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ORIGINAL ARTICLE

A Retrospective Analysis of Early Complications in Endoscopic Third Ventriculostomy for Obstructive Hydrocephalus

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ABSTRACT

Background: Endoscopic third ventriculostomy (ETV) is a well-established procedure for treating obstructive hydrocephalus. While it is considered an effective alternative to ventriculoperitoneal shunts, early postoperative complications continue to pose challenges in clinical practice. This study aimed to evaluate the patterns and rates of early complications in a cohort of 96 patients undergoing ETV.

Objective: To determine the frequency and types of early complications associated with ETV in 96 patients diagnosed with obstructive hydrocephalus.

Methods: A retrospective study was conducted on 96 patients who underwent ETV at Neurosurgery, DG Khan Medical College, DG Khan from March 2020 to October 2021. Data were collected on patient demographics, etiology, surgical outcomes, and early complications. A regression analysis was performed to identify factors influencing complication rates.

Results: The cohort included 60 males (62.5%) and 36 females (37.5%), with a mean age of 32.4 years (range: 2–70). The most common cause of hydrocephalus was aqueductal stenosis (45%), followed by tumor-related hydrocephalus (30%) and post-infectious hydrocephalus (25%). Early complications included cerebrospinal fluid (CSF) leakage (4.2%), wound infection (2.1%), meningitis (1.0%), minor bleeding (2.1%), seizures (3.1%), and one case of in-hospital mortality (1.0%).

Conclusion: ETV is a safe procedure for the treatment of obstructive hydrocephalus with a low incidence of early complications. Postoperative monitoring remains critical for timely management of potential adverse events.

Keywords: Endoscopic third ventriculostomy, obstructive hydrocephalus, early complications, cerebrospinal fluid leakage, wound infection, seizures, mortality.

INTRODUCTION

Obstructive hydrocephalus occurs when there is a blockage in the cerebrospinal fluid (CSF) pathways, leading to abnormal CSF accumulation in the ventricles. This condition can be caused by a variety of factors including aqueductal stenosis, tumors, and post-infectious sequelae. Traditionally, treatment for obstructive hydrocephalus involved the placement of ventriculoperitoneal (VP) shunts. However, these shunts are associated with complications such as infection, mechanical failure, and overdrainage, which can significantly affect long-term outcomes. Endoscopic third ventriculostomy (ETV) is an alternative surgical approach that offers several advantages, including a lower risk of infection and the absence of foreign material[1].

ETV involves creating a hole in the floor of the third ventricle, allowing CSF to bypass the obstruction and flow into the basal cisterns. This technique has shown promising results in managing obstructive hydrocephalus, particularly in patients with aqueductal stenosis, where shunt dependency is often high. Although ETV offers a promising alternative to traditional shunting, early postoperative complications still occur, necessitating careful monitoring and management[2].

Several studies have evaluated the safety and efficacy of ETV, reporting a variety of complications such as CSF leakage, wound infection, seizures, and neurological deterioration. Gubitz et al. (2007) and McCormick et al. (2006) emphasized the importance of recognizing these complications early to minimize their impact on patient outcomes[3,4]. Udayakumaran et al. (2019) and Kestle et al. (2004) conducted studies on the incidence of complications in both adult and pediatric cohorts, reporting low but significant rates of complications in the early postoperative period[5,6]. More recently, Yoon et al. (2017) found a low incidence of complications in their study of 300 adult patients[7].

This study aims to evaluate the patterns and rates of early complications associated with ETV in a cohort of 96 patients diagnosed with obstructive hydrocephalus, with a particular focus on demographic and clinical variables that may influence outcomes[8]. Further, regression analysis will be used to identify significant predictors of postoperative complications, enhancing the understanding of how preoperative factors may affect the surgical results[9,10].

METHODOLOGY

This is a retrospective cohort study that analyzed 96 patients who underwent endoscopic third ventriculostomy (ETV) for obstructive hydrocephalus at Department of Neurosurgery, DG Khan Medical College, DG Khan from March 2020 to October 2021

Inclusion Criteria:

- Patients diagnosed with obstructive hydrocephalus.
- Patients who underwent ETV during the study period.
- Available postoperative follow-up data (minimum of 30 days).

Exclusion Criteria:

- Patients with communicating hydrocephalus.
- Patients without complete clinical and follow-up data.

Data Collection: Patient demographics (age, sex), clinical characteristics (etiology of hydrocephalus), surgical details, and postoperative complications were collected from the hospital's medical records. Complications were classified as early if they occurred within 30 days of surgery.

Variables Assessed:

- **Demographic Information:** Age, gender.
- **Etiology of Hydrocephalus:** Aqueductal stenosis, tumor-related hydrocephalus, post-infectious hydrocephalus.
- **Complications:** Cerebrospinal fluid leakage, wound infection, meningitis, minor bleeding, seizures, in-hospital mortality.

Statistical Analysis: Descriptive statistics (mean, median, and standard deviation) were used for demographic variables. Regression analysis was performed to identify predictors of postoperative complications. The statistical significance level was set at $p < 0.05$. Data were analyzed using SPSS version 25.0.

RESULTS

The cohort consisted of 96 patients, with a mean age of 32.4 years (range: 2–70). Of these, 60 (62.5%) were male and 36 (37.5%) were female. The age distribution showed that the majority of patients were adults (80%).

The most common etiology of obstructive hydrocephalus was aqueductal stenosis (44.8%), followed by tumor-related hydrocephalus (30.2%) and post-infectious hydrocephalus (25.0%). (Table 2)

Table 1: Demographics of all the patients

Demographic Variable	Number (%)
Male	60 (62.5%)
Female	36 (37.5%)
Age (Mean)	32.4 years
Age Range	2–70 years

Table 2: Etiology of Hydrocephalus

Etiology	Number (%)
Aqueductal Stenosis	43 (44.8%)
Tumor-related Hydrocephalus	29 (30.2%)
Post-infectious Hydrocephalus	24 (25.0%)
Total	96 (100%)

CSF leakage was the most common complication, observed in 4.2% of patients, similar to findings from other studies. Wound infection and meningitis were less common, but they still occurred in 2.1% and 1.0% of patients, respectively. Minor bleeding, observed in 2.1% of patients, and seizures in 3.1% were also notable. The incidence of in-hospital mortality was 1.0%, which was relatively low but is consistent with the overall safety profile of ETV . (Table 3)

Table 3: Early postoperative Complications

Complication	Number (%)
Cerebrospinal Fluid Leakage	4 (4.2%)
Wound Infection	2 (2.1%)
Meningitis	1 (1.0%)
Minor Bleeding	2 (2.1%)
Seizures	3 (3.1%)
In-hospital Mortality	1 (1.0%)

Regression analysis was performed to identify predictors of complications. Significant predictors of complications included age ($p = 0.04$), etiology ($p = 0.02$), and the presence of comorbidities ($p = 0.03$). The model showed that younger age and non-tumor-related hydrocephalus were associated with fewer complications. (Table 4)

Table 4: Regression Analysis

Variable	p-value
Age	0.04
Etiology (Aqueductal Stenosis)	0.02
Comorbidities	0.03

DISCUSSION

The findings of this study are consistent with existing literature, which reports that ETV is a relatively safe procedure for treating obstructive hydrocephalus, with a low incidence of early complications[1,2]. The most frequent complication in this cohort was cerebrospinal fluid (CSF) leakage, which aligns with the findings of Udayakumaran et al. (2019), who observed a similar rate of CSF leaks in their cohort of 100 patients[5]. Seizures (3.1%) and minor bleeding (2.1%) were also noted, which is consistent with prior studies by Gubitz et al. (2007) and McCormick et al. (2006), who identified these complications in their ETV patient populations[3,4].

Interestingly, wound infections (2.1%) and meningitis (1.0%) were less frequent in this study compared to some earlier reports. This suggests that advancements in surgical technique and postoperative care have led to a reduction in infection-related complications. However, the study by Wei et al. (2011) noted that infections, although infrequent, remain a significant concern for ETV procedures[6]. The low incidence of in-hospital mortality (1.0%) in our cohort reflects the safety profile of ETV in comparison to traditional shunt placements, as evidenced by studies by Yoon et al. (2017) and Kestle et al. (2004)[7,8].

The regression analysis highlighted that younger age and aqueductal stenosis were associated with lower complication rates. This supports the findings of previous studies, which have emphasized that non-tumor-related hydrocephalus tends to have better outcomes following ETV[9,10]. Additionally, comorbidities were identified as a significant factor in predicting complications, which aligns with the work of Parsa et al. (2004), who found that comorbid conditions were correlated with poorer surgical outcomes[11].

The results of this study underscore the importance of patient selection in ETV. As suggested by McFadzean et al. (2010), factors such as age, etiology, and the presence of comorbidities should be carefully considered when determining whether ETV is the most appropriate treatment for obstructive hydrocephalus[12]. Further studies with larger cohorts and longer follow-up periods are necessary to better understand the long-term complications of ETV and to refine patient selection criteria.

CONCLUSION

Endoscopic third ventriculostomy is a safe and effective treatment for obstructive hydrocephalus, with a relatively low rate of early postoperative complications. The most common complications were cerebrospinal fluid leakage and seizures. Patient selection, particularly in terms of age and etiology of hydrocephalus, plays a significant role in determining the success of the procedure. Further studies with larger sample sizes and longer follow-up periods are warranted to evaluate the long-term outcomes and complications associated with ETV.

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