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COMPARISON OF CRANIAL METRICS BETWEEN PATIENTS TREATED WITH ENDOSCOPIC THIRD VENTRICULOSTOMY AND THOSE TREATED WITH A VENTRICULO PERITONEAL SHUNT

Neurosurgery

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ABSTRACT

Aims and Objectives: To compare the Cranial Metrics of patients with Hydrocephalus treated with Endoscopic Third Ventriculostomy and Ventriculo Peritoneal Shunt **Materials and Methods:** This is a prospective comparative single Centre study at a central institute in New Delhi. Patients in the study included patients that presented to the emergency and referred patients from other departments presenting with Hydrocephalus **Results:** The age distribution was between 2-12 years, Mean ± SD of post-operative frontal horn diameter(mm) in ETV was 34.93 ± 2.44 as compared to VP shunt (32.53 ± 2.83), Mean ± SD of post-operative occipital horn diameter(mm) in ETV was 63.76 ± 5.9 and VP shunt was 63.22 ± 5.42, Mean ± SD of post-operative biparietal diameter(mm) in ETV was 115.5 ± 1.7 and VP shunt was 116.38 ± 2.77, Mean ± SD of pre-operative frontal occipital horn ratio in ETV was 0.51 ± 0.02 compared to VP shunt (0.5 ± 0.02),Mean ± SD of duration of surgery(hours) in ETV was 2.43 ± 0.49 as compared to VP shunt (1.03 ± 0.2). **Conclusion:** Either approaches can be adopted for treatment of hydrocephalus but in a high volume centre and in emergency settings a VP shunt would be the better choice considering the fact that the time period for the surgery, materials are easily available in any set up as well as the shorter learning curve as compared to ETV.

KEYWORDS

Hydrocephalus, Endoscopic Third Ventriculostomy, Ventriculo Peritoneal Shunt, Cranial Metrics

INTRODUCTION

Third Ventriculostomy was introduced by Walter E Dandy[1,2,3] to bypass aqueductal stenosis and this technique was later refined by Stookey and Scaff by using endoscopes. The goal of Endoscopic Third Ventriculostomy (ETV) is to provide free flow of CSF between the ventricular system and basal cistern by fenestrating the floor of the 3rd ventricle between the mamillary body and infundibular recess. When this is done the CSF in the ventricular system circulates through the prepontine cistern reaches the cortical subarachanoid space and is absorbed by the arachnoid villi. Compared to shunt placement ETV offers a more natural physiological solution to hydrocephalus. It is associated with lower complication rates avoids implantation of foreign material and eliminates shunt related complications such as over drainage.

Ventriculo Peritoneal shunt involves the drainage of the CSF from the Lateral Ventricles into the Peritoneal cavity by means of a silicone tubing passed subcutaneously from the lateral ventricle to the abdomen. The flow of the CSF is usually regulated by means of a pressure regulated valved chamber or more recently by programmed valved chambers. It is still one of the most common, easiest and affordable means of treating HCP.

METHODS

This was a comparative study conducted in the Department of Neurosurgery Safdarjung Hospital New Delhi over a period of 18months. The authors used the Chabra Shunt System for Ventriculo Peritoneal Shunt and the rigid endoscope for Endoscopic Third Ventriculostomy. Relevant clinical and radiological data was collected, and patients were followed over a 6 months period.

Cranial Metrics comprising of the Head Circumference (HC), Frontal Occipital Horn Ratio (FOHR), the Bi Parietal Diameter (BPD), The Occipital Horn Diameter (OHD) and The Frontal Horn Diameter (FHD) were used to compare the radiological outcomes of the two procedures. All these metrices were measured by trained radiologists in the hospital using CT Scans of the patient both in the pre-operative and post-operative period.

The Frontal Occipital Horn Ratio (FOHR) is a measure of hydrocephalus severity that has been validated across multiple imaging modalities. This ratio is defined in part by the diameter of the frontal and occipital horns of the lateral ventricle, and it is particularly accurate for capturing the severity of hydrocephalus across ventricular phenotypes, especially in colpocephalic patients, with disproportionate enlargement of the occipital horns of the lateral ventricles. The FOHR was obtained this formula (Maximum frontal horn diameter + maximum occipital horn diameter) divided by 2 × the biparietal diameter

Table 1 : Distribution of Cranial Metrics

PARAMETERS	ETV (MEAN±SD)		VP SHUNT (MEAN ±SD)	
	PRE OPERATIVE	POST OPERATIVE	PRE OPERATIVE	POST OPERATIVE
HC (in cm)	51.76±1.69	51.09±1.9	52.12±2.54	50.78±3.06
FHD (in mm)	40.8±2.12	34.93±2.44	39.48±2.45	33.7±2.89
OHD(in mm)	78.93±3.18	63.76±5.9	77.28±3.3	63.22±5.42
BPD (in mm)	115.56±1.64	115.51.7	116.58±2.83	116.38±2.77
FOHR (in mm)	0.51±0.02	0.43±0.03	0.5±0.02	0.41±0.04
TIME (in hrs)	2.43±0.49		1.03±0.2	

Table 2 : Distribution of Complications

Complications	ETV (n=25)	VP shunt (n=25)	Total
None	20 (90.91%)	20 (86.96%)	40 (88.89%)
HCP	2 (9.09%)	1 (4.35%)	3 (6.67%)
Slit ventricle	0 (0%)	1 (4.35%)	1 (2.22%)
Subdural hygroma	0 (0%)	1 (4.35%)	1 (2.22%)
Total	22 (100%)	23 (100%)	45 (100%)

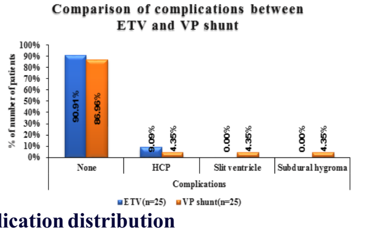

Fig 1 : Complication distribution

RESULTS

50 patients underwent surgery for HCP using ETV and VPS. 25 patients underwent ETV and 25 underwent VPS. Of these 29 patients were male and 21 patients were female.

The Mean ± SD of post-operative head circumference(cm) in ETV was 51.09 ± 1.9 and VP shunt was 50.78 ± 3.06 with no significant difference between them.

The Mean ± SD of pre-operative frontal horn diameter(mm) in ETV was 40.08 ± 2.12 and VP shunt was 39.48 ± 2.45 and the Mean ± SD of post-operative frontal horn diameter(mm) in ETV was 34.93 ± 2.44 which was significantly higher as compared to VP shunt (32.53 ± 2.83).

The Mean ± SD of pre-operative occipital horn diameter(mm) in ETV was 78.93 ± 3.18 and VP shunt was 77.28 ± 3.3 and the Mean ± SD of post-operative occipital horn diameter(mm) in ETV was 63.76 ± 5.9 and VP shunt was 63.22 ± 5.42 with no significant difference between them.

The Mean ± SD of pre-operative biparietal diameter(mm) in ETV was 115.56 ± 1.64 and VP shunt was 116.58 ± 2.83 whereas the Mean ± SD of post-operative biparietal diameter(mm) in ETV was 115.5 ± 1.7 and VP shunt was 116.38 ± 2.77.

The Mean ± SD of pre-operative frontal occipital horn ratio in ETV was 0.51 ± 0.02 which was significantly higher as compared to VP shunt (0.5 ± 0.02) whereas the Mean ± SD of post-operative frontal occipital horn ratio in ETV was 0.43 ± 0.03 and VP shunt was 0.41 ± 0.04.

Significant difference was seen in duration of surgery(hours) between ETV and VP shunt. (p value <.05) Mean ± SD of duration of surgery(hours) in ETV was 2.43 ± 0.49 which was significantly higher as compared to VP shunt (1.03 ± 0.2).

No significant difference was seen in the distribution of complications between ETV and VP shunt (p value>.05) Complication was none in majority of patients; 90.91% in ETV and 86.96% in VP shunt followed by HCP in 9.09% of patients in ETV and 4.35% of patients in VP shunt and slit ventricle in 0% of patients in ETV and 4.35% of patients in VP shunt. Complication was subdural hygroma in 0% of patients in ETV and 4.35% of patients in VP shunt with no significant difference in distribution between them.

DISCUSSION

Our patients did not show much change in the HC in the post-operative period a change from 51.76cm to 51.09cm in ETV treated patients and a change of 52.12cm to 50.78cm in VP shunted patients the changes being not so significant because most of the patients in our study were of various age groups most being in the age group where their cranial sutures have fused, and a change of FOHR from 0.51 – 0.41 in ETV treated patients and from 0.5 – 0.41 in VP shunt treated patients. Both groups showed reduction in FOHR in either form of treatments. Tarek et al[4] in their study found a significant improvement in HC of children who underwent VP shunting from 44.5cm to 35.4 cm, their study group comprised of 20 patients and all were below 2yrs, the FOHR was found to be significantly reduced in 6months reaching 63% of its preoperative value with a mean improvement of 36%. Dewan et al,[5] found a greater reduction of HC in patients who underwent VP shunt compared to those with ETV, they also found the FOHR decreased by 0.15 in the VPS cohort, whereas patients who underwent ETV/CPC experienced negligible volume reduction (-0.02). All the studies including ours showed reduction in FOHR in pre and post-operative period whether the patient was treated via VP shunt or ETV , the HC was circumference especially if the study group is of a diverse age group like ours.

The failure rates between ETV and VP Shunt in studies done by Appelgren et al. 2010 showed Failure rates in ETV group of 55% and VP shunt group of 58%,[6] De Ribaupierre et al., 2007 showed failure rates of 26% w/ ETV vs 42% w/ VP shunt surgery, [7] Kulkarni et al., 2010 stated that "ETV had a higher early rate of failure than shunting".[8] All these studies showed high complication rates as compared to our study and in the study by Kulkarni et al and Appelgren had higher failure rates with patients manages with ETV as compared to our study. We have come to reason that our lower complication rate is due to the fact that our number of cases was much smaller than that done by the other researchers.

2 or of our 25 patients had to undergo shunt revision due to shunt obstruction and the due to shunt over drainage resulting in slit ventricle syndrome, Patra et al had over a period of 12 years and 273 found that nearly half of the patients (47.9%) required shunt re- vision,[9] Jonathan et al over a period of follow-up of 19.9 years involving 234 patients found a high revision rate of 17 years after initial placement.[10] The time period and the number of patients chosen by them is over a longer period and a larger population group which begs us to come to the conclusion that a longer follow-up period and a larger number of patients will help us get a wider picture in our institute.

The duration in our study found that VPS was much shorter as compared to ETV with VPS taking approximately 1.03 ± 0.2 hrs and for ETV taking approximately 2.43 ± 0.49 hrs while Jiang et al stated that the duration of surgery in ETV and hospital stay for ETV was shorter as compared to VPS.[11] The difference could be the lack of experience on our part to perform an ETV as most cases are usually opted for VPS. More experience and exposure will perhaps change the duration of ETVs at our institute too.

CONCLUSION

This study of ours over a period of 18 months albeit for a short period has given us some insight into the different advantages and disadvantages of each approach to the management of hydrocephalus. ETV though more time consuming an average of 2hrs as compared to 1hr for VP shunt in our institute however avoids the risk of a foreign body being place and of any blockage or misplacement of shunts as recorded in literatures. In our study there was not much difference in the post-operative cranial metrics and the post-operative complication rates were also similar in both the methods.

Therefore in conclusion we would like to state that provided the patient does not have any contraindication for ETV, either approaches can be adopted for treatment of hydrocephalus but since most of the patients that come to us with hydrocephalus do so in the emergency settings a VP shunt would be the better choice considering the fact that the time period for the surgery, materials are easily available in any set up as well as the shorter learning curve as compared to ETV.

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