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EVALUATION OF SHUNT OPERATIONS IN TREATMENT OF HYDROCEPHALUS

A THESIS

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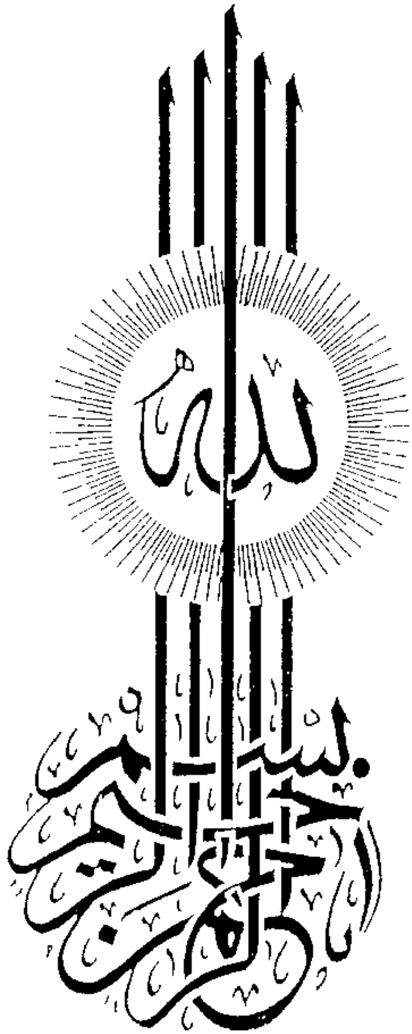
1985

بسم الله الرحمن الرحيم

« واتقــوا الله ويعلمكم الله »

صدق الله العظيم


بسم الله الرحمن الرحيم

TO MY PARENTS AND TO MY

DAUGHTER EL - SHIMA .

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ACKNOWLEDGMENT

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INTRODUCTION & AIM OF WORK

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Hydrocephalus is a global problem faced by neurological surgeons and paediatricians in all parts of the world. The condition of hydrocephalus can be defined as an abnormal accumalation of cerebro-spinal fluid within the Ventricular system as a result of an imbalance between the rate of production, conduction and absorption of the cerebrospinal fluid. It is usually accompanied by a progressive enlargment of the ventricles and an elevation of the pressure within. In the infant, when the bones in the head are still soft, progressive hydrocephalus produces an abnormal rate of growth of the head circumference.

Diversion of C.S.F. by shunt procedures is the most common method of treatment of hydrocephalus in the present time. The most popular operations are ventriculo-atrial and ventriculo-peritoneal shunt. Each method has its advantages and complications.

The managment of the patients who have been surgically treated for hydrocephalus by instillation of a shunt implant system is an every day problem. Some of these patients are admitted with failing shunt system; presenting a difficult problems of decision and managment. Practical difficulties are:-

1- Early detection of patients who need to be submitted to revision surgery, in order to correct the shunt dysfunction.
2- Selection of the most appropriate surgical technique for a shunt revision to be used in a given case.

3- Decision as to whether a minor surgical correction, of just one small component of the shunt system is sufficient.

4- Decision as to whether the whole shunt system should be taken out and replaced by a totally new system in the same time.

5- Decision as to which particular component of the device should be replaced, leaving the rest of the shunt system in place.

6- Decision as to whether the shunt system should be removed and replaced by a completely new shunt system on another site.

Because of the distressing frequency of shunt implant failure, the patient condition assessment problem, the difficulty to decide whether to revise the shunt system or not and to what extent this revision process should take, it is thought to be worthy to study every case in details.

The aim of this work is to clarify several points:

1- The methods of detection of shunt implant complications and failure.

2- To determine the best way of handling the various kinds of shunt implant complications.

3- To reduce the incidence of shunt implant complications by a careful apprasial of the problem as a whole.

4- To improve the design of shunt implant and its specification.

REVIEW OF LITERATURE

HISTORICAL BACKGROUND

Hydrocephalus has been recognised as a clinical and pathological entity since the days of Hippocrates, but it is fair to say that as late as the beginning of the present century the pathology of this condition was obsecure, no rational methods of therapy had been developed as well as no successful surgical treatment of hydrocephalus had ever been achieved. In the 19 th century, the understanding of the anatomy of the cerebrospinal fluid pathways had advanced by the works of Magendie, Lushka, Key, Retzius and Monro. Then between 1913 and 1929, Walter Dandy, almost single-handed, established the true pathology of hydrocephalus and developed sound physiological and surgical principales for its treatment. *Dandy and Blackfan (1914)*[161], first proved that the cerebrospinal fluid is formed within the ventricles principally if not entrirely by the choroid plexuses; that approximately 800 to 1,000 ml. of cerebrospinal fluid is formed each 24 hours within the ventricles, that the only escape of cerebrospinal fluid from the lateral and third ventricles is by the way of the aqueduct of sylvius, the fourth ventricle, into the cisterna magna and then into the other subarachnoid spaces. The circulation of cerebrospinal fluid from the lateral ventricles to the subarachnoid spaces normally requires two to three minutes. The absorption of the cerebrospinal fluid back into the blood stream is from the subarachnoid spaces directly into the rich capillary bed within the subarachnoid spaces.

Dandy and Blackfan (1914)[61], proved the existance of two distinct types of hydrocephalus.

1- The obstructive (or non-communicating)type and,

2- The non-obstructive (or communicating) type.

They established that the cause of non-communicating obstructive hydrocephalus is the inability of the cerebrospinal fluid to escape from the obstructed ventricles to the subarachnoid system where it can be absorbed by natural processes; and that the cause of communicating (non-obstructive) hydrocephalus is impaired absorption of the cerebrospinal fluid after it has reached the subarachnoid system because of congenital mal-development of the subarachnoid spaces or their oblitration by postinflammatory adhesions.

The classic "observations on the pathology of hydrocephalus" by *Dorothy Russell(1949)*[268] provided an impressive collection of various pathological lesions producing hydrocephalus, all of which were believed to create obstruction at some point in the pathway of the cerebraspinal fluid.

The plan of treatment of hydrocephalus has developed hand in hand with the continous correction of our knowledge about the pathology of the disease. More understanding of the disorder allowed better managment of patients and subsequently better prognosis.

The ingenious discovery of the computerized axial tomography by *Godfrey Hounsfield in 1973*, is regarded as the greatest step in radiology since the discovery of X-rays by *Roentgen in 1895.* It resulted in the Nobel prize for Medicine being awarded Jointly to *Dr. Hounsfield and Prof.* A.M. *Cormack.*

ANATOMY OF THE VENTRICULAR SYSTEM AND THE ARACHNOID

The ventricular system includes:-

1- The 2 lateral ventricles. 2- The 3rd ventricle.

3- The aqueduct of sylvius and 4- The 4th ventricle.

1- The lateral ventricles

- These are ependymal lined cavities of the cerebral hemispheres.
- The arch-sphaped lateral ventrilcles contain cerebrospinal fluid and conform to the general shape of the hemispheres.[185] (Fig. 1)
- The lateral ventricles can be divided into 5 parts:
  1- The anterior (frontal) horn,
  2- The ventricular body,
  3- The collateral (atrium) trigone,
  4- The inferior (temporal) horn, and
  5- The posterior (occipital) horn.

Each lateral ventricle communicates with the midline third ventricle by the interventricular foramen of Monro.

The anterior horn of the lateral ventricle:

This part lies rostoral to the interventricular foramen, has a triangular shape in frontal section and extends forward, laterally and ventrally.[63]

The roof and rostral wall of this horn are formed by the corpus callosum, while its medial wall is the septum pellucidum which separates the ventricles of the two hemispheres.