAL MENINGITIS

Thesis

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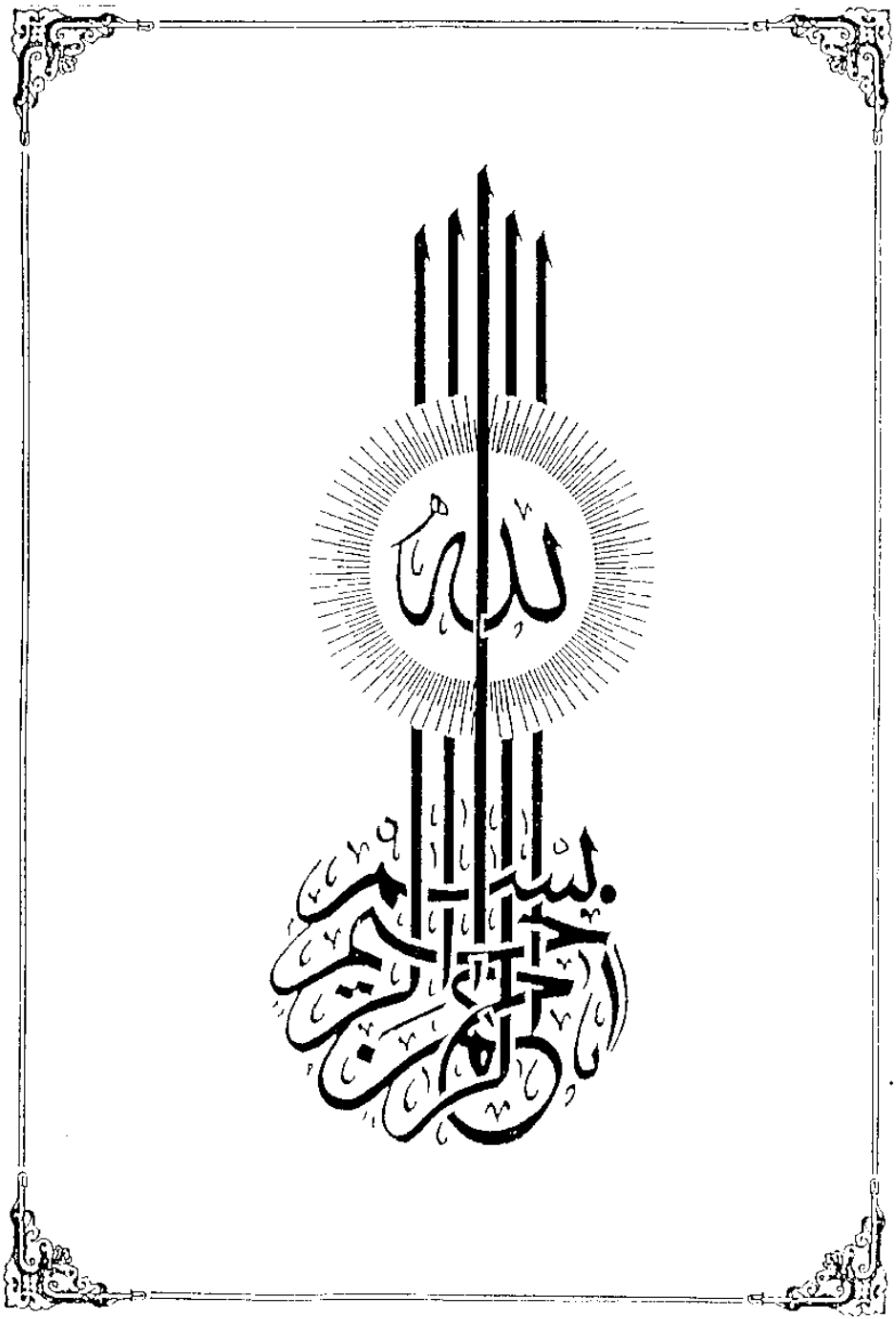

LIST OF ABBREVIATIONS

ADH	Anti Diuretic Hormone
AIDS	Acquired Immune Deficiency Syndrome
CIE	Counter Immuno Electrophoresis
CNS	Central Nervous System
CSF	Cerebro Spinal Fluid
CT	Computerized Tomography
DIC	Disseminated Intravascular Coagulation
ELISA	Enzyme- Linked Immunosorbant Assay
HIV	Human Immune Deficiency Virus
IL-1B	Interleukin- 1B
LA	Latex Agglutination
LDH	Lactate Dehydrogenase
PMN	Polymorphonuclear Leucocytes
TLC	Total Leucocytic Count
TNF	Tumour Necrosis Factor
WBC	White Blood Cells

CONTENTS

INTRODUCTION AND AIM OF THE WORK

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Bacterial meningitis is an extremely severe and life threatening infection that needs early reliable diagnosis and prompt treatment (Abdel Ghani et al., 1989).

It is still fatal in 10-30 % of cases despite the introduction of new and potent antibacterial drugs (McCracken, 1984).

The fatality rate varies with age, severity, duration of disease and causative organism, being higher with H. influenzae and streptococcus pneumoniae (10 - 30 %) than with Neisseria meningitidis (5-10%) (Klein et al., 1986 and Girgis et al., 1989).

De Beer et al., (1984) Stated that, the etiological diagnosis of meningitis is still a problem in clinical practice as CSF chemical analysis and cellular changes often overlap.

Also, the conventional method of diagnosis of bacterial meningitis using bacterial cultures is slow and can be misinterpreted if antibiotic treatment is started before sample collection(Lewis, 1974). That is why, a rapid and conclusive method for early diagnosis of meningitis is urgently needed (Jorgenson and Lee, 1978).

Rodewald et al., (1991) found that CSF WBC counting more than 6/mm^3 can predict and diagnose early cases of acute bacterial meningitis even before the results of routine CSF analysis become available.

Aim of the work :

The aim of this study is to test the value of CSF white blood cell count in early diagnosis of acute bacterial meningitis.

REVIEW OF LITERATURE

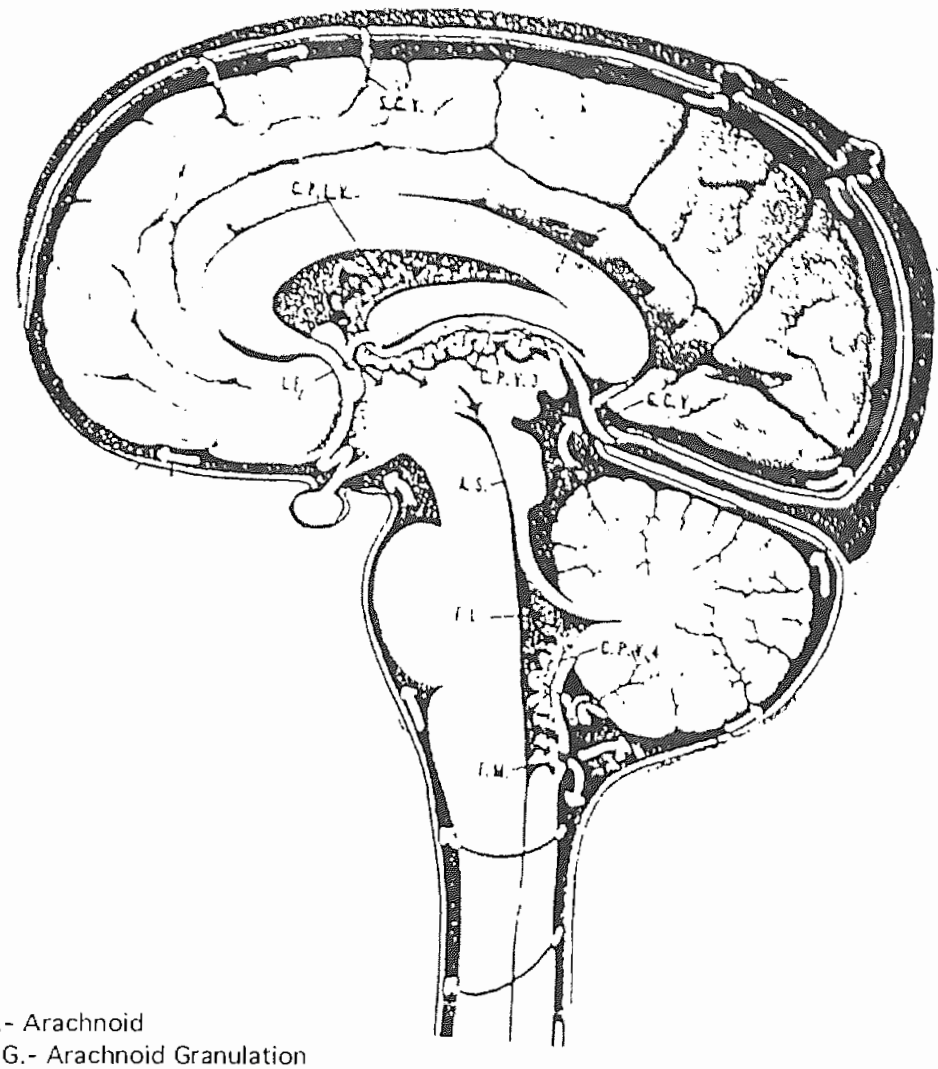
ANATOMY AND PHYSIOLOGY

The relationship between brain meninges and skull :

The meninges are formed of three layers; the dura mater arachnoid and the piamater which is the inner most one. The pia mater is continuous with the external surface of the brain and spinal cord forming acuff of meningeal tissue around the penetrating vessels. The arachnoid encloses the brain more loosly and between the pia and arachnoid, the subarachnoid space is present which is filled with CSF. The outerword pressure of the brain and CSF holds the arachnoid in contact with the most superficial layer of meninges, the dura mater, which is adherent to the periosteium and skull except where it invaginates into the cranial cavity to form four rigid septae, the falx cerebri, the falx cerebelli, the tentorium cerebelli and the diaphragma selli (John, 1990).

CSF secretion :

The CSFis mainly formed by secretion from the choroid plexuses and circulates over the surface of the brain and spinal cord. The products of metabolism of the brain and spinal cord pass from the perivascular spaces into CSF when the endothelial blood brain barrier is damaged by pathological processes, the cell containing inflammatory exudate enters the CSF (Walsh, 1990).



A.- Arachnoid
B.G.- Arachnoid Granulation
A.S.- Aquedct of Sylvius
C.C.M.- Cisterna Cerbello-Medullaris
C.I.- Cisterna Cerebello-Medullaris
C.P.L. V- Charoid Plexus of Lateral Ventricle
C.P.V.3- Choroid Plexus of 3rd Ventricle
C.P.V.3- Choroid Plexus of 4TH Ventricle
C.S.- Cisterna Superior
D.- Dura mater
F.L. Foramen of Luschka
F.M.- Foramen of Magendie
G.C.V.- Great Cerebral Vein
I.F.- Interventricular Foramen "Monro"
S.A.S.- Subarachnoid Space
S.C.V.- Superior Cerebral Vein
S.S.S- Superior Sagittal Sinus

Fig. (1) : C . S. F. Circulation

CSF circulation :

The CSF circulates from the lateral to the third ventricle through the "foramina of monro", then to the fourth ventricle through the "Aqueduct of sylvius". The fourth ventricle is connected with the subarachnoid space through a central foramen "foramen of magendie" and two lateral foramina "Foramina of luschka". The CSF is reabsorbed from the subarachnoid space by the arachnoid villi to reach the venous circulation. So, it is in a dynamic state and replaced several times daily (Romanes, 1981).

Normal values of CSF :

The normal CSF is characterized by being crystal clear, contain not more than 5 white blood cells /cmm. , no red blood cells, its protein content is less than 45 mg% and its glucose content is about half that present in a simultaneous blood sample.

The CSF sodium level is usually about 98% of the plasma sodium. The chloride ions in CSF ranges from 7.2 -7.5 g/L (Walsh, 1990).

Blood Brain Barrier :

The capillaries of the brain and spinal cord differ from capillaries elsewhere in the body as they do not have

fenestrations or inter cellular clefts. Molecules, thus, cross cerebral capillaries by active transport and on the basis of lipid solubility rather than by simple diffusion.

This relative impermeability of the brain capillaries is the basis of the barrier system that sequester the brain and CSF from extra cranial environment and it is a major factor in selection of antibiotics for intracranial infections (John, 1992).

MENINGITIS

Meningitis is an inflammation of the arachnoid, piamater and intervening CSF. The inflammatory process extends through the subarachnoid space into the brain and spinal cord and regularly involves the ventricles (Saif El-Din and Abdel-Wahab, 1991).

Types of Meningitis :

Three basic types of meningitis occur, acute pyogenic meningitis, Acute lymphocytic meningitis and chronic meningitis (Morris, 1987).

Acute pyogenic (septic) meningitis :

This type of meningitis is caused by purulent bacteria such as Neisseria meningitidis, Streptococcus pneumoniae streptococci, H. influenzae and other pyogenic organisms. Post operative and traumatic meningitis are caused by staphylococci and gram negative enteric bacteria (Moses and Ernest, 1980).

Lymphocytic Meningitis :

This type is characterized by lymphocytic rather than neutrophilic pleocytosis. Large number of different viruses have been isolated from these cases including mumps, ECHO,

coxsackie, Epstein-Barr and Herpes simplex type II (Morris, 1987).

Chronic Meningitis :

The major histopathologic changes are those characteristic of granuloma formation and is usually caused by Mycobacterium T.B., cryptococcus neoformans, coccidiodes, Histoplasma and other fungi (Guy et al., 1975).

The causative organism :

Any organism may cause meningitis, once it gets through the blood brain barrier, but the organisms that commonly doing so are Neisseria meningitidis, Streptococcus pneumoniae and Haemophilus influenzae (Christie, 1987).

1- Neisseria meningitidis :

These are gram negative, non motile non sporulating diplococci that are spherical or oval, measuring 0.6 to 0.8 μm in diameter. Most pathogenic strains are encapsulated they are aerobic and grow best in the presence of 5% to 10% CO_2 in a humid atmosphere at 37 ^{o}C and a pH 7.4 to 7.6 (Overturf, 1989).

They are divided by the surface capsular polysaccharide into at least 13 subgroups :