VENTRICULOPERITONEAL SHUNT MALFUNCTION
[A Review]

Thesis

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ABBREVIATIONS

CFVS	:	CSF flow-void signal
CSF	:	Cerebrospinal fluid
CT	:	Computerized tomography
DP	:	Differential pressure
ETV	:	Endoscopic third ventriculostomy
EVD	:	External ventricular drain
HCP	:	Hydrocephalus
IQ	:	Intelligence quotient
ISF	:	Interstitial fluid
LP	:	Lumboperitoneal
MRI	:	Magnetic resonance imaging
NPH	:	Normal pressure hydrocephalus
NSR	:	national shunt registry
SAH	:	Subarachnoid hemorrhage
TLC	:	Total leukocytic count
US	:	Ultrasonography
VA	:	Ventriculoatrial
VP	:	Ventriculoperitoneal

ABSTRACT

The benefits of ventriculoperitoneal shunts are well known in the management of hydrocephalus. Unfortunately, the complications associated with shunts are not uncommon. The aim of this work is to review the hydrocephalus and its management with discussing the causes of VP shunt malfunction and the obvious means to reduce their complications. The study was done on 50 cases with shunt malfunction, 48% were presented with shunt obstruction while 30% for infection, the remaining 22% of cases for miscellaneous complications. To conclude, selecting the proper device, improving the general condition of patients and good surgical technique can reduce the complications.

Keywords:

Malfunction

Ventriculoperitoneal shunt

Complications

INTRODUCTION

INTRODUCTION

Hydrocephalus is an abnormal accumulation of C.S.F within the ventricle and subarachnoid spaces; it is often associated with dilatation of ventricular system and increased ICP. It can be classified as obstructive (communicating and non-communicating) or non-obstructive.

Shunting is the standard management for hydrocephalus till now and recently endoscopic third ventriculostomy (ETV). Endoscopic third ventriculostomy is indicated in non-communicating type with obstruction at the level of or distal to the posterior third ventricle as an adequate stenosis or tumors obstructing third or fourth ventricle with high success rates exceeding 75% in carefully selected patients. However limitations include: infants; previous shunting; S.A.H; brain radiation; adhesion and certain tumors **(Sainte Rose et al., 1995)**.

Ventricular shunts are inserted into certain body cavities as in the peritoneum, atrium, pleural cavity, the gall bladder and the subgaleal space. Several types of valves have been designed for shunting, this includes the pressure gradient valves (high and low pressure valves), flow controlled valves, antisiphon devices, gravity compensating devices and the new addition are the programmable valves **(Rekate, 2002)**.

This ideal site for the ventricular catheter tip is just in front of the foramen of Monro, frontal, parietal or occipital **(Albright** *et al.,* **1998)**. No single site has been shown to be superior to the rest, thus the surgeons familiarity with the shunt equipment is an important factor in its selection **(Patrik** *et al.,* **1997)**.

SHUNT MALFUNCTION

Shunt malfunction may result from either under drainage or over drainage of C.S.F.

- Under drainage occurs if shunt becomes obstructed or disconnected. Obstruction may be in the proximal ventricular catheter, the valves, connectors or the distal end. The most common is proximal occlusion occurring in approximately 80% of the time **(Epstein, 2000)**.
- Over drainage may result in slit ventricles, intracranial hypotension and subdural hematoma. About 10-12% of long term shunts will develop one of these within 6.5 years of initial shunting **(Pudenz** *et al.,* **1991)**.

Shunt failure reaches its maximum within the first few months after surgery ranging from 25% to 40% at one year follow up. The risk of failure persists after this critical period and remains approximately 4-5% per year **(Drake** *et al.,* **1994)**.

Patient and Methods:

All patients admitted in Kasr Al-Aini hospitals during the period of three years of the study where shunt insertion or revision will be the material of this study.

The reason of shunting; type of shunting; site of insertion, reason for revision; (proximal and distal); period between initial shunting and revision causes of malfunction are to be discussed.

Aim of Work:

- Review of literature hydrocephalus and its management by shunt.
- Comparative study for the different cranial approaches for shunting.
- Highlighting the etiology of shunt malfunction and the possible ways of management.

REVIEW OF LITERATURE

FUNCTIONAL ANATOMY OF THE CEREBROSPINAL FLUID PATHWAYS

The anatomy of' the major pathways traversed by the cerebrospinal fluid CSF will be considered in the following chapter in a functional sequence. At first, a description of the ventricular system is given, together with its linings. This includes the choroidal plexus; the main site of CSF secretion. It is followed by a description of the drainage mechanism of CSF. Special reference is given to the different physiological barriers of the central nervous system namely the blood-brain, brain-CSI and brain-interstitial fluid barriers.

The ventricular system:

The ventricles of the brain include the paired lateral ventricles, 3rd and 4th ventricles.

Lateral ventricles (ventriculus lateralis): The two lateral ventricles are irregular cavities situated in the lower and medial parts of the cerebral hemispheres, one on either side of the midline. They are separated from each other by a median vertical partition, the septum pellucidum, but communicate with the 3rd ventricle and indirectly with each other through the interventricular foramen of Monro. They are lined by a thin membrane; the ependyma covered by ciliated epithelium and contain cerebrospinal fluid. Each lateral ventricle is a C-shaped cavity which extends from its anterior horn in the frontal lobe in a continuous curve posteriorly (central part), then inferiorly, and finally anteriorly, to end in the temporal lobe as the inferior horn. From its convex posterior surface a posterior horn extends backwards to a variable extent into the occipital lobe **(Gray's Anatomy, 2004)**.

The size and shape of this ventricle is very variable. In the young, the walls lie almost in opposition, while with increasing age and loss of neural tissue the ventricle expands and may reach a considerable size without an increase in its internal pressure **(Gray's Anatomy, 2004)**.

The **anterior horn** or cornu of the lateral ventricle curves inferiorly into the frontal lobe from the interventricular foramen. It is triangular in coronal section .The narrow floor is formed by the rostrum of the corpus callosum; the roof and anterior wall by the trunk and genu of the corpus callosum; the vertical medial wall by the septum pellucidum and column of the fornix; the lateral wall by the bulging head of the caudate nucleus **(Gray's Anatomy, 2004)**.

The **central part** of the ventricle: Also called **body** of the lateral ventricle, it is roofed by the trunk of the corpus callosum. Its medial wall, which decreases in height as it is followed posteriorly, is formed by the fornix and septum pellucidum anteriorly, and by the fornix posteriorly.

The floor consists from lateral to medial of the following structures:

(1) The caudate nucleus.
(2) The thalamostriate vein runs anteriorly in the groove between thalamus and caudate nucleus.
(3) The stria terminalis runs with the thalamostriate.
(4) A narrow strip of the dorsal surface of the thalamus.
(5) The choroid plexus.
(6) The fornix: anteriorly it is a rounded bundle but posteriorly it becomes progressively flattened and extends laterally into the floor of the lateral ventricle.

The posterior horn or cornu begins at the splenium of the corpus callosum, and extends posteriorly into the occipital lobe, tapering to a point. The roof, lateral wall, and floor are formed by a sheet of fibers (tapetum) from the splenium of the corpus callosum. The medial wall is invaginated by two ridges; the upper of these (bulb of the posterior horn) is formed by the fibers of the forceps major **(Gray's Anatomy, 2004)**.

The inferior horn is the direct continuation of the ventricular cavity into the temporal lobe. It runs inferiorly, posterior to the thalamus, and then passes anteriorly, curving medially to end at the uncus. The lateral wall is formed by the tapetum of the corpus