ORIGINAL ARTICLE

SHUNT-FREE LIFE AFTER ENDOSCOPIC THIRD VENTRICULOSTOMY IN TRIVENTRICULAR HYDROCEPHALUS: A RETROSPECTIVE OBSERVATIONAL STUDY OF THREE YEARS

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ABSTRACT

Introduction: For many years CSF shunts were proposed as the main and only treatment of choice for Hydrocephalus but due to increased rate of infection, malfunction, surgical revisions and other complications along with the advancement in endoscopic technology, the management of hydrocephalus has been completely revolutionized. The aim of this study was to determine the long term efficacy of Endoscopic Third Ventriculostomy in terms of successful and failed surgical procedures along with intra and post-operative complications.

Material & Methods: This case series study was conducted in department of Neurosurgery Prime Teaching Hospital and Irfan General Hospital Peshawar from February 2019 to January 2022. Consent from was taken from the Ethical Committee of Irfan General Hospital and Prime teaching Hospital. All patients of obstructive hydrocephalus were included. Those patients who had ventriculitis, infected CSF or had undergone a previous ventriculoperitoneal shunt were excluded. All information was put in proforma. Results were analyzed by SPSS version 20 and descriptive statistics were used for demographics and clinical outcomes.

Results: Out of 48 patients, 33 patients (68.7%) were between the ages 1-20 years. The majority of participants were males (68%). ETV was successful in 34 patients (70.8%) with most common cause was Tri ventricular Hydrocephalus 21(43.8%) followed by tumors 16(33.4%). When followed for three years the results of the study showed that ETV was effective in long term as only 14 (29.2%) patients required a revision surgery which was either shunt or redo ventriculostomy while the majority of patients 34(70.8%) remained shunt free. The most common complication reported was CSF leak in 3(6.3%) patients.

Conclusion: The results of our study concluded that endoscopic third ventriculostomy is a safe, effective and advance surgical procedure for patients with obstructed hydrocephalus. Our results also concluded that ETV is effective in long term management and decreases the need for shunt placement. Better surgical outcomes in terms of lower complication rates, decreased hospital stay and no mortality rate were associated with ETV.

Key Words: CSF Leak, Hydrocephalus, Shunt Free, Triventricular Hydrocephalus

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INTRODUCTION

Hydrocephalus is characterized by the symptomatic buildup of the Cerebrospinal fluid (CSF) in the cerebral ventricles with or without changes in intracranial pressure, which may be

attributed to excessive production or obstruction in the normal flow of CSF. Dysfunction in the venous absorption of CSF by the Pacchionian arachnoid granulations also leads to the development of CSF.[1,2] Global prevalence of hydrocephalus is 85 individuals per 100,000 with increased cases among pediatric and elderly population than adults.[3] Tri ventricular hydrocephalus is characterized by enlargement and distention of both lateral ventricles and third ventricle secondary to aqueductal stenosis or obstruction.[4] Communicating and non-communicating (obstructive) hydrocephalus was first described in 1913 by Dandy following which several classifications of hydrocephalus have been proposed. Hydrocephalus has been divided into four types in adults; communicating, obstructive, hyper secretory, and normal pressure hydrocephalus (NPH). Hydrocephalus present at birth also known as congenital or developmental hydrocephalus is often due to spinal dysraphism or genetic syndromes.[5] Non communicating (obstructive hydrocephalus) results from a blockage in the pathways of the CSF. Most common areas of obstruction are foramina Monro, the aqueduct of Sylvius, foramen magnum and the fourth ventricle. Tumors can obstruct the flow of CSF at any point along its pathway and causes hydrocephalus. Choroid plexus papilloma, ependymoma, subependymal giant cell astrocytoma, pituitary adenoma, hypothalamic or optic nerve glioma, craniopharyngioma, hamartoma, and metastatic tumors are some of the frequent tumors associated with Hydrocephalus. Posterior fossa tumors are highly correlated with hydrocephalus.[6] The blockage in flow of CSF after its exit from the ventricles is categorized as communicating hydrocephalus which can be obstructive or non-obstructive. Post hemorrhagic or inflammatory changes accounts for most cases of communicating hydrocephalus while one third of the cases are due to subarachnoid hemorrhage.[7]

Different treatment options are considered due to the diverse etiology and presentation of hydrocephalus. The first ever surgical treatment for HS was performed in 5th century B.C by Hippocrates, the father of medicine. In the beginning of 20th century, endoscopic choroid plexectomy was performed by Lespinass. CSF shunts were proposed as the main and only treatment of choice for Hydrocephalus for many years but due to increased rate of infection, malfunction, surgical revisions and other complications along with the endoscopic technology advancement, the management of hydrocephalus has been completely revolutionized.[8]

Due to advances in operation instruments, neuroimaging and navigation system, the endoscopic third ventriculostomy (ETV) is currently the preferred treatment option as compared to ventriculoperitoneal shunt due to fewer incisions, decreased complication rate and no implanted foreign bodies.[9] Previous studies have determined the clinical outcomes of the ETV. This study aimed to determine the long-term efficacy of Endoscopic Third Ventriculostomy in terms of successful and failed surgical procedure along with intra and post-operative complications, hospital stay and patient satisfaction.

MATERIAL AND METHODS

This case series study was conducted in Department of Neurosurgery, Prime Teaching Hospital and Irfan General Hospital Peshawar from February 2019 to January 2022. Consent from the ethical committee and patients were taken. The total of 48 patients were included in the study through non probability consecutive sampling according to the inclusion criteria. Those patients were included in the study who were diagnosed with obstructed hydrocephalus, had visible pre-pontine cistern on MRI and from the age 1 onward. Patients declining the consent, having ventricultis, infected CSF or who had undergone a previous ventriculoperitoneal shunt were excluded from our study. Failure of ETV was defined as no improvement of symptoms resulting in the requirement of revision surgery for CSF diversion which may be placement of shunt or redo ventriculostomy. Success was defined as no need for shunt in long term. After taking the consent, the Endoscopic third ventriculostomy (ETV) was performed in the participants diagnosed with obstructive hydrocephalus through subjective and physical examination along with the MRI findings.

Procedure:

Patients were positioned in supine lying under general anesthesia. The head was elevated and neck was flexed slightly to decrease the risk of subdural hematoma and post-operative pneumocephalus. At about 2.5 cm lateral to the midline (in mid pupillary line) and 1.5 cm anterior to coronal suture, a horse-shoe incision

was made at the Kocher's point. After that durotomy was performed and trocar inserted. When CSF was seen coming out so the endoscope was introduced in the lateral ventricle. Choroid plexus was identified following which foramen Monro was visualized and third ventricle was identified. Stoma was made behind the posterior clinoid process at the tuber cinereum, just in front of the mamillary bodies and prepontine system was punctured and basilar artery became visible. The Membrane of Liliequist was also punctured. After establishing the alternative CSF pathway from the ventricles to the prepontine system, the endoscope was removed. Thus a passage was created between the third ventricle and pre pontine cisterns for the flow of CSF. After the procedure the patient was then shifted to ICU and radiological assessments were carried out. The Follow up period was from 6 to 8 months.

Clinical outcomes and complications were documented, and data was entered into specifically designed Proforma. Results were analyzed by SPSS version 20. Descriptive statistics were used to find the frequencies and percentages of demographics and clinical outcomes.

RESULTS

A total of 48 patients were selected with ages ranging from 1 year to 60 years with the mean age of 14±5 years. Out of 48 patients, 33 patients (68.7%) were between the ages 1-20 years. The mean duration of follow-up visit was from 6 to 8 months. The majority of participants were males (68%). ETV was successful in 34 patients (70.8%) with no mortality. In first follow up visit a total of 40(85%) patients reported improvement in their symptoms. When followed for three years the results of the study showed that the ETV was effective in long term as only 14 (29.2%) patients required a revision surgery which was either shunt or redo ventriculostomy while the majority of patients 34(70.8%) remained shunt free. The most common cause identified was Tri-ventricular Hydrocephalus 21(43.8%) followed by tumors 16(33.4%), intra op and post op complication was recorded in 9 (18%). Average hospital stay was 3 days. The most common complication reported was CSF leak in 3(6.3%) patients, intra operative hemorrhage in 2 (4.2%) patients and memory issue with 1(2.08%) patient. Post-operative seizures were reported in 3(6.25%) patients.

DISCUSSION

Endoscopic third ventriculostomy is one of the techniques which are very commonly used in neuroendoscopical procedures. It was incorporated primarily for the patients who presented with tri ventricular hydrocephalus with blocked aqueduct of Sylvius and also for patients with the bulged floor of third ventricle. Due to its advancement in the past decades, it is now primarily used not only for the patients of pure obstructive hydrocephalus but also for communicating and normal pressure hydrocephalus. Communicating hydrocephalus due to aqueductal stenosis is the most common indication for endoscopic ventriculostomy.[10] However ETV also has some risks and intra and post-surgical complications. Depending on the etiology of hydrocephalus, the overall prevalence of complications associated with ETV is 8 to 15%. Complications could be intra and post-operative (early :< one month late: > one month) and can range from temporary to permanent disabilities. Intra-operative and early complications include neural injury, seizures, hemorrhage, hypothalamic dysfunction and pneumoventricle.[11]

The results of our study illustrated better long-term outcomes in terms of no need of any surgical procedure following the initial ventriculostomy as only 14 (29.2%) patients required revision surgery in the first two years while majority of patients 34(70.8%) remained shunt free. The findings of our result are consistent with a study carried out in Canada in which 163 patients were followed for 10 years after the initial procedure and demonstrated that over 60% patients remained shunt free and concluded that Endoscopic third ventriculostomy is effective in long term management as compared to ventriculoperitoneal shunt.[12] The reason for this may be attributed to the factor that in all patients who had undergone primary Endoscopic third ventriculostomy with no prior shunt placement, the tuber cinerium is relatively thin which makes the stoma to be remained open for longer durations while those undergoing ventriculoperitoneal shunt has increased risk of stoma closure and chances of shunt failure.

The success rate of endoscopic third ventriculostomy in our study was satisfactory 34 (70.8%) showing good clinical outcomes of the procedure. A randomized study carried out to compare effectiveness of ETV and

ventriculoperitoneal shunt showed success rate of 65.4% of ETV as compared to VP shunt (61.54%) and concluded that ETV should be the first choice of treatment in hydrocephalus.[13] The ETV is effective and safe but good clinical expertise and experience is necessary to further improve the success rate and decrease the complications associated with the procedure.

Better clinical outcomes along with less morbidity and mortality rates are associated with ETV. No mortality was reported in our study while the complications were CSF leak in 3(6.3%) patients, intra operative hemorrhage in 2 (4.2%) and memory issue with 1(2.08%). Post-operative seizures were reported in 3(6.25%) patients. The morbidity rate reported in literature associated with ETV is 0 to 31.2% while the mortality rate is 0.28% to 1.28%. CSF leakage is reported to range from 1.7% to 5.2%. Injury to the basilar artery is also reported in 0.2 to 0.3% of cases.[14]

The results of our study illustrated post-operative seizure after ETV in 2 (4.2%) patients while a case series conducted to evaluate post-operative seizures showed higher incidence of seizures (n=9 24%).[15] The reason of the complication is attributed to the area of hemisphere affected by entry of endoscope as 80% of the post-surgical seizures are attributed to the damage of hemisphere where endoscope is entered.

Only those participants were recruited in the current study that had undergone endoscopic third ventriculostomy for obstructed hydrocephalus and there was no control group for comparison, making it the limitation of the study exposing to risk of bias with no randomization. But the study illustrated the hypothesis on which further higher level evidence can be carried out such as randomized control trials to proof or negate the hypothesis generated through the case series.

CONCLUSION

Our study concludes that endoscopic third ventriculostomy is a safe, effective and advance surgical procedure for patients with obstructed hydrocephalus. Our results also concluded that ETV demonstrates better surgical outcomes in terms of less complication rates, decreased hospital stay and no mortality rate. Introduction of ETV reduces the number of future shunt insertions and hospital admissions there by reducing the cost and improving the quality of life for affected patients.

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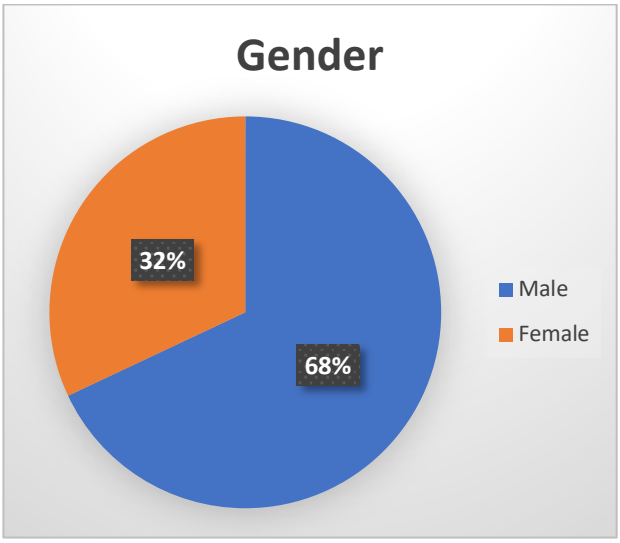

Figure 1: Gender descriptive statistics

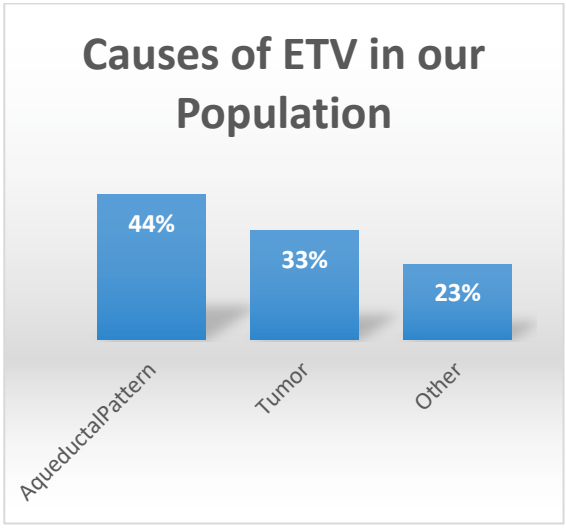

Figure 1: Causes of Hydrocephalus in Our Population

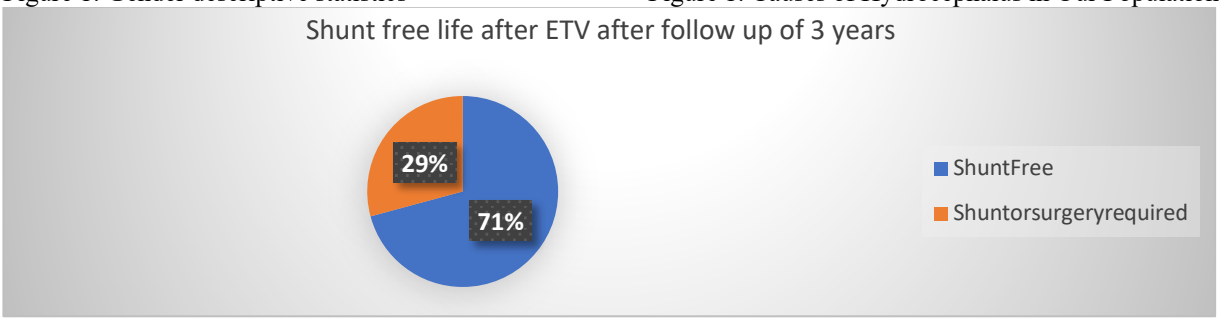

Figure 2: Shunt free life after ETV after follow-up of 3 years

Table 1: Descriptive Statistics of Variables

	Variables	Frequency and percentages
Success of ETV	Successful ETV	34 (70.8%)
Pain relief	Pain relief in 1st follow up visit	40(85%)
Hospital stay	Average hospital stay	3±2.5

Table 2: Descriptive statistics of ETV complications

Complications of ETV	
Intra and post op complications	9 (18%)
CSF leak	3 (6.3%)
Intra operative heamorrhage	2 (4.2%)
Memory issues	1 (2.08%)
Post operative seizures	3 (6.25%)