Secondary Third Ventriculostomy in Shunt Malfunction

A Systematic Review Study

Submitted for partial fulfillment of Master degree in Neurosurgery

By

Hazem Gamal Nasser El Sayed
MBBCh
Resident, Neurosurgery department, Faculty of medicine, Ain Shams University

Under supervision of

Prof. Dr. Adel Nabih Mohamed Abd Allah
Professor of neurosurgery, Faculty of medicine,
Ain Shams University

Prof. Dr. Hasan Mohammad Jalalod′din
Associate Professor of neurosurgery, Faculty of medicine,
Ain Shams University

Dr. Omar El Farouk Ahmed Ibrahim
Lecturer of neurosurgery, Faculty of medicine,
Ain Shams University

2017

بسم الله الرحمن الرحيم

***

واتقوا الله ويعلمكم الله

والله

بكل شئ عليم

***

صدق الله العظيم

سورة البقرة الآية 282

Acknowledgement

Words cannot express my deepest gratitude to Prof. Doctor Adel Nabih for his help and guidance throughout this work.

I would also like to offer special thanks to my dear Prof. Doctor Hasan Jalalod'din for his sincere efforts, time and valuable advices that contributed greatly to accomplish this work.

I would like also to thank Doctor Omar El Farok for his time, guidance and unique kindness.

And last but not least my beloved wife for her continuous support and patience

Secondary Third Ventriculostomy in Shunt Malfunction.

Abstract

OBJECT:

This study aims at reviewing available scientific data based on clinical trials about the efficacy of secondary ETV in shunt malfunction that might raise the hope of shunt independence , reduction of shunt related morbidities and reduction of economic burden of shunt hardware usage

METHODS:

The Study review yielded thirteen relevant papers with total number of patients four hundred and ninety seven (497) patients operated for Endoscopic third ventriculostomy in variable cases of Both adult and pediatric patients with hydrocephalus of both communicating and non communicating nature with shunt malfunction.either mechanical failure or shunt infection.Causes of hydrocephalus included tumor, Chiari malformation Types I and II , aqueduct stenosis, spina bifida, post meningitic hydrocephalus and intraventricular hemorrhage (IVH). Successful ETV was defined as resolution of symptoms with shunt independence.

RESULTS:

Secondary ETV showed to be successful in 342 cases (68.8%) in the form of shunt independence and failure in 155 cases (31.18%) with median follow up period 3 years (range 0.5-5.2 years).

CONCLUSIONS:

Success of secondary ETV reaching 68.8% in heterogeneous groups of patients showing heterogeneity in many fields including number of patients, age group, primary etiology of hydrocephalus, presenting cause of shunt malfunction, Shunt-ETV interval , number of previous shunting and also the postoperative management strategy.

KEYWORDS:

“Secondary ETV”,“Endoscopic third ventriculostomy”,“Shunt malfunction”,“Hydrocephalus”, “previously shunted”,“Neuro-endoscopy”.

Contents

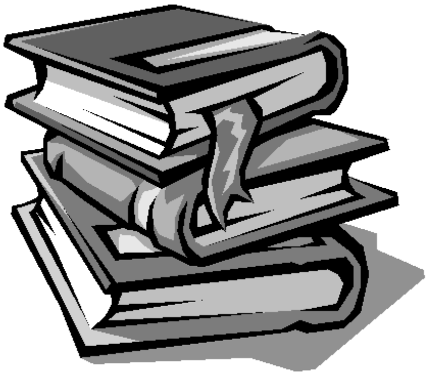
List of abbreviations

AS	**Acqueductal stenosis**
ASDs	**Anti siphon devices**
CNS	**Central nervous system**
CSF	**Cerebro spinal fluid**
CT	**Computed tomography**
IVH	**Intraventricular Hemorrhage**
MRI	**Magnetic resonance imaging**
NPH	**Normal pressure hydrocephalus**
PC MRI	**Phase contrast MRI**
PMH	**Post meningitic Hydrocephalus**
VA shunt	**Ventriculo-atrial shunt**
VP shunt	**Ventriculo-peritoneal shunt**

List of tables

List of Figures

Introduction



Hydrocephalus can be defined as hydrodynamic disturbance of cerebrospinal fluid (CSF) formation, flow, or absorption, leading to an increase in volume occupied by this fluid in the central nervous system (CNS) (1).

In The United States the incidence of congenital hydrocephalus is 3 per 1,000 live births; the incidence of acquired hydrocephalus is not known exactly due to the variety of disorders that may cause it.

Among children and adults in the US, estimates of CSF shunt placements range from 5500 to 18,000 every year , and costs have been estimated at 1 billion dollar (2, 3).

Surgical management is the preferred therapeutic option for hydrocephalus including wide variety of options starting with repeated lumbar puncture, choroid plexectomy and coagulation, CSF diversion classically by shunting and recently endoscopic diversion by either aqueductoplasty or third ventriculostomy procedures (4).

Cerebrospinal fluid shunt placement is the principal therapy in hydrocephalus having broad indications for both communicating and non communicating subtypes.

Only about 25% of patients with hydrocephalus are treated successfully without shunt placement.

These CSF shunts are often complicated by mechanical failure (5, 6) and infection, (7, 8) and complications may lead to multiple hospital admissions for patients with hydrocephalus, both to neurosurgical and general health services.

The risk of shunt malfunction is relatively high 25 to 40% in the first year after shunt placement, 4 to 5% per year thereafter, and 81% of shunted patients require revision after 12 years. Therefore, shunt failure is almost inevitable during a patient’s life (9, 10).

Given this near inevitability of shunt failure, endoscopic third ventriculostomy (ETV) for hydrocephalus was an important advancement for patients with hydrocephalus.

Endoscopic Third ventriculostomy (ETV) although first described as early as 1900s by Walter E. Dandy by both endoscopic and open sub frontal approach witnessed remarkable advances in success rates and also morbidity and mortality reduction with the recent advances in endoscopic and neuro- monitoring tools over the last 4 decades.

ETV main indication is non-communicating hydrocephalus such as cases of aqueductal stenosis either congenital or acquired considered better option than shunting with success rate reaching about 68% (11).

Recently ETV could be advocated in some communicating hydrocephalus cases such as normal pressure hydrocephalus.

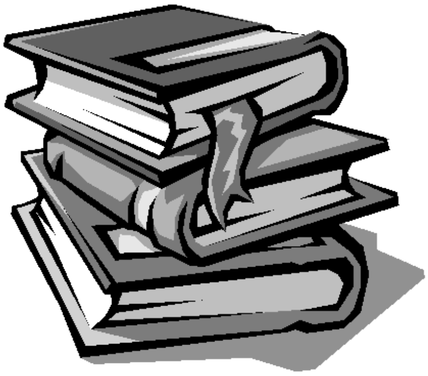
Unfortunately ETV found to have failure rate about 15% in complex hydrocephalus such as post meningitic and post hemorrhagic hydrocephalus where there are both communicating and non communicating elements in spite of patent stoma by post operative imaging (12).

Interestingly, the results are different when ETV is performed after shunt failure (secondary ETV) than when ETV is performed as an initial treatment modality for hydrocephalus (primary ETV).

Primary and secondary ETV outcomes for post-hemorrhagic hydrocephalus are 27% and 71%, respectively, and for post-meningitic hydrocephalus they are 0% and 75%, respectively (13).

This study aims at reviewing available scientific data based on clinical trials about the efficacy of secondary ETV in shunt malfunction that might raise the hope of shunt independence , reduction of shunt related morbidities and reduction of economic burden of shunt hardware usage

Review of Literature



☙ Chapter one ❧

Hydrocephalus

Definition of Hydrocephalus

In 1914 **Prof Walter Dandy** (1) based on clinical observations and pathological dissection classified hydrocephalus to communicating and non communicating subtypes on the basis of ventricular dye injection and recovery from spinal subarachnoid space.

Dandy and Blackfan (14), classified hydrocephalus, in terms of the CSF bulk flow theory. They argued that ventricular enlargement is caused by a backup of CSF flow, caused by obstruction either within the ventricles (non-communicating hydrocephalus) or beyond the ventricles (communicating hydrocephalus).

Rekate (1) proposed definition of hydrocephalus as an active distention of the ventricular system of the brain resulting from inadequate passage of cerebro-spinal fluid (CSF) from its point of production within the cerebral ventricles into its point of absorption within the systemic circulation as illustrated in (**Figure 1**).

This definition exclude other entities of hydrocephalus that doesn't include ventriculo-megaly such as hydrocephalus ex vaco , normal pressure hydrocephalus (NPH) and those with ventriculo-megaly due to another pathology rather than hydrodynamic disturbance in CSF flow such as ventriculo-megaly due to brain atrophy.

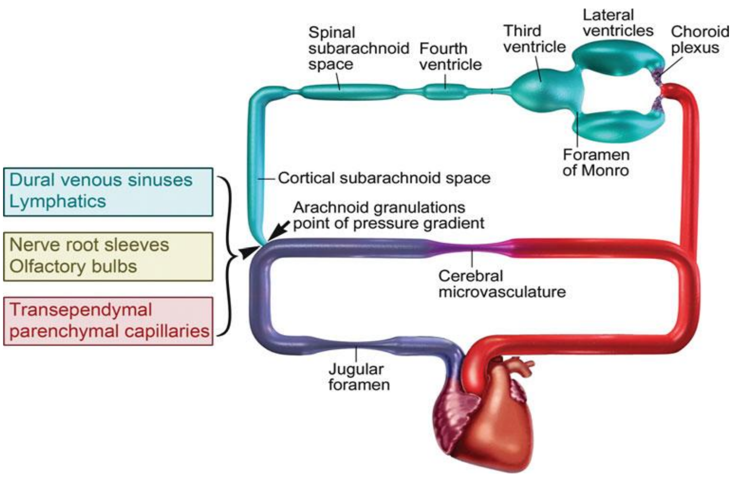


Fig.1 Representing diagrammatic illustration of CSF circulation and ETV bypass mechanism. Rekate et al. (1)

Incidence and prevalence

Hydrocephalus is a common neurosurgical condition affecting humans of all ages with variable effects. Estimated prevalence is 1-1.5% (15).

In The United states the incidence of congenital hydrocephalus is 3 per 1,000 live births; the incidence of acquired hydrocephalus is not known exactly due to the variety of disorders that may cause it (2).

Hydrocephalus is one of the most common conditions treated by pediatric neurosurgeons, with an incidence of 1 in 2000 births (11).

Etiology and patho-physiology of hydrocephalus.

Rather than rare cases of CSF overproduction like cases of choroid plexus papillomas, an obstruction at any point along the CSF pathway may result in hydrocephalus.

It is usual to distinguish between etiologies that lie within the ventricular system or at the fourth ventricular outflow – obstructive hydrocephalus (non-communicating) – and those that impair circulation through the subarachnoid spaces or absorption into the venous system – communicating hydrocephalus (12).

Where the etiology is known, it is possible to further divide hydrocephalus into congenital and acquired forms.

Examples of the various etiologies of hydrocephalus are shown in (**Table 1),** which includes both adult and pediatric hydrocephalus.

Table 1 Etiology of Hydrocephalus

Obstructive HCP	**Communicating HCP**
Congenital	**Congenital**
Acqueduct stenosis Dandy Walker cyst Arachnoid cyst Vascular malformations (Vein of Galen aneurysm)	Arnold Chiari malformation. Encephalocele Skull base deformity
Acquired	**Acquired**
Tumors (Third Ventricle,Pineal body& posterior fossa) Ventricular scarring Other masses (giant aneurysm)	Infection(Post meningitic) Hemorrhage (IVH) Venous Hypertension(sinus thrombosis) Meningeal carcinomatosis CSF over secretion (Choroid plexus papilloma)