AIN SHAMS UNIVERSITY
FACULTY OF MEDICINE
PEDIATRIC DEPARTMENT

THE CEREBRO-SPINAL FLUID IN CLINICAL DIAGNOSIS IN PEDIATRICS

ESSAY

Submitted In Partial Fulfilment
For Master Degree In
(PEDIATRICS)

BY
IBRAHIM MOHAMMED IBRAHIM EL-ATTAR

SUPERVISOR

Prof. Dr. SALAH AWWAAD
Prof. of Pediatrics,
Faculty of Medicine,
Ain Shams University

CAIRO
1989

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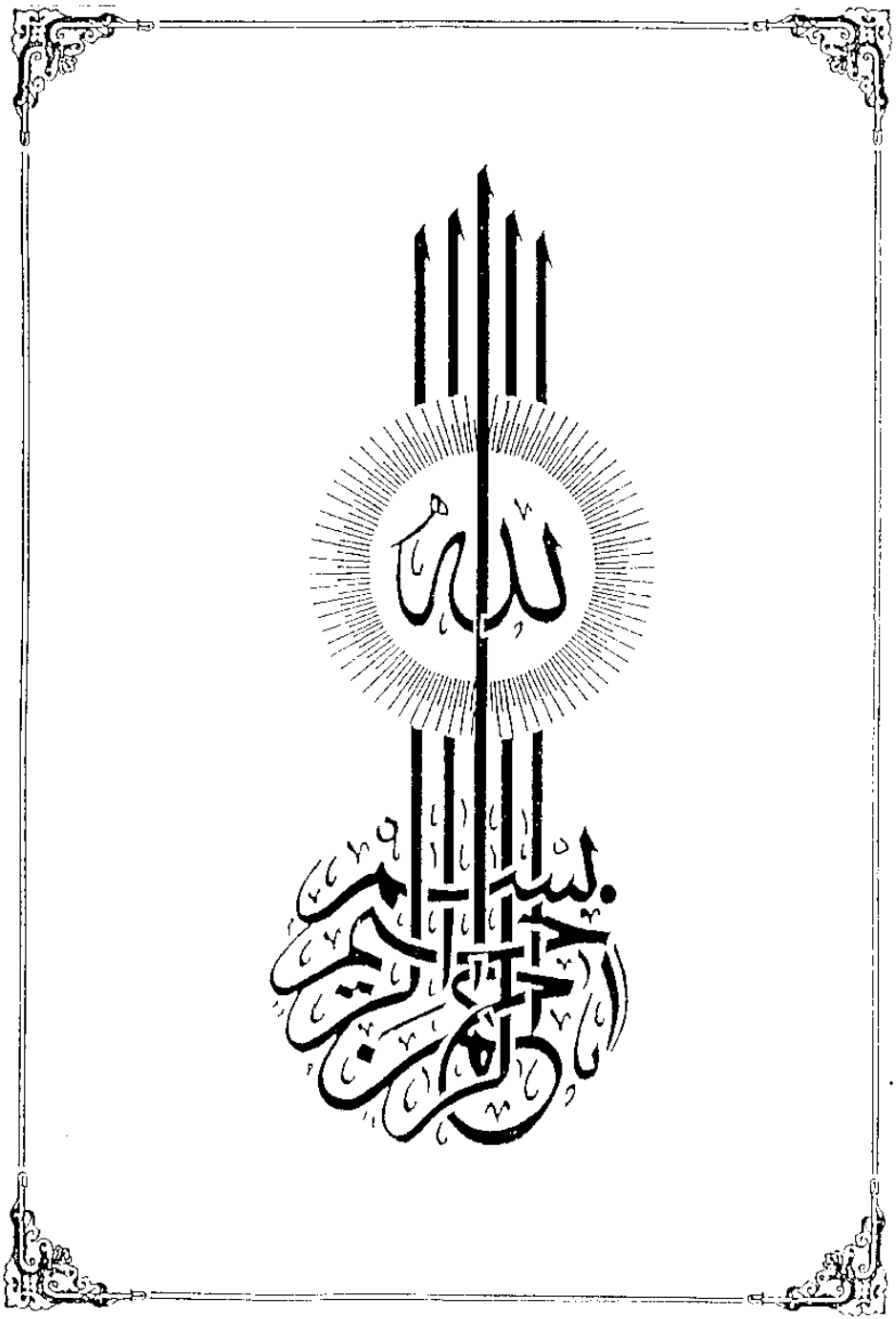

A C K N O W L E D G E M E N T

I wish to thank my Prof. Dr. SALAH AWWAAD, Professor of Pediatrics, Ain Shams Faculty of Medicine, for his continuous guidance, supervision, and encouragement during the present study.

My supreme gratitudes is due to him. He assigned the work, suggested the topic and kindly supported me with all necessary facilities. His judicious guidance, objective criticism and valuable illustrations are deeply appreciated.

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The cerebrospinal fluid (CSF) is a dynamic, metabolically active substance, with bidirectional flow, that has many important functions. It is very valuable as a diagnostic aid in the evaluation of inflammatory conditions, infectious or non-infectious, involving the brain, the meningese and the spinal cord.

Because of the close relationship between the CSF and the central nervous system (CNS), all pathological processes that primarily affect the C.N.S., would naturally affect the C.S.F. (Daube & Sandok, 1978).

The CSF is the part of the central nervous system that is most accessible to the clinician and therefore, examination of the CSF forms the basis of the investigations of all diseases of the CNS (Tilkian & Conover, 1975).

Proper understanding of the normal characteristics of the CSF is essential for the detection of the changes that occur in its composition in different nervous diseases, and in other related affections.

The present study is a critical review on the subject of "CSF In Clinical Diagnosis In Pediatrics".

II –HISTORICAL REVIEW

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Galen, in the second century described the cerebro spinal fluid as vaporous humour, produced in the ventricles that provided energy to the entire body (Conly & Ronald, 1983).

The discovery of the cerebro-spinal fluid (CSF) is generally ascribed to Cotugno (1775) (Liquor Cotunii), but the first clear description was provided some fifty years after Cotugno's report by Magendie in 1825 (Best, 1961).

Our knowledge of the anatomical relationships of the CSF is based on the classical researches of Francois Magendie (1842), who in his monograph on the CSF gave a remarkably complete and accurate description of the three meningese and their relation to the ventricles of the brain. He described the foramen in the roof of the fourth ventricle which is known by his name. His observations were made on the fresh cadavers, and by the simple method of draining of the CSF from the lumber theca and replacing it with air, he was able, after turning back the dura mater, to demonstrate to his students that the outer layer of arachnoid was a complete membrane quite free from and independent of the dura mater. He also recognised the pulsations in the fluid associated with respiration, and

observed that after the CSF had been drained away from the subarachnoid space, fresh fluid was formed to take its place. By injection experiments he traced the prolongations of the subarachnoid space along the cranial nerves. In only two points his opinions failed to be corroborated by later work, viz:

1) That the CSF was secreted by the pia mater,
2) That though there was no open communication between the lateral ventricles and the basal cistern, the CSF could diffuse from one into the other.

Further work, particularly on the absorption of the fluid from the subarachnoid space, was done by Quincke in 1872, by Key & Retzius in 1876 and by Leonard Hill in 1896. Their observations after a period of neglet and contradiction have later been almost completely substantiated by American physiologists, who cleared up most of the doubtful points on the anatomical and physiological relationships of the fluid (Greenfield & Charmchael; 1925)

Studies of bulk flow have shown that absorption of the CSF takes place through the microscopic arachnoid villi, which are minute projections of subarachnoid space into the lumen of the venous sinuses. The work of Welch & Friedman

(1960) suggested that these operated as valves, but electro-microscopic studies by Tripathi (1973 & 1974) demonsterated vacuoles within the cells of the villi which suggested that there is a dynamic system of transcellular channels or pores which allow the bulk outflow of CSF across the mesothelial barrier (Walton, 1986).

III-ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS CONCERNING THE CSF: ITS ORIGIN, CIRCULATION, FUNCTIONS, COMPOSITION AND PRESSURE

III- THE CSF-ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS

The structures included in the CSF system are: the meningese, the meningeal spaces formed between the meningeal linings and the brain, the ventricular system and the CSF itself.

The meningese consist of three mesodermally derived membranes, the outer most is the dura mater, next is the Web-like arachnoid mater, and the innermost is the thin pia mater, which adheres closely to the structures of the CNS. The epidural space lies external to the dura mater, between it and the bone. The subdural space lies between the dura mater and the arachnoid matar and the subarachnoid space lies between the arachnoid mater and the pia mater, and it is this space that contains the CSF. The CSF is also contained in the cavities within the brain, namely: the two lateral ventricles, the third ventricle, the aqueduct of sylvius and the 4th ventricle (Daube & Sandok, 1978).

Embryologically, the leptomeningese (the arachnoid mater and the pia mater), begin as a single membrane, which later becomes seperated by numerous confluent subarachnoid spaces containing the CSF. The arachnoid mater, however, remains attached to the pia mater by numerous web-like

trabeculae. The potential space between the dura mater and the arachnoid mater is termed the subdural space and normally contains a thin layer of fluid. The subarachnoid space varies greatly in size and shape, particularly over the surface of the brain and in the lumbar region of the spinal canal. In the brain, these enlargements of the subarachnoid space are called cisterns, and they are usually named for anatomical location. for example, interpedunclear cistern located between the two cerebral peduncles, and the cisterna magna which is the large space below the cerebellum. In the spinal canal where the spinal cord ends at the level of the second lumber vertebra and the arachnoid mater remains closely applied to the dura matar to the level of second sacral vertebra, a large lumber subarachnoic cistern is formed which contains a reservoir of CSF "the filum terminale" and the nerve roots of the cauda equina as they pass to their intervertebral foramina The major arterial channels of the brain are located in subarachnoid space (Doupe & Sandok, 1978) (Fig 1).