

ORIGINAL ARTICLE

Neuroendoscopic Management of Hydrocephalus in Children

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DOI: <https://doi.org/10.36552/pjns.v23i3.360>

ABSTRACT

Objective: To determine the Neuroendoscopic management of hydrocephalus in children.

Materials and Methods: The study was conducted at the Department of Neurosurgery, Peoples University of Medical and Health Science for women Nawabshah from January 2014 to May 2015. All of the patients with hydrocephalus diagnosed on history, clinical examination and CT scan included in the study. Subjects with co-morbidities such as uncontrolled diabetes, cardiac diseases or uremia were excluded. Patients with age of 6 months to 13 years either gender were included in the study. Aesculap rigid rod lens neuroendoscope with 0 degree was utilized. Warm ringers were utilized for irrigation, a Fogarty embolectomy catheter was utilized for ETV. Hemostasis was accomplished with irrigation, tamponade or coagulation. Endoscopic third ventriculostomy (ETV) was labeled successfully when characteristics of intracranial hypertension (ICP) clinically improved and the size of ventricular decreased on post-operative CT scan. All the data was recorded in the Proforma.

Results: Thirty patients with male to female ration 2.5:1 were administered. Age ranged between 6 months and 12 years with a mean of 22.03 months. There were 15(%) cases of Tri Ventricular Hydrocephalus, 10 cases of Tetra Ventricular Hydrocephalus. Two cases of Dandy Walker Hydrocephalus, one case of Asymmetrical Ventricles Hydrocephalus and postoperative fever occurred in two subjects. CSF leak appeared in one patient who was managed conservatively. No operative mortality was found. ETV worked effectively for Hydrocephalus treatment in 99.9% patients included in the study.

Conclusion: Neuroendoscopy is helpful in preventing the practice of shunts for hydrocephalus treatment in children, preventing its cost and complications. Neuroendoscopy is a procedure used in neurosurgery, which is highly frequent for the management of hydrocephalus and intra-ventricular lesions.

Key Words: Hydrocephalus, Neuroendoscopy, children.

INTRODUCTION

Hydrocephalus is the expansion in the ventricular system of the brain due to poor transfer of CSF (Cerebrospinal fluid) from its formation place to absorption place into systemic circulations.¹ At present the most frequently practiced therapeutic options for hydrocephalus treatment are Neuroendoscopic surgery and ventriculoperitoneal shunt. Although each option has some benefits and drawbacks, ventriculoperitoneal shunt methods have the high rate of complication. These frequent complications can be presented as a well-known collection of signs and symptoms. Highest

frequency characterized by drainage method is infection and obstruction, in spite of the technical advancement accomplished in the development of drainage method.² Each of this complication required surgery to treat raising the mortality and morbidity of this logical thing. Neuroendoscopy is an effective alternative for hydrocephalus management.³ Neurosurgeons have been using endoscopy since the early 20th century. During 1918, Walter Dandy being among the earliest surgeons, employed endoscope for choroid plexectomy among four cases of communicating hydrocephalus.⁴ The outcomes were

poor, because 3 of 4 subjects died. Because of these disappointing outcomes Dandy developed a novel method for fenestration of the floor of the third ventricle via a sub-frontal method.⁵ Though this method remained unpopular because it required an optic nerve sacrifice to afford it. Fay and Grant in 1923, successfully visualized and took the photographs of ventricles' interior area of a child, who had hydrocephalus via a cystoscope.⁶ At the same period of time, a Urologist William Mixter first time in history, carried out an ETV. William Mixter utilized a urethroscope for examining the child's ventricles who had obstructive hydrocephalus; and he fenestrated the third ventricle's floor during this method.¹² The ETV intended to form a fresh communication between the subarachnoid space and ventricular system by fenestration of the third ventricle's floor. The developers of EVT such as; Patterson, Hoffman, Hirsh and Bergland, suggested that the technique should just be applied to the cases with non-communicating or obstructive hydrocephalus, among whom typical absorption system of CSF is yet present at arachnoid villi.⁸ Certainly, the literature exhibited ETV to be further effective when hydrocephalus is because of compression of fourth ventricle or aqueductal stenosis or aqueduct by tumors.⁸ Factors of hydrocephalus for example meningitis, intraventricular bleeding and subarachnoid bleeding have been considered by a few authors to exclude subjects from ETV. Though, in recent times these have become comparative contraindications taking into consideration the decrease of the mortality and morbidity of ETV. Current publication has revealed an acceptable outcome of ETV than VP Shunt if its symptom was widened to subjects with Cerebrospinal fluid infection, subarachnoid hemorrhage, intraventricular hemorrhage, normal pressure hydrocephalus (NPH), and further communicating hydrocephalus.⁹⁻¹³ Gangmei et al¹⁴ reported a success rate of ETV up to 73.4% in (33/45) cases with NPH and 60% in (12/20) cases with hydrocephalus (abnormal buildup of CSF) secondary to hemorrhage or infection. The most recent preliminary outcome of a randomized to VP-Shunt (with fixed-pressure valves) to ETV, exhibited that, for VP Shunt, the 12 month improvement rates were 77.0%, while only 50.0% of subjects who experienced ETV exhibited improvement. The variance was significant, statistically.¹⁵ Thus, now it is problematic to support ETV as a standard or improve the perception of pathophysiology of non-obstructive hydrocephalus. Besides the etiology of hydrocephalus,

success rates of ETV at age < 6 months are revealed to have greater rates failure.⁸ This study has been conducted to determine the Neuroendoscopic management of hydrocephalus in children aged 6 months to 12 years.

MATERIALS AND METHODS

Study Design

The current descriptive case study was conducted at the Neurosurgery department of Peoples University of Medical & Health Sciences for Women Nawabshah, from January 2014 to May 2015.

Inclusion Criteria

Patients with hydrocephalus diagnosed on history, clinical examination and CT scan included in the study.

Exclusion Criteria

Subjects with co-morbidity such as uncontrolled diabetes, cardiac diseases or uremia were excluded.

Data Collection

Patients with age of 6 months to 13 years old were included in the study. Aesculap rigid rod lens neuroendoscope with 0 degree was utilized. Warm ringers were utilized for irrigation, a Fogarty embolectomy catheter was utilized for ETV. Endoscopic third ventriculostomy (ETV) was labeled successfully when characteristics of intracranial hypertension (ICP) clinically improved and the size of ventricular decreased on post-operative CT scan. All the data was recorded in the Proforma.

Data Analysis

All data was used for analysis.

RESULTS

Gender

Thirty patients with male to female ration 2.7:1 were managed.

Age

Age ranged 6 months to 8 Years with a mean of 22.03 months.

Type of Hydrocephalus

There were 16 (30.0%) cases of Tri Ventricular Hydrocephalus, 11 (36.7%) cases of Tetra Ventricular Hydrocephalus. 02 (6.7%) cases of Dandy Walker Hydrocephalus and 1 (3.3%) case of Asymmetrical Ventricles Hydrocephalus (Table 1).

Table 1: Patients distribution according to demographic characteristics (n = 30).

Demographic Characteristics	Frequency (%)
Age groups (years)	
> 1	09 (30%)
1 to 3	15 (50%)
4 to 6	05 (16.7%)
7 to 8	01 (03.3%)
Total	30 (100%)
Gender	
Boys	21 (70%)
Girls	09 (30%)
Total	30 (100.0%)
Hydrocephalus classification	
Tri Ventricular Hydrocephalus	16 (53.3%)
Tetra Ventricular Hydrocephalus	11 (36.7%)
Dandy Walker Hydrocephalus	2 (6.7%)
Asymmetrical Ventricles Hydrocephalus	1 (3.3%)
Total	30 (100.0%)

Operative Procedure

Right ETV + Septum Pellucidotomy 53.3%, Right ETV + Septum Pellucidotomy + Irrigation 36.7%, septum pellucidotomy 6.7% and Asymmetrical Ventricles Hydrocephalus was performed in 1 case (Table 2).

Outcome

Management success rate was 86.7%. Postoperative fever occurs in 2 subjects. CSF leak appeared in one

subject, who was managed conservatively. There was no operative mortality and one case failed due to abnormal anatomy (Table 3).

Table 2: Management procedures (n = 30).

Procedure	Frequency	Percent
Right ETV + Septum Pellucidotomy	16	53.3
Right ETV + Septum Pellucidotomy + Irrigation	11	36.7
septum pellucidotomy	2	6.7
Asymmetrical Ventricles Hydrocephalus	1	3.3
Total	30	100.0

Table 3: Neuroendoscopic management outcome (n = 30).

Postoperative Complications	Frequency (%)
Success rate	26 (86.7%)
Fever	2 (6.7%)
CSF leak	1 (3.3%)
Procedure failed	1 (3.3%)
Total	30 (100.0%)

DISCUSSION

In our study, twenty one patients were male, and male to female ratio was = 2.5:1. In comparison to our results, study conducted by Muga et al¹⁶ reported that musculoskeletal system abnormalities highly frequent, after that CNS anomalies, among which the most frequent was hydrocephalus afterward microcephaly and anencephaly and later chromosomal with highly frequent Down's syndrome. Polydactyl was the single most frequent malformation. Males were noted more than females, however, the variance was not significant, statistically. ETV has 2 major purposes: the restoration of CSF communication between the subarachnoid and ventricle space; and the reduction of pulsatile stress via raising conformity of the ventricular walls.¹⁷ ETV was extensively used for hydrocephalus among children as a substitute to CSF shunt primarily in an effort to prevent implantation of foreign entity and to superiorly induce physiological CSF dynamics. Children with shunts depend upon surgery all through their lives.¹⁸ Therefore, the introduction of neuroendoscopy was enthusiastically

received. ETV has been a monotonous surgical procedure for the previous 20 years and offers a substitute to the CSF shunt.

In our study Right ETV + Septum Pellucidotomy was done among most of the cases. In comparison to our results, a study conducted by Vulkaran et al¹⁹ reported that Children can most probably be successful with ETV, currently can be precisely identified and can spare the longstanding complications associated with CSF shunting. Another study conducted by Javadpour et al²⁰ also reported in their results that throughout the follow-up phase, ETV remained evident among 7 (33%) of subjects (n = 21). Their results also suggested that selective application of ETV as a primary administration in babies with hydrocephalus is reliable and can diminish shunted populace of all freshly diagnosed hydrocephalic babies by around 21.0%. Another study conducted by Yadav et al²¹ also reported that ETV was rather safe and useful in typical birth weight full term infants, however in premature low birth weight infants the outcomes were poor.

The results of our study showed that management success rate was 86.7%. Postoperative fever occurs in 2 subjects. CSF leak occurred in 1 subject who was managed conventionally and no operative mortality was found and one case failed due to abnormal anatomy. A study conducted by Brohi et al²² exhibited 68.0% efficacy; which is somewhat lesser than this study, however no significant variance exist, statistically. Long period of follow-up is possibly the factor for slightly lesser success rate within the study by Brohiet al.²² Further studies such as Sufianov et al²³ recounted 71.40% efficacy; which is highly closer to the general efficacy in this study. In comparison to our results, a study conducted by Simone Peraioet et al²⁴ reported that neuroendoscopy contributes significantly in the longstanding administration of complex hydrocephalus, considerably reducing the shunt revision rate and the number of shunts. The total postoperative complication rate was 28.0% (2.90%: subdural collection; 8.80%: shunt malfunction; 16.10%: shunt infection). At final clinical follow-up, 65.0% kids had just 1 shunt, 25.0% had a twofold ventricular catheter, and 10.0% were shunt free. Similar results were also seen in a study conducted by de Ribaupierre et al,²⁵ in which the ETV failure rates were 26.0% and that of VP shunt was 42.0% at follow-up period of 5 years. The similar trend was observed in further series. Kulkarni et al²⁶ also documented that

the RR of ETV failure was initially greater than CSF shunt. Though, the risk turned gradually lower at around 3 months after the process, and was around 50% the risk of shunt failure at 2 years. Other reports also have found similar results.^{27,28}

CONCLUSION

Neuroendoscopy is helpful in preventing the practice of shunts for hydrocephalus treatment in children, preventing its cost and complications. Neuroendoscopy is a technique used in neurosurgery, which is highly frequent for the management of hydrocephalus and intra-ventricular lesions. However, the financial implications are a concern and the reason for its unavailability in most of the public sector hospitals. More similar studies are required on this management.

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Additional Information

Disclosures: Authors report no conflict of interest.

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:

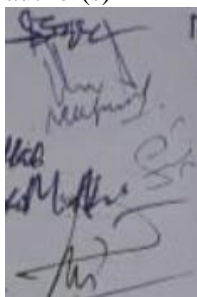
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work

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AUTHORSHIP AND CONTRIBUTION DECLARATION			
Sr.#	Author's Full Name	Intellectual/Contribution to Paper in Terms of:	
1.	Abdul Razaque Mari (Main/Principal Author).	1. Proposed topics and Basic Study Design, methodology.	Signature by the author(s) 
2.	Hamid Akbar Sheikh (2nd Author)	2. Paper writing, referencing, Data Calculations and quality insurer	
3.	Muzzamil Dilber (3rd Author)	3. Data collection and calculations	
4.	Fehmida Arab Mallah (4th Author)	4. Analysis of data and interpretation of results etc.	
5.	Muhammad Ali Jamali (5th Author)	5. Literature review and manuscript writing	
6.	Shamas Raza Brohi (6th Author)	6. Study Design and methodology	

Date of Submission: 06-07-2019
 Date of Revision: 30-07-2019
 Date of Online Publishing: 25-09-2019
 Date of Print: 30-09-2019