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Original Article

Early Complications of Endoscopic Third Ventriculostomy in Obstructive Hydrocephalus

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ABSTRACT

Obstructive hydrocephalus (HCP) occurs when cerebrospinal fluid is blocked leading to the enlargement of ventricular pathways stream resulting into increase pressure within skull. Endoscopic third ventriculostomy (ETV) is considered an effective management strategy for hydrocephalus especially for third/fourth ventricle level. **Objective:** To study the per-operative and post-operative early complications of endoscopic third ventriculostomy in obstructive hydrocephalus patients. **Methods:** This prospective study was conducted at Department of Neurosurgery, Liaquat University Hospital, Hyderabad, from 1st January 2020 to 31st December 2022. One hundred and fifty patients were included. All the cases, were underwent general anesthesia and elective surgery was performed in them. The patients were followed post operatively for 7 days in context to cerebrospinal fluid (CSF) leakage, wound infection, bleeding, seizures as well as meningitis. **Results:** Seventy six (50.7%) were males and 74 (49.3%) were female. Mean age was 5.5 ± 2.3 years with maximum number of patients (70.7%) were under or equal the age of 5 years. Complications occurred in 18 patients (12%) out of 150 patients. Cerebrospinal fluid leakage was the most common complication occurred in 5 (3.33%) patients, wound infection was seen in 2 (1.3%) patients, meningitis developed in 3 (2%) patients, minor bleeding was seen in 3 (2%) patients, seizures developed in 4 (2.6%) patients, in hospital mortality occurred in 1 (0.66%) patient on 3rd post-operative day. **Conclusions:** Ventriculostomy appeared to be the better surgical approach for obstructive hydrocephaly management. Minimum numbers of associated complications were observed in present study group.

INTRODUCTION

Obstructive hydrocephalus (HCP) occurs when cerebrospinal fluid is blocked leading to the enlargement of ventricular pathways stream resulting into increase pressure within skull. This is commonly caused by Aqueductal stenosis and tumors leading to blockage of one or more of the passages which are responsible for ventricle connection. In a systematic review and meta-analysis of population-based epidemiological studies, overall hydrocephalus global prevalence of 85/100,000. When stratified by age groups, the global prevalence of hydrocephalus is 88/100,000 in the pediatric population, 11/100,000 in adults and 175/100,000 in the elderly and potentially >400/100,000 in those >80 years of age [1]. The prevalence of hydrocephalus is significantly higher in Africa and South America when compared to other continents. Endoscopic third ventriculostomy (ETV) is considered an effective management strategy for hydrocephalus especially for third/fourth ventricle level [2, 3]. Endoscopic third ventriculostomy is a surgical procedure in which small stoma has to be created on the floor of third ventricle to divert CSF pathways from ventricular system to inter-peduncular and pre-pontine cisterns to bypass CSF ventricular pathway, lessen the symptoms of hydrocephalus [4, 5]. Large number of

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studies performed on pediatric population demonstrated that children gave inherent results which show favorable outcomes in surgery. Although large number of ETV complications are due to the procedure itself but overall mortality rate is ranging between 0.2-1.2%. Morbidity risk is also associated with this therapeutic procedure which is up to 2.38% [6-8]. The endoscopic third ventriculostomy has revolutionized the world of medical sciences by increasing the life expectancy and quality of life of hydrocephalus patients. Certain complications are also associated with this surgical procedure including fever, diabetes insipidus, gaze palsy, hemiparesis, impaired consciousness, memory disorders, uncontrolled bleeding as well as precocious puberty. Some other related implications such as CNS infection, subdural hemorrhage, CSF leakage, hematoma and epilepsy are also reported by few other researchers as well [9-12].

Present study was designed for the estimation of pre-operative and post-operative early complications of endoscopic third ventriculostomy in obstructive hydrocephalus in a hospital based study setting of Pakistan.

METHODS

This prospective study was conducted at Department of Neurosurgery, Liaquat University Hospital Hyderabad from 1st January 2020 to 31st December 2022 after approval ref no. LUMHS/NS/075. Patients fulfilling the inclusion criteria as suffering from obstructive hydrocephalus and admitted in neuro-surgery ward for their further workup were included in the study. Non-probability consecutive sampling technique was used for data collection. A total of 150 cases was enrolled post sample collection through WHO sample size calculator-based Software applying 5% margin error and 95% confidence interval. Those cases having lesion close to basilar artery or in the region of third ventricle floor were excluded from the study. In addition to this, cases having third ventricle measurement less than 7mm, and diagnosed through CT scan for the same were also excluded from the research. Patient's complete clinical history, clinical examination and diagnostic examination which included computerized tomography, imaging and magnetic resonance indexing of brain were documented through a well-structured questionnaire. The clinical as well as demographic information related to the patient were also recorded in the questionnaire. All the cases, were underwent general anesthesia and elective surgery was performed in them. The patients were followed post operatively for 7 days in context to Cerebrospinal Fluid (CSF) leakage, wound infection, bleeding, seizures as well as meningitis. Gender, overall complications, and pattern of problems (e.g., cerebrospinal fluid leak, wound infection, meningitis, seizures, hemorrhage, and in-hospital mortality) were estimated using frequencies and percentages. The data were entered and analyzed through SPSS version 26.0 for analysis.

RESULTS

The mean age of the study participants was5.5±2.3 years with maximum number of patients (50.7%) were under or equal the age of 5 followed by 22.6% in the age group of 6-10 years whereas least number of patients were observed in >20 years age group (8.7%). There were 76 (50.7%) males and 74 (49.3%) females (Table 1).

Table 1: Demographic Characteristics of Patients (n=150)

Variables	Frequency (%)
Age (Years)	
≤5	76 (50.70)
6 to 10	34 (22.6)
11 to 15	13 (8.7)
16 to 20	14 (9.3)
>20	13 (8.7)
Gender	
Female	74 (49.3)
Male	76 (50.7)

The various complications observed in the cases were CSF leakage, seizures, minor bleeding, meningitis, wound infection and in hospital mortality (Table 2).

Table 2: Distribution of Complications among Cases (n=150)

Complications	Frequency (%)
CSF Leakage	5 (3.3)
Wound Infection	2 (1.3)
Meningitis	3 (2)
In-Hospital Mortality	1 (0.6)
Minor Bleeding	3 (2)
Seizures	4 (2.6)
Total No.	18 (12)

There was a higher risk of complication within the early years of life. The highest numbers of cases were observed in cases ≤ 5 years of age, followed by those within the age group of 6-10 years. There was no case of meningitis, seizures and bleeding in patients >10 years (Table 3).

Table 3: Comparison of Complications According to Age (n=150)

Complications	Age (Years)				
	≤5	6-10	11-15	16-20	>20
CSF Leakage	3 (2%)	1 (0.6%)	-	-	1 (0.6%)
Wound Infection	1 (0.6%)	1 (0.6%)	-	-	-
Meningitis	2 (1.3%)	1 (0.6%)	-	-	-
In-Hospital Mortality	1 (0.6%)	-	-	-	-
Minor Bleeding	2 (1.3%)	1 (0.6%)	-	-	-
Seizures	3 (2%)	1 (0.6%)	-	-	-

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DISCUSSION

Hydrocephalus is a prevalent disorder approximately ranging between 1-1.5% all over the globe. In the past decade, much progress has been made in the management of this disorder. Shunt was more commonly used in previous times but due to large number of associated risk, its usage has been extensively declined in recent years. Advancement in the field of medical sciences led to the development of more appropriate protocol adoption for the treatment of obstructive hydrocephalus. Ventriculostomy is an advanced protocol for hydrocephalus management. In present study, per-operative and post-operative early complications of endoscopic third ventriculostomy in obstructive hydrocephalus patients were observed and recorded [13-15]. In the present study, majority of the patients were less than 5 years of age. Among patients, almost equal number of males and females were observed in present study. Cerebrospinal fluid leakage appeared to be the most prominent complication associated with ventriculostomy followed by seizures, meningitis, minor bleeding and meningitis. Literature also reported the similar values for complication rate and associated implications for ventriculostomy [16-19].Different studies reported CSF leakage is the most prominent and frequent complication observed in endoscopic third ventriculostomy [20, 21]. In current study leakage occurred in 5 patients (3.3%). In the studies by Jung et al., and Bouras and Sgouros reported cerebrospinal fluid leakage in 1.61% of patients [22, 23], and in another study it is reported as 1.7% and go as high as 5.2% in literature, CSF leakage rate is little bit higher in our study. This can be caused by increased intraventricular pressure which generally occurs post-operatively. It is normally considered as the first sign of ETV failure but can be recovered by serial LP and resuturing of the skin incision. Post-operative seizures were seen in 4 patients (2.6%), anti-epileptic drugs were started, 3 patients had good control of seizures one patient suddenly deteriorated and lead to in hospital mortality, Bouras and Sgouros reported 0.21% seizures rate [23]. Wound infection is another major complication that frequently observed in the ETV. In our study wound infection occurred in 2 patients (1.3%) both cases occurred in patients with CSF leakage, treated initially with broad spectrum antibiotics and serial LPs then with antibiotics as per culture. Meningitis and ventriculitis are mainly reported in the range of 0.1-6.1% [24-26]. In present study, 3 patients (2%) developed meningitis in patients with CSF leakage; Bouras and Sgouros [23] reported 1.60% of patients developed meningitis which is close to the rate of current study. Only few studies cite bleeding and mortality related to ETV. Bouras and Sgouros in his review, reports 3.7% of bleeding incidents whereas in other study reports minor bleeding in 16.5% of patients, in present study minor bleeding occurred in 3 patients (2%) [23], which is quite low as compared to previous studies, 2 patients had minor bleeding from stoma edges and 1 patient had venous bleeding around foramen of Monro by traction injury of endoscope, in all patients bleeding stopped spontaneously with irrigation of Ringer's lactate [23, 24]. Present study also highlights 0.6% death rate during hospital stay on 3rd post-operative day after seizures and sudden deterioration. Many of the death cannot be directly linked with ETV procedure and other associated issues [27, 28]. From all the available options for the treatment and management of hydrocephalus, ventriculostomy appeared to be the most suitable option due to its less invasive nature with minimal risk of associated complications, morbidity and mortality with favorable outcome as compared to other available options like shunting as compared to ventriculostomy. Avoidance of multiple-trials, prediction of success rate and pre-operative planning could prove prerequisite for successful endoscopic third ventriculostomy [29-31].

CONCLUSIONS

Ventriculostomy appeared to be the better surgical approach for obstructive hydrocephalus management. Cerebrospinal fluid leakage appeared to be common complication of ventriculostomy followed by seizures, minor bleeding, meningitis and wound infection. Ventriculostomy can be recommended as procedure of choice in obstructive hydrocephalus in terms of early post-operative complications which are well tolerated by the patients.

Authors Contribution

Conceptualization: SP
Methodology: SP, VK
Formal analysis: HU, MHA, SAA
Writing-review and editing: HU, SAA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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