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ENDOSCOPIC THIRD VENTRICULOSTOMY VERSUS VENTRICULOPERITONEAL SHUNT IN TREATMENT OF OBSTRUCTIVE HYDROCEPHALUS COMPLICATING PEDIATRIC POSTERIOR FOSSA TUMORS

By

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ABSTRACT

Background: Posterior fossa tumors are the most common solid tumors found in the pediatric population. Approximately, 70–90% of patients with posterior fossa tumors present with hydrocephalus. This presents an interesting problem to pediatric neurosurgeons for which there remains no consensus: What is the best management strategy for hydrocephalus at the time of the initial presentation of the patient?

Objective: This multicenter prospective cohort study compared endoscopic third ventriculostomy (ETV) and ventriculoperitoneal shunt (VPS) in the treatment of pediatric patients with secondary obstructive hydrocephalus due to posterior fossa tumors.

Patients and Methods: Sixty four patients with posterior fossa tumors (24 medulloblastoma, 12 ependymoma, 27 astrocytoma and 1 schwannoma) associated with secondary hydrocephalus were divided into two equal groups according to the treatment procedure done to the secondary hydrocephalus either ETV or VP shunts, with a follow-up period of 6 months, were prospectively studied in this work.

Results: Both procedures (ETV and VP shunt) proved to be effective clinically and radiographically. Endoscopic third ventriculostomy (ETV) proved to be superior due to shorter duration of surgery (17 min versus 58 min), no mortality (0% versus 6.25%), and lower incidence of procedure failure (15.6% versus 21.9%) with highest success rate of 100% was for astrocytomas followed by 80% for ependymomas and 63.6% for medulloblastomas.

Conclusion: Both procedures (ETV and VP shunt) proved to be effective clinically and radiographically in the treatment of secondary obstructive hydrocephalus in pediatric patients with posterior fossa tumors. For ETV, the safety, simplicity, a more physiological of internal shunting, a significantly shorter surgery duration, absence of mortality, lower significant complications rate, a lower rate of procedure failure, the significant advantages of not becoming shunt dependent and avoidance of hardware complications (malfunction, obstruction, infection) and making safe handling and resection of the posterior fossa tumors feasible, all the previous factors made the ETV to be recommended as the first choice in the treatment of pediatric patients with obstructive hydrocephalus due to posterior fossa tumors.

Keywords: Pediatric Patients, Posterior Fossa Tumors, Obstructive Hydrocephalus, VP shunt, Endoscopic Third Ventriculostomy (ETV).

INTRODUCTION

Regarding pediatric posterior fossa tumors with secondary hydrocephalus, early studies have suggested that preresection treatment of hydrocephalus improves surgical resection of these tumors, postoperative mortality, and postoperative course. However, numerous studies have also demonstrated that only 10–40% of patient demonstrate persistent hydrocephalus after tumor resection ***(Lin and Riva Cambrin, 2015)***.

In an attempt to minimize the placement of permanent shunts and avoid the associated complications, endoscopic third ventriculostomy is a plausible choice for the emergency control of severe hydrocephalus caused by posterior fossa tumors. It can quickly eliminate symptoms and, in addition, it eliminates the risk of the cerebrospinal fluid infection related to external drainage and avoids complications of shunting like shunt infection and failure. It has also been suggested that in developing countries, where the disease is usually diagnosed in the later stages and the increase in ICP is more severe at the time of diagnosis, preoperative shunting, or ETV is advisable ***(Bhatia et al., 2009)***.

Endoscopic third ventricolostomy is a surgical procedure that allows the CSF to flow directly from the third ventricle to the basal cisterns and subarachnoid spaces, thus bypassing the aqueduct and the posterior fossa ***(Schroeder et al., 2008)***. The use of cranial endoscope for performing third ventriculostomy is now universally accepted especially for treating obstructive hydrocephalus ***(Mumtaz et al., 2013)***.

We were mainly trying to compare endoscopic third ventriculostomy (ETV) and ventriculoperitoneal shunt (VPS) in the treatment of pediatric patients with obstructive hydrocephalus due to posterior fossa tumors.

PATIENTS AND METHODS

During the period between September 2013 and September 2016, **sixty four** pediatric patients with posterior fossa tumors (24 medulloblastoma, 12 ependymoma, 27 astrocytoma and 1 schwannoma) and associated with secondary hydrocephalus were treated in Al-Azhar University Hospitals, Ain Shams University Hospitals, Cairo University Hospitals, and Children's Cancer Hospital Egypt (CCHE-57357). They were divided into two equal groups (ETV Group and VP Group) according to the treatment procedure done to the secondary hydrocephalus either ETV or VP shunt. About two thirds of ETV cases were done in Children's Cancer Hospital Egypt (CCHE-57357).

A full history was taken, and all patients were subjected to a complete neurological examination. Preoperative computed tomography (CT) scan and magnetic resonance (MR) imaging were reviewed with special attention being paid to the degree of ventricular enlargement, the presence of periventricular edema, and location of the tumor. The degree of hydrocephalus (mild, moderate, severe) was defined in all cases based on a preoperative CT scan. The maximum width of the lateral ventricles at the frontal horns was divided by the largest transverse diameter of the skull’s internal table, producing a standardized ratio (Evans Ratio or Ventricular Index). Mild, moderate, and severe ventriculomegaly was designated for ratios of 0.27 to 0.34, 0.35 to 0.40, and >0.40, respectively. A ratio of <0.27 was considered to be normal ***(Schmid and Seiler, 1986)***.

Patients were followed-up clinically regarding the clinical symptoms and signs of hydrocephalus and radiologically regarding the radiological data of hydrocephalus for 6 months postoperative scheduled [2 weeks, 1 month, 3 months and 6 months] with imaging studies at 2 weeks and 3 months postoperatively unless clinical deterioration occurred at any time postoperative requiring urgent imaging studies and urgent surgical intervention.

Any recurrence of intracranial hypertension symptoms among the follow-up period was considered to be an indication for repeating the CT scan and/or MR imaging. Any recurrence of hydrocephalus was considered to be a postoperative failure, and it was an indication to perform a revision procedure. Any documented mortality was recorded to be either hydrocephalus-related or non hydrocephalus-related.

Data were collected and summarized in both groups regarding the duration of surgery, improvement of symptomatology, improvement of hydrocephalus, success versus failure rate, incidence of surgical complications, postoperative failure, and incidence of revision of the CSF diversion procedure. Data of both groups were analyzed and compared using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage, and the following tests were done: Independent-samples t-test of significance was used when comparing between two means and Chi-square (X^2) test of significance was used in order to compare proportions between two qualitative parameters and Probability (P-value) where P-value $\leq$0.05 was considered significant.

RESULTS

ETV Group consisted of 32 pediatric patients: 19 males (59.4%) and 13 females (40.6%) with male to female ratio of 1.5:1, and age ranged from 2-14 years with a mean of 6.87±3.36 years. They had an obstructive hydrocephalus due to posterior fossa tumors [11 patients (34.4%) were medulloblastomas, 5 patients (15.6%) were ependymomas, and 16 patients (50%) were astrocytomas]. Patients clinically presented with the following: eleven patients (34.4%) presented only with increased intracranial pressure symptoms (headache, vomiting, blurring vision, and squint), three patients (9.4%) presented only with posterior fossa manifestations (cerebellar ataxia), and eighteen patients (56.2%) had both increased intracranial pressure symptoms with posterior fossa manifestations (unsteady gait and focal neurological deficit). Clinical examination of the patients revealed that seven patients (21.8%) had only signs of increased ICP at time of presentation including 5 patients (15.6%) with papilledema and 2 patients (6.2%) with papilledema and 6th cranial nerve palsy. Seven patients (21.8%) presented only with posterior fossa signs (cerebeller ataxia and long tract signs mainly weakness), and sixteen patients (50%) presented with signs of both and two patients (6.2%) were completely free on neurological examination. As the Evan's Ratio ranged between 0.31-0.54 with a mean of 0.38±0.055. So, according to Evan's Ratio, radiological examination of those patients revealed that 19 patients (59.4%) had moderate hydrocephalus (0.35-0.40), and 13 patients (40.6%) had severe hydrocephalus (>0.4) (Table 1).

The procedure time from incision to closure ranged between 14-24 minutes with a mean of 17.41±2.43 minutes for this group. ETV complications occurred were CSF leak in the form of burr hole bulge occurred in 6 patients (18.75%) that resolved spontaneously in couple of days without any specific treatment. Posterior fossa pseudomeningocele occurred in 4 patients (12.5%). Pneumocephalus occurred in 11 patients (34.4%) that resolved spontaneously without any specific treatment. No surgical site infections (SSIs) or intraventricular hemorrhage (IVH) occurred in patients of this group. No permanent procedure related morbidity nor mortality occurred in patients of this group (Table 2).

Clinical improvement as regard increased ICP manifestations occurred in a mean period of 4.47±1.65 days. Two patients presented with 6th cranial nerve palsy improved postoperatively with no mortality occurred in this group. Postoperative Evan's Ratio ranged from 0.26-0.37 with a mean of 0.31±0.033 (mean±standard deviation). From 27 cases of successful ETV, only 6 patients (22.2%) had no hydrocephalus, 15 patients (55.6%) had mild hydrocephalus, and 6 patients (22.2%) had moderate hydrocephalus. Postoperative decrease in Evan's Ratio in relation to preoperative value was significant as the P-value was <0.05. The presence of CSF flow void across the ventriculostomy with an apparent systolic/diastolic flow in postoperative MRI confirmed its patency (Table 3).

ETV was done for all patients of this group with success in 27 pateints (84.4%) and failed in 5 patients (15.6%) and for whom VP shunt needed with p-value <0.001 that showing a highly statistically significance for ETV group. It was noticed that in the 5 failed cases of ETV:- 4 patients were with medulloblastomas and one patient with ependymoma, subtotal resection was done for three cases, and time interval between ETV and shunt need was (28,30,15,15,21days) for each.

Gross total resection (GTR) was done in 25 patients (78.1%), and subtotal resection (STR) was done in 7 patients (21.9%). During surgery for excision of the posterior fossa tumor, the dura was lax enough in all the cases, and there was no need for intraoperative CSF tapping. Retraction of the cerebellum was surprisingly easy and harmless, which gave us a good exposure and facilitated tumor dissection in most of the cases.

VP shunt Group consisted of 32 pediatric patients: 20 males (62.5%) and 12 females (37.5%) with male to female ratio of 1.6:1, and age ranged between 2-18 years with a mean of 8.47±4.14 years. They had an obstructive hydrocephalus due to posterior fossa tumors [13 patients (40.6%) were medulloblastomas, 7 patients (21.9%) were ependymomas, and 11 patients (34.4%) were astrocytomas, and 1 patient (3.1%) was vestibular schwannoma]. Patients clinically presented with the following: eighteen patients (56.3%) presented only with increased intracranial pressure symptoms (headache, vomiting, blurring vision, and squint), two patients (6.2%) presented only with posterior fossa manifestations (one by unsteady gait and the second by hearing difficiency and tinnitus), and twelve patients (37.5%) had both increased intracranial pressure symptoms with posterior fossa manifestations (unsteady gait and focal neurological deficit). Clinical examination of the patients

revealed that seventeen patients (53.1%) had only signs of increased ICP at time of presentation including 14 patients (82.3%) with papilledema, 2 patients (11.8%) with papilledema and 6th nerve palsy, and 1 patient (5.9%) presented with disturbance in conscious level (DCL). Six patients (18.7%) presented with posterior fossa signs (cerebeller ataxia and long tract signs mainly weakness), eight patients (25%) presented with signs of both, and one patient (3.1%) was free on neurological examination. As the Evan's Ratio ranged between 0.31-0.54 with a mean of 0.38 ±0.055, radiological examination of those patients revealed that 17 patients (53.1%) had moderate hydrocephalus (0.35-0.40), and 15 patients (46.9%) had severe hydrocephalus (>0.4) (Table 1).

Table (1): Comparison between ETV and VP shunt groups according to demographic data (age and sex), histopathology, symptoms, signs and degree of hydrocephalus.

Groups / Parameters	ETV	VP shunt	p-value
Age (years)			
Mean±SD	6.87±3.36	8.47±4.14	>0.05
Range	2-14	2-18	
Sex			
Male	19 (59.4%)	20 (62.5%)	>0.05
Female	13 (40.6%)	12 (37.5%)	

Histopathology	ETV		VP shunt		p-value
	No.	%	No.	%	
Medulloblastoma	11	34.4%	13	40.6%	>0.05
Ependymoma	5	15.6%	7	21.9%	
Astrocytoma	16	50%	11	34.4%	
Schannomma	0	0%	1	3.1%	

Symptoms	ETV		VP shunt		p-value
	No.	%	No.	%	
Symptoms of ↑ ICP	11	34.4%	18	56.3%	>0.05
Symptoms of PF	3	9.4%	2	6.2%	>0.05
Symptoms of both	18	56.2%	12	37.5%	>0.05

Signs	ETV		VP shunt		p-value
	No.	%	No.	%	
Signs of Increase ICP	7	21.9%	17	53.1%	**<0.01(s)**
Signs of PF	7	21.9%	6	18.7%	>0.05
Signs of both	16	50%	8	25%	**<0.05(s)**
Free	2	6.2%	1	3.1%	>0.05

Radiological data	ETV		VP shunt		p-value
	No.	%	No.	%	
CT: degree of HCP					
Moderate	19	59.4%	17	53.1%	>0.05
Severe	13	40.6%	15	46.9%	

The procedure time from incision to closure ranged between 40-75 minutes with a mean of 58.19±9.21 minutes for this group. Complications occurred were no CSF leak in the form of burr hole bulge occurred in those patients, posterior fossa pseudomeningocele occurred in 3 patients (9.4%), and pneumocephalus occurred in 6 patients (18.7%) that resolved spontaneously without any specific treatment. No surgical site infections (SSIs) or intraventricular hemorrhage (IVH) occurred in patients of this group. Shunt obstruction and infection occurred in six patients (18.7%) and one patient (3.1%) respectively in patients of this group. Two patients (6.2%) died postoperatively in patients of this group: one due to non hydrocephalus related causes and the other due to sequelae of CSF infection (Table 2).

Table (2): Comparison between ETV and VP shunt groups according to procedure time and complications.

Duration (min)	**ETV(m)**	**VP shunt(m)**	**p-value**
Mean±SD Range	17.41±2.43 14-24	58.19±9.21 40-75	<0.001(HS)

Complications	**ETV**		**VP shunt**		**p-value**
	No.	**%**	**No.**	**%**	
CSF leak (burr hole bulge)	6	18.7	0	0%	<0.05**(s)**
PF pseudomeningocele	4	12.5%	3	9.4%	>0.05
Shunt obstruction	0	0%	6	18.7%	<0.05**(s)**
Shunt infection	0	0%	1	3.1%	>0.05
Pneumocephalus	11	34.4%	6	18.7%	>0.05
mortality	0	0%	2	6.25%	>0.05

Clinical improvement as regard increased ICP manifestations occurred in a mean period of 6.28±1.83 days. Two patients presented with 6th cranial nerve palsy improved postoperatively. One patient presented with both increased ICP manifestations and posterior fossa manifestations died postopertively due to sequelae of CSF infection. One patient presented with DCL died postopertively due to non hydrocephalus related causes.

Postoperative Evan's Ratio in all patients was <0.27, so from 25 cases of successful VP shunts, 21 patients (84%) had no hydrocephalus, and 4 patients (16%) had mild hydrocephalus. Postoperative decrease in Evan's Ratio in relation to preoperative value was very highly significant as the P-value was <0.001.

VP shunts were done for all patients of this group with success in 25 pateints (78.1%) and failed in 7 patients (21.9%) with p-value <0.001 that showing a highly statistically significance for VP shunt group. It was noticed that in the 7 failed cases of VP shunt:- failure occurred after tumor excision, and gross total resection was done for four cases, and subtotal resection was done for the others. 5 patients with medullobla-stomas, and 2 patients with ependymo-

mas, and cause of shunt failure was proximal shunt obstruction in six cases and shunt infection in one case, and time interval between VP shunt and shunt revision was (5,30,90,5,7,45, 60days) for each. Gross total resection (GTR) was done in 25 patients (78.1%), subtotal resection (STR) was done in 5 patients (15.6%) and no surgery done in 2 patients (6.3%) in patients of this group (Table 3).

Table (3): Comparison between success vs. failure and shunt need and radiological outcome of each procedure in successful cases in both groups.

p-value	Failure and shunt need	Success	Outcome
<0.001(HS)	5(15.6%)	27(84.4%)	**ETV**
<0.001(HS)	7(21.9%)	25(78.1%)	**VP shunt**

VP shunt (n=25)		ETV (n=27)		Evan's Ratio (Successful Cases)
%	No.	%	No.	
84%	21	22.2%	6	*No hydrocephalus*
16%	4	55.6%	15	*Mild hydrocephalus*
0%	0	22.2%	6	*Moderate hydrocephalus*
<0.001 (HS)		<0.05 (S)		**p-value**

DISCUSSION

Management of secondary hydrocephalus complicating pediatric posterior fossa tumors has an utmost priority before any considerations are given to the surgical approach of the posterior fossa tumor itself. However, following tumor excision, the obstructive component of the hydrocephalus is relieved in most patients, and the flow of CSF will be restored, thus the shunt will be no more necessary, but the patient now becomes shunt dependent. As long-term survival becomes more frequent in children with posterior fossa tumors, issues pertaining to the quality of life, such as postoperative shunt dependency become increasingly important and must be taken into consideration. Moreover, placement of shunt is a blind procedure and shunt systems are prone to several complications ***(El-Ghandour, 2010)***.

Many factors have been reported to be associated with required shunt placement including a young age (<10 years), midline tumors, more severe ventricular enlargement at diagnosis, incomplete tumor resection, CSF related infection, prolonged use of EVD, cadaveric dural grafts, and persistent pseudomeningocele ***(Santos de Oliveira et al., 2008).***

Endoscopic third ventriculostomy creates a communication between the ventricular system and the subarachnoid spaces at the level of floor of the third ventricle, as the rational basis of ETV is provided by the obstructive nature of hydrocephalus due to the presence of blockage of CSF pathway at level of the fourth ventricle outlets or at the aqueduct of Sylvius ***(El-Ghandour, 2010)***.

In the current study, both procedures (ETV and V-P shunt) proved to be effective clinically and radiographically. Improvement of intracranial hypertension symptoms occurred in 84.4% of ETV cases and in 78.1% of the VP shunt cases. In a comparative study ***(El-Ghandour, 2010)***, the author compared 32 and 21 pediatric patients with obstructive hydrocephalus due to posterior fossa tumors who were operated by ETV and VPS respectively, and reported that improvement of intracranial hypertension symptoms occurred in 96.9% of ETV patients and in 100% of the V-P shunt patients.

In our study there was a highly statistically significant difference between each CSF diversion procedures according to the surgical duration as it ranged between 14-24 minutes with a mean of 17.41±2.43 minutes for ETV group and between 40-75 minutes with a mean of 58.19±9.21 minutes for VP group with p-value <0.001. In a comparative study ***(El-Ghandour, 2010)***, the author reported that the mean duration of surgery in the ETV group was 15min compared to 35min in the VPS group.

In this study, we noticed in all successful ETV treated patients that the highest success rate 100% was for astrocytomas, followed by 80% for ependymomas, and 63.6% for medulloblastomas. In another study, the authors reported that low-grade gliomas have the highest success rate (100%), followed by 50% in ependymomas, and 47.6% in medulloblatomas. So they reported that based on the radiological findings, and negative CSF cytology, with GTR of tumors, good candidates for successful ETV can be predicted to avoid the insertion of VP shunt ***(El Beltagy et al., 2010)***.

In this study, there was a significant decrease in the postoperative Evan's Ratio in relation to the preoperative value in all cases treated by different both procedures. The decrease in ventricular size was best in the V-P shunt cases and good in ETV cases as from 27 cases of successful ETV, only 6 patients (22.2%) had no hydrocephalus, 15 patients (55.6%) had mild hydrocephalus, and 6 patients (22.2%) had moderate hydrocephalus while from 25 cases of successful VP shunts, 21 patients (84%) had no hydrocephalus, and 4 patients (16%) had mild hydrocephalus. In a comparative study ***(El-Ghandour, 2010)***, the author reported that postoperative CT scan showed improvement of hydrocephalus in 87.5% of ETV group and in 100% of V-P shunt group, and the decrease in ventricular size was marvellous in the V-P shunted group.

At 5 years following shunt insertion, the cumulative complication rate was reported in one large population-based study to be 32% ***(Wu et al., 2007)***. Complications may include mechanical malfunction as the most frequent cause of CSF shunt failure. Its incidence may be as

high as 50% in children including ventricular catheter obstruction (63.2%), distal catheter occlusion (23.5%), migration (8.8%), disconnection (1.4%), and breaking (1.4%) ***(Di Rocco et al., 2015)***. Infection is a common aetiology of shunt failure and represents the second cause of shunt dysfunction after mechanical malfunction. The reported incidence of shunt infection ranges from 1 to 40% and average 8.5–15% ***(Sivaganesan et al., 2012)***. Symptomatic overdrainage ranges widely from 3 to 71% in different studies with possible occurrence of subdural, extradural, or intracerebral hematomas, upward transtentorial herniation, and intratumoral hemorrhage may occur following shunting in advanced hydrocephalus ***(Tschan et al., 2014)***. In pediatric populations, 14% of shunts will fail within 1 month of insertion, and within the first year, 35–50% of shunts placed will require revision. Over the course of their lives, the vast majority of individuals with shunted hydrocephalus will require a shunt revision ***(Paulsen et al., 2010 and Kulkarni et al., 2013).***

The overall complication rate of ETV was around 9% including intraventricular hemorrhage, memory disturbance from injury to the fornix, Cerebrospinal fluid leakage, focal neurological deficits, third nerve palsy and hypothalamic dysfunction ***(Sacko et al., 2010 and Bouras & Sgouros, 2011)***.

In this study, the complications occurred in the two groups included: CSF leak in the form of burr hole bulge occurred in 6 patients (18.75%) in ETV group that resolved spontaneously in a couple of days without any specific treatment but no CSF leak occurred in VP shunt group with p-value <0.05 that showing a statistically significant difference between the two groups. Posterior fossa pseudomeningocele occurred in 4 patients (12.5%) in ETV group and 3 patients (9.4%) in VP shunt group. Pneumocephalus occurred in 11 patients (34.4%) in ETV group that resolved spontaneously without any specific treatment and 6 patients (18.7%) in VP shunt group. No surgical site infections (SSIs) occurred in patients of the two groups. No intraventricular hemorrhage (IVH) occurred in patients of the two groups. Shunt obstruction and infection occurred in six patients (18.7%) and one patient (3.1%) respectively in VP shunt group with p-value <0.05 that showing a statistically significant difference between the two groups. No mortality (0%) occurred in patients of ETV group but two patients (6.25%) died postoperatively in VP shunt group, one due to non hydrocephalus related causes and the other due to sequelae of CSF infection.

In this study only 5 patients (15.6%) in ETV group showed recurrence of hydrocephalic manifestations within one month (failure of ETV) after a mean follow up period of 21.8 days and all cases were treated with VP shunt insertion. It was noticed that in the 5 failed cases of ETV: 4 patients were with medulloblastomas, and one patient with ependymoma, and subtotal resection was done for three cases. The authors ***(El Beltagy et al. 2010)*** assumed that the lower success rate in case of medulloblastomas even when achieving total resection of the tumor may be attributed to the higher grading and CSF

seeding in certain medulloblastomas and medulloblastomas might be more infiltrative than other tumor types in the lateral recesses of the fourth ventricle, thus impending CSF outflow.

There were seven patients (21.9%) of VP shunt treated patients after a mean follow up period of 34.57 days showed shunt malfunction. It was noticed that in the 7 failed cases of VP shunt:- failure occurred after tumor excision, and gross total resection was done for four cases and subtotal resection was done for the others, 5 patients with medulloblastomas, and 2 patients with ependymomas, and cause of shunt failure was proximal shunt obstruction in six cases and Pseudomonus CSF infection in one case that died after about 2 months due to sequelae of CSF infection, and all other obstructed VP shunt patients were treated by shunt revision.

In a comparative study, the author reported that the overall incidence of complications was 9.3% in ETV group compared to 38% in VPS group ($p<0.05$) as postoperative complications in the ETV group included CSF leak in one patient (3.1%), it was transient and was resolved conservatively but postoperative shunt infection occurred in two cases (9.4%) and it ended in mortality due to ventriculitis in one case (4.7%), and the other case was subjected to three shunt revision procedures. After tumor excision, pseudomeningocele occurred in two cases (9.4%) and it was resolved after performing a shunt revision procedure. Subdural collection occurred in two cases (9.4%) after VPS (one of these two cases was bilateral and needed surgical evacuation), one case (4.7%) developed epidural hematoma which was evacuated surgically, and one case (4.7%) suffered a presumed "upward herniation" but recovered completely after urgently excising the posterior fossa tumor. So they conclude that ETV is the more physiological procedure and they considered that postoperative complications in the VPS group more fatal than in the ETV group ***(El-Ghandour, 2010)***. Another study including 37 patients ***(Bhatia et al., 2009)*** reported CSF infection and meningitis in two cases (5.4%) and both resolved with antibiotics, and bleeding in one case (2.7%) that spontaneously resolved with no sequelae.

Regarding the Failure of the procedures, there is large amount of variability in the literature concerning the failure rate of both procedures in the management of pediatric obstructive hydrocephalus. For ETV, the failure rate ranges between 8% to 69% ***(Kadrian et al. 2008 and El-Ghandour, 2010)***. For VP shunt, the failure rate ranges between 27% and 70% ***(El-Ghandour, 2010)***.

In the current study, ETV was done for all patients of ETV group with success in 27 pateints (84.4%) and failed in 5 patients (15.6%) and for whom VP shunt needed with p-value <0.001 that showing a highly statistically significance for ETV group. It was noticed that in the 5 failed cases of ETV, the time interval between ETV and shunt need was (28,30,15,15,21days) for each. VP shunts were done for all patients of VP group with success in 25 pateints (78.1%) and failed in 7 patients (21.9%) with p-value <0.001 that showing a highly statistically significance for VP shunt group. It was noticed that in the 7 failed

cases of VP shunt, the time interval between VP shunt and shunt revision was (5,30,90,5,7,45,60days) for each.

In a comparative study, the author reported that among 32 patients operated by ETV included in his study, recurrence of hydrocephalus occurred in two patients at 6.5 and 14 months postoperatively, respectively (both patients had intraoperative bleeding), and a repeated ETV was performed. Among 21 patients operated by VPS, shunt revision was performed 15 times in 8 patients. The incidence of recurrence of hydrocephalus was 6.2% among ETV patients compared to 38% among VPS patients ($p<0.01$) ***(El-Ghandour, 2010)***. Among 37 pediatric patients with posterior fossa tumors, preresectional ETV was successful in controlling hydrocephalus in 32 cases (86.5%). In five cases (13.5%), ETV failed with redevelopment of hydrocephalus postoperatively at some point over the course of follow-up (up to 7.5 years) ***(Bhatia et al., 2009)***.

CONCLUSION

Both procedures (ETV and VP shunt) proved to be effective clinically and radiographically in the treatment of secondary obstructive hydrocephalus in pediatric patients with posterior fossa tumors. For ETV, the safety, simplicity, a more physiological of internal shunting, a significantly shorter surgery duration, absence of mortality, lower significant complications rate, a lower rate of procedure failure, the significant advantages of not becoming shunt dependent and avoidance of hardware complications (malfunction, obstruction, infection) and making safe handling and resection of the posterior fossa tumors feasible, all the previous factors made the ETV to be recommended as the first choice in the treatment of pediatric patients with obstructive hydrocephalus due to posterior fossa tumors.

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مقارنة تفميم البطين المخي الثالث بواسطة المنظار المخي مع الصمام المخي البريتوني في علاج الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ في الأطفال

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خلفية البحث: تعتبر أورام الحجرة الخلفية للمخ من أكثر الأورام حدوثا في الأطفال وأكثر من ٧٠ - ٩٠% من الأطفال المصابين بأورام الحجرة الخلفية يعانون من الإستسقاء الإنسدادي مما يجعل التعامل مع هذه الحالات يشكل صعوبة واضحة لجراحي المخ والأعصاب تندرج تحت هذا السؤال : ما هي الطريقة المثلى لعلاج الإستسقاء الإنسدادي في هذه الحالات ؟

الهدف من البحث: مقارنة كفاءة وفعالية تفميم البطين المخي الثالث بواسطة المنظار المخي والصمام المخي البريتوني في علاج الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ في الأطفال.

المرضي وطرق البحث: تم دراسة أربعة وستين مريضا يعانون من الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ (٢٤ ورم أرومي نخاعي ، ١٢ ورم بطاني عصبي ، ٢٧ أورام الخلايا الكوكبية ، ١ ورم شفاني) وذلك عن طريق تقسيمهم الي مجموعتين متساويتين حسب طريقة علاج الإستسقاء الإنسدادي: إما عن طريق تفميم البطين المخي الثالث بواسطة المنظار المخي أو الصمام المخي البريتوني ، والقيام بمتابعة الحالات لمدة ٦ شهور.

النتائج: كلا من الطريقتين سواء تفميم البطين المخي الثالث بواسطة المنظار المخي أو الصمام المخي البريتوني أثبتا فاعليتهما في علاج الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ في الأطفال وذلك بالمتابعة الإكلنيكية ، وأيضا عن طريق عمل الأشعة اللازمة لهم. وقد ثبت أن تفميم البطين المخي الثالث بواسطة المنظار المخي في علاج الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ في الأطفال كان متميزا عن الصمام المخي البريتوني في بعض النقاط الهامة مثل قصر وقت الجراحة (١٧دقيقة في مقابل ٥٨ دقيقة للصمام المخي البريتوني) مع عدم حدوث وفيات (٠% في مقابل ٢٥,٦% للصمام المخي البريتوني) مع قلة حدوث فشل في علاج الإستسقاء الإنسدادي (٦,١٥% في مقابل ٩,٢١% للصمام المخي البريتوني) ، مع معدل نجاح عالي جدا يصل إلي ١٠٠%

في أورام الخلايا الكوكبية الموجودة بأحد فصى المخيخ الجانبيين ، وثمانون بالمائة في الأورام البطينية العصبية ، وحوالي ٦,٦٣% للأورام الأرومية النخاعية.

الإستنتاج: أثبت كل من الطريقتين سواء تفميم البطين المخي الثالث بواسطة المنظار المخي أو الصمام المخي البريتوني فاعليتهم في علاج الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ في الأطفال وذلك بالمتابعة الإكلينيكية وأيضا عن طريق عمل الأشعة اللازمة لهم. وبالنسبة لتفميم البطين المخي الثالث بواسطة المنظار المخي فإنه يعتبر إجراءا آمنا وبسيطا وأكثر فسيولوجية مع قصر وقت الجراحة وغياب حدوث الوفيات وقلة حدوث معدل المضاعفات وقلة حدوث فشل في علاج الإستسقاء الإنسدادي مع أهم المميزات والتي تجعل المريض غير معتمد علي الصمام المخي البريتوني. وبالتالي، لم تحدث المضاعفات المعروفة مثل الإنسداد وعدم الكفاءة وإلتهاب السائل النخاعي ، وأيضا مع جعل التعامل وإستئصال الأورام جراحيا سهلا وبصورة آمنة ، فإن كل هذه العوامل تجعل تفميم البطين المخي الثالث بواسطة المنظار المخي ينصح به ويفضل كإجراء جراحي آمن ، ويعتبر الإختيار الأول والمفضل عالميا في علاج الإستسقاء الإنسدادي الناشئ عن أورام الحجرة الخلفية للمخ في الأطفال.