D:\Nsurg\Vol. 24, No. 3, Jul. – Sep., 2020\Nsurg-5.Doc (A) P. 237 – 242 II

ORIGINAL ARTICLE

Frequency and Pattern of Early Complications after Endoscopic Third Ventriculostomy in Obstructive Hydrocephalus

MUHAMMAD ANWAR ULLAH[1,2], FAHIM ULLAH KHAN[3], MUHAMMAD USMAN[1], MOHAMMAD ISHAQ[1], ZAHID KHAN[1]

[1]Department of Neurosurgery, Lady Reading Hospital, Peshawar
[2]Department of Neurosurgery Unit, DHQ Hospital Timergara
[3]Department of Pharmacy, Abasyn University, Peshawar – Pakistan

DOI: 10.36552/pjns.v24i3.466

ABSTRACT

Objective: *To determine the frequency, pattern and outcome of early complications after endoscopic third ventriculostomy (ETV) in Obstructive hydrocephalus.*

Material and Methods: *The study included 160 patients from Neurosurgery department, Lady Reading Hospital Peshawar and private clinics over a period of twelve months. After performing ETV under general anesthesia by a single expert neurosurgeon, the patients were followed up for seven days post operatively for the CSF leak, wound infection, meningitis, seizures, bleeding and in hospital death.*

Results: *Eighty five percent of the patients had no untoward complications, while 15% showed complications including CSF leak (5%), wound infection (3%), meningitis (2%), seizures (2%), bleeding (2%) and in hospital death (1%).*

Conclusion: *Due to the less invasive nature, endoscopic third ventriculostomy is favored for treating obstructive hydrocephalus in select patient population as it is safe and have better outcomes.*

Keywords: *Endoscopic third ventriculostomy, Obstructive hydrocephalus, CSF leak, Complications.*

Abbreviations: *ETV: Endoscopic Third Ventriculostomy. CSF: Cerebrospinal Fluid. CT Scan: Computed Tomography Scan.*

INTRODUCTION

The development of unidirectional valve systems, connected to biocompatible silicon catheters, the ventriculo-artrial and ventriculo-peritoneal shunts remained first line treatment options for the management of all types of hydrocephalus for over 40 years.[1] The technical developments on the valves, led to the creation of autoregulating, antisiphon, externally adjustable and gravitational valves.[2] The aim of these developments was to assure continuous and stable flow independent of the horizontal or upright position of the patient and the individually required pressure to reduce the hydrocephalus and evading the over drainage. These means are helpful to avoid the risk of hydraulic mismanagements leading to over or underdrainage but the major problems associated with the shunt implantation persist i.e., shunt infection and shunt dysfunction.[2,3]

These two complications led the neurosurgeons to search new modalities to manage obstructive hydrocephalus. One such possible alternative for shunt implantation was the inner shunting by puncturing floor of the third ventricle and communicating with the basal cisterns. Walter Dandy[4] in 1922 used ventriculostomy to visualize the ventricles using subfrontal approach and then modified it to the lateral subtemporal route. Stookey and Scarff further improved this technique by puncturing lamina

Date of Submission: 1-6-2020
Date of Printing: 30-9-2020

terminalis and third ventricular floor from subfrontal approach.[5] For the first time, Mixter was the one who used an endoscope for making the stoma in the floor of the third ventricle through the transventricular approach.[6] ETV has been revolutionized the treatment of obstructive hydrocephalus with enhancement of the tools, especially working channels within the endoscopic sheath, and also optic quality improvements play a pivotal role in this aspect.[7,8] Obstructive hydrocephalus could be safely and effectively treated by ETV, which is to make stoma in floor of the third ventricle, results in communicating third ventricle with the basal cisterns, hence allowing free CSF flow.[9] McNickle in 1947, described Ventriculostomy as "an attempt to bypass obstruction".[10]

In the literature the complication rate for the ETV ranges between 2 – 15%, having very rarely permanent debilitating complications. Having said that, complications like gaze palsy, fever, altered consciousness, diabetes insipidus, precocious puberty, hemiparesis, memory disorders, weight gain and bleeding have been reported.[11-13] Other complications, which are presented by some other researchers in this filed are, intraventricular, intracerebral, or subdural hemorrhage, hypothalamic injury, CSF leak, basilar artery injury, CNS infection, subdural hygroma or hematoma, headache due to sub dural air collection over the frontal cortex, and epilepsy, having a complication rate with the frequency of 8.5%.[12]

The aim of the current study was to address the ETV in obstructive hydrocephalus patients in terms of determining the pattern and frequency of the complications as well as the outcome of the procedure. Furthermore, to assess the improvement in the level of care for patient of obstructive hydrocephalus.

MATERIAL AND METHODS

Study Design

This descriptive study was carried out at the Neurosurgery department of Lady Reading Hospital, Peshawar and private clinics over a period of 1 year (March 2016 to February 2017). Ethical approval was sought out before starting the study, through hospitals research and ethical committee under *reference number 406/LRH*. Those patients who fulfilled the inclusion criteria were included in the study through emergency or outpatient and were admitted to the neurosurgery ward for further workup. The purpose and benefits of this study were made clear to the patients in the language they understood and a written informed consent was obtained.

Sample Size

Our sample size was 160 cases with 95% confidence interval, 4.4% margin of error and 8.8% proportion of complication rate using World Health Organization (WHO) sample size calculations.[12] The consecutive non probability sampling technique was used.

Inclusion Criteria

The inclusion criteria encompassed all the patients with obstructive hydrocephalous and patients of either sex with the age range of 6 months to 60 years.

Exclusion Criteria

While, patients with lesion near a basilar artery or in the third ventricular floor, and patients with third ventricular size less than seven millimeters, diagnosed by computerized tomography scan were excluded from the study.

Data Collection

Detailed history, examination and baseline investigations, including imaging; such as CT Scan in all patients, while MRI brain in those patients, who could afford were done. All the demographics were recorded on a predesigned proforma including name, age, gender and address. The authenticity of the exclusion criteria was maintained to rule out any bias. All the study participants were put on next available OR list, after optimization for the general anesthesia.

Surgeries

On next available elective list surgery was performed by a single Neurosurgeon with minimum of five years of post-fellowship experience. The patients were then followed up till 7 days' post operatively, for CSF leak, wound infection, meningitis, seizures, bleeding and in hospital death. Wound swab and CT scanBrain were carried out for the management of these complications.

Data Analysis

SPSS version 22 was used for data analysis, which was collected on pre-designed forms. For quantitative variables like age, mean ± SD was calculated. While, for categorical variables like gender, overall complications and pattern of complications (CSF leak,

wound infection, meningitis, seizures, bleeding and in hospital death), frequencies and percentages were calculated. Stratification was done for complications and pattern of complications among gender and age to see the effect modification using chi square test with p value of ≤ 0.05 kept at significant.

RESULTS

Age and Gender Distribution:

Age distribution among 160 patients shows, 72% patients (n = 115) were < 5 years of age, 10% (n = 16) were 6 – 15 years of age, 7% (n = 11) were 16 – 25 years of age, 6% (n = 10) were 26 – 35 years of age and 5% (n = 8) were 36 – 45 years of age. Mean age was 4 ± 2.16 years.

Gender distribution among 160 patients showed that 56% patients (n = 90) were male and 44% (n = 70) were female.

Complications:

Frequency of complication among 160 patients was analyzed as, 24 (15%) patients had complications while, 136 (85%) patients did not have any complications.

Patterns of complications among 160 patients showed that, 5% patients (n = 8) had CSF leak, 3% (n = 5) had wound infection, 2% (n = 3) Meningitis, 2% (n = 3) seizures, 2% (n = 3) had minor bleeding while 1% (n = 2) had in hospital death.

Stratification of complication and their patterns with age and gender is shown in Table 1 and Table 2 respectively.

Table 1: *Stratification of Patterns of Complications with respect to Age Distribution (n = 160).*

Complications		< 5 Years	6 – 15 Years	16 – 25 Years	26 – 35 Years	36 – 45 Years	Total	p-value
CSF Leak	Yes	3	2	1	1	1	8	0.2731
	No	112	14	10	9	7	152	
Total		115	16	11	10	8	160	
Wound Infection	Yes	3	1	1	0	0	5	0.6461
	No	112	15	10	10	8	155	
Total		115	16	11	10	8	160	
Meningitis	Yes	3	0	0	0	0	3	0.8787
	No	112	16	11	10	8	157	
Total		115	16	11	10	8	160	
Seizures	Yes	3	0	0	0	0	3	0.8787
	No	112	16	11	10	8	157	
Total		115	16	11	10	8	160	
Bleeding	Yes	3	0	0	0	0	3	0.8787
	No	112	16	11	10	8	157	
Total		115	16	11	10	8	160	
In Hospital Death	Yes	2	0	0	0	0	2	0.9394
	No	113	16	11	10	8	158	
Total		115	16	11	10	8	160	

Table 2: *Stratification of Patterns of Complications with respect to Gender Distribution (n = 160).*

Complications		Male	Female	Total	P value
CSF Leak	Yes	4	4	8	0.7147
	No	86	66	152	
Total		90	70	160	
Wound Infection	Yes	2	3	5	0.4568
	No	88	67	155	
Total		90	70	160	
Meningitis	Yes	2	1	3	0.7135
	No	88	69	157	
Total		90	70	160	
Seizures	Yes	2	1	3	0.7135
	No	88	69	157	
Total		90	70	160	
Bleeding	Yes	2	1	3	0.7135
	No	88	69	157	

Total		90	70	160	
In Hospital Death	Yes	1	1	2	0.8577
	No	89	69	158	
Total		90	70	160	

DISCUSSION

Hydrocephalus is widespread problem having approximately 1 – 1.5% prevalence. Management protocols included diversion, either intracranial or extracranial.[14] In the past few decades, much progress has been made in shunt technology, but the treatment of hydrocephalus still remains a challenge which has led the neurosurgeons for alternate options.

Our study showed that the majority of patients (72%) were under 5 years of age. The mean age of our patients was 4 ± 2.16 years. Among all the patients, 56% were male and 44% female. Overall, 24 (15%) patients had complications in which 5% patients had CSF leak, 3% wound infection, 2% meningitis, seizures and bleeding each, and 1% patient had in hospital death.

In literature the complication rate of ETV ranges between 2 – 15%, but in few studies it reaches as high as 30%. The complication rate of our study is compatible with the literature.[11,12]

The reported frequencies of CSF leak after ETV for obstructive hydrocephalus include 1.8%, 5.16% and 10.2%.[13,15,16] In our study, the rate of CSF leak was 5% (8 patients). Out of those 8 patients, 7 recovered with conservative treatment in the form of spinal tap, while 1 patient developed meningitis, who also recovered subsequently after a period of 3 weeks, with conservative treatment.

Three percent (n = 5) of our patients developed wound infection. All of these were treated with broad spectrum antibiotic at first, 2 of them responded. In one patient, it did not work, so swab was sent and later put on swab C/S specific antibiotic and patient improved. In the literature wound infection is reported to be 1.8%[16] and 6.25%[17].

Meningitis, seizures and bleeding was seen in 2% each in our study. Meningitis was treated conservatively and later on patients improved. One patient who developed post-operative seizures, expired despite of maximum doses of anti-epileptics and other supportive treatment, while the rest were improved with medications. The bleeding occurred in 2% of our patients that was pre-operative and settled down with continuous irrigation during the procedure. In one patient the small bleeding vessel was also cauterized. These complications were also somewhat comparable with the literature.[12,13,15-16].

The mentioned mortality rate after ETV in the literature is ranges from 0.22%[17] to 10.3%[18]. In our study it was 1% (2 patients). As mentioned earlier, one patient died because of seizures, while other due to bad chest.

Endoscopic third ventriculostomy is contemplated as a first line treatment modality for curing obstructive hydrocephalus. Because of its less invasive nature, it is a preferred treatment option. Moreover, ETV also evades the drawbacks associated with shunt implantation. In our opinion, ETV is a safe and effective treatment in select cases with a better ETV outcome.

Limitations

This study was carried out in Peshawar so patients from that particular area were enrolled in this study. The results of this study could not be generalized to the entire Pakistani population.

CONCLUSION

Our results demonstrated that Endoscopic third ventriculostomy can be considered as a treatment modality of choice for obstructive hydrocephalus. Post-operative complications were minimal with only 1% mortality rate in our series. We concluded that proposed study unlocks a novel opportunity in that respect that ETV is a successful treatment for treating obstructive hydrocephalus. ETV, if executed properly, can be a potentially simple, effective and safe treatment procedure of choice with a tolerable level of complications.

REFERENCES

1. Grunert P, Charalampaki P, Hopf N, Filippi R. The role of third ventriculostomy in the management of obstructive hydrocephalus. Min-Minimally Invasive Neurosurgery, 2003; 46 (01): 16-21.
2. Aschoff A, Kremer P, Hashemi B, Kunze S. The scientific history of hydrocephalus and its treatment. Neurosurg Rev. 1999; 22 (2-3): 67-93.
3. Bayston R. Hydrocephalus shunt infections. J Antimicrob Chemother. 1994; 34 (suppl_A): 75-84.
4. Dandy W. An operative procedure for hydrocephalus. Bull Johns Hopkins Hosp. 1922; 33: 189-90.
5. Scarff JE. Treatment of obstructive hydrocephalus by

puncture of the lamina terminalis and floor of the third ventricle. J Neurosurg. 1951; 8 (2): 204-13.
6. Mixter W. Ventriculoscopy and puncture of the floor of the third ventricle: preliminary report of a case. Bost. Med. & Surg. J. 1923; 188 (9): 277-8.
7. Hirsch J-F. Percutaneous ventriculocisternostomies in non-communicating hydrocephalus. Shunts and Problems in Shunts: Karger Publishers; 1982: p. 170-8.
8. Jones RF, Kwok BC, Stening WA, Vonau M. The current status of endoscopic third ventriculostomy in the management of non-communicating hydrocephalus. Minim Invas Neurosur. 1994; 37 (01): 28-36.
9. Greenberg M. Handbook of Neurosurgery. 6-th ed. New York, 2006: 289-365.
10. Kulkarni AV, Riva-Cambrin J, Browd SR. Use of the ETV Success Score to explain the variation in reported endoscopic third ventriculostomy success rates among published case series of childhood hydrocephalus. J Neurosurg Ped. 2011; 7 (2): 143-6.
11. Yadav YR, Parihar V, Pande S, Namdev H, Agarwal M. Endoscopic third ventriculostomy. J Neurosci Rural Pract. 2012; 3 (2): 163.
12. Sokal P, Birski M, Rusinek M, Paczkowski D, Zieliński P, Harat A. Endoscopic third ventriculostomy in treatment of hydrocephalus. Videosurg Other Miniinvasive Tech. 2012; 7 (4): 280.
13. Yadav YR, Parihar V, Agrawal M, Bhatele PR. Endoscopic third ventriculostomy in tubercular meningitis with hydrocephalus. Neurology India, 2011; 59 (6): 855.
14. Brohi SR, Brohi AR, Sidiqui MA, Mughal SA, Saeed S. Outcome of endoscopic third ventriculostomy in hydrocephalus. J Surg Pak. 2010; 15 (1): 25-8.
15. Ali M, Usman M, Khan Z, Khan KM, Hussain R, Khanzada K. Endoscopic third ventriculostomy for obstructive hydrocephalus. J Coll Physicians Surg Pak. 2013; 23 (5): 338-41.
16. Mohanty A, Santosh V, Devi BI, Satish S, Biswas A. Efficacy of simultaneous single-trajectory endoscopic tumor biopsy and endoscopic cerebrospinal fluid diversion procedures in intra-and paraventricular tumors. Neurosurg Focus, 2011; 30 (4): E4.
17. Chen CC, Kasper E and Warnke P. Palliative stereotactic-endoscopic third ventriculostomy for the treatment of obstructive hydrocephalus from cerebral metastasis. Surg Neurol Int. 2011; 2: 76.
18. Feng H, Huang G, Liao X, Fu K, Tan H, Pu H, et al. Endoscopic third ventriculostomy in the management of obstructive hydrocephalus: an outcome analysis. J Neurosurg. 2004; 100 (4): 626–33. Doi: 10.3171/jns.2004.100.4.0626.

Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study was conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Address for Correspondence:
Dr. Muhammad Usman
Department of Neurosurgery, Lady Reading Hospital, Peshawar - Pakistan
Email: drusman387@yahoo.com

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Muhammad Anwar Ullah	Conception and study design, data collection, drafting, final approval of the version to be published.
2.	Fahim Ullah Khan	Literature search, critical review, final approval of the version to be published.
3.	Muhammad Usman	Drafting, Data analysis, Critical review, final approval of the version to be published.
4.	Mohammad Ishaq	Data interpretation, Data analysis, final approval of the version to be published.
5.	Zahid Khan	Data collection, drafting, final approval of the version to be published.

Date of Submission: 01-06-2020
Date of Revision: 01-7-2020
Date of Online Publishing: 25-09-2020
Date of Print: 30-09-2020