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## ORIGINAL ARTICLE

# Six Years Experience of Ventriculoperitoneal Shunt in Children with Hydrocephalus- A Single Center Study from Developing Country

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### ABSTRACT

**Objective:** To determine etiology, clinical presentation and outcome of Ventriculoperitoneal shunt in hydrocephalus during one year follow up.

**Study Design:** This was cohort study.

**Place and Duration of Study:** Neurospinal & Cancer Care Institute, Karachi, from May 2013 to May 2019.

**Material and Methods:** Patient aged one day of life to fifteen years with hydrocephalus were included in the study. Patient with history of previously operated hydrocephalus, coagulopathy and infected CSF were excluded. Sample size was 160. Patients were followed post-operative for 12 months. Structured proforma was used. Data was analyzed on SSPS 22.

**Results:** A total of 160 patients were included. Ages ranged was from 7days to 15years. Congenital hydrocephalus was 60.6% and meningomyocele was in 24.3%. Shunt complication was seen in 16% of patient; among them 11% had meningitis, shunt malfunction in 4.4% and pseudocyst was found in 0.6% patient. Infection was found more in patients from rural area ( $p < 0.05$ ) and there was no correlation seen between type of hydrocephalus with complication ( $p > 0.05$ ).

**Conclusion:** Most common etiology was congenital hydrocephalus. Hydrocephalus with meningomyocele was found in 24%. Infection was more commonly seen in patients from rural area.

**Key Words:** *Hydrocephalus, Congenital hydrocephalus, Ventriculoperitoneal shunt.*

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### INTRODUCTION

Hydrocephalus is defined as an increased size of brain ventricles because of imbalance in production, circulation and absorption of cerebrospinal fluid (CSF).<sup>1</sup> The prevalence of hydrocephalus is 12 per 10,000 births.<sup>2</sup> Hydrocephalus is classified into two groups, one is obstructive hydrocephalus and the other one is communicating hydrocephalus. The causes of

obstructive hydrocephalus are infratentorial brain tumors, X-linked hydrocephalus, aqueduct stenosis, Chiari malformations or Dandy-Walker. In obstructive hydrocephalus. The endoscopic third ventriculostomy (ETV) is one of treatment option. Communicating hydrocephalus relates to either decreased absorption or increase in production of CSF, commonly seen in post-infectious hydrocephalus or post-hemorrhagic.<sup>3</sup>

Conservative treatment does not give promising results, so ventricular tabs, ventricular shunts, or endoscopic third ventriculostomy (ETV) are the preferred procedures. Such procedures give relief from hydrocephalus but the outcome of hydrocephalus depends mainly on the etiology, associated anomalies, delay in surgery and presence of complications.<sup>1,3,4</sup>

Brain imaging like ultrasound brain (US), computed tomography (CT), and magnetic resonance imaging (MRI) helps to establish the diagnosis of hydrocephalus. However, MRI brain is more advanced and preferable to assist etiology and also proceed with management.<sup>5</sup>

Early sign and symptoms are misunderstood and ignored by family and patients with hydrocephalus are brought late for medical treatment because of local taboos and social beliefs plus limited resources. Poor socioeconomic conditions are an obstacle in providing timely and much-needed care to patients.<sup>6,7</sup>

The VP shunt associated complications can be categorized for easiness into three: infection, mechanical failure and functional failure. Keeping in mind, the kind of shunts, the time of shunt placement, and clinical awareness of potential complications helps in the management of patients with VP shunt.<sup>8</sup>

Although hydrocephalus is common in the pediatric population and with VP shunt survival rate is high with good quality of life, but myths are more common in developing countries which leads to delay in treatment and poor outcome of hydrocephalus. Through our study, we are sharing our experience to increase awareness regarding hydrocephalus and treatment option.

## MATERIAL AND METHODS

This was a cohort study. The study was performed at the Neurospinal & Cancer Care Institute, Karachi, from May 2013 to May 2019. Sample size was calculated through openepi software, (frequency of hydrocephalus 12/10,000, confidential interval 95%), sample size was calculated to be 160. Non-probability consecutive sampling was done. All patients aged 1day to 15 years with hydrocephalus who underwent VP shunting procedure were included in the study.

Patient with coagulopathy, previously operated at another centers, infected CSF were excluded. Informed consent was taken. Data was recorded on preformed proforma. For congenital hydrocephalus cases, MRI brain was done to rule out associate anomalies. Patient age, sex, etiology, length of hospital stay, type of hydrocephalus, surgical history and clinical manifestations were recorded on structured proforma. Etiologies of hydrocephalus were grouped into congenital and acquired. Patients were followed post-operative at 2weeks, one month, 3months, 6 months then 12months. Data was analyzed on SPSS Statistics 22. Frequency was calculated for qualitative data, mean and standard deviation was taken for quantitative data. Chi square test was done to calculate p value.

## RESULTS

A total of 160 pediatric patients were included in our study. Aged range was 7days to 15 years. Male to female ratio was 1.5:1. The cause of hydrocephalus was congenital in 97(60.6%) of cases. Mean duration of hospital stay was  $35 \pm 20$ days. One hundred thirty patients (81%) came for follow up at 2weeks, 110(68.7%) followed at one month, 95(56%) followed at 3months, 70(43%) patients came for 6month follow up and 72 (44%) came for follow up at 12months post-operatively. Patient who did not come for follow up, update was taken through telephone. Minimum time of complication development was first 4months (pseudocyst 1, meningitis 4, shunt obstruction 4), remaining developed complication after 7months (meningitis 12, shunt obstruction 3). Patients with shunt obstruction went into re-surgery. Patients who developed meningitis were treated with intravenous antibiotics. Commonest were gram-positive cocci 12 (7.5 %), while 4(2.5%) cases had mixed infection and was treated with intravenous antibiotics till 3 consecutive reports were negative. No mortality occurred in one-year duration. More infection was found in patients from rural area  $p < 0.05$ , there was no correlation seen between congenital and acquired type of hydrocephalus with complication ( $p > 0.05$ ).

**TABLE 1: Patients demographic feature**

Characteristics	N=160	Percentage
<b>Gender</b>		
Male	97	60.6
Female	63	39.4
<b>Residential area</b>		
a) Rural	99	61.8
b) Urban	61	38.2
<b>Age of patient</b>		
a) 1day- 5yrs	97	60.6
b) 6yrs -10yrs	31	19.4
c) 11yrs-15yrs	32	20.0

**TABLE 2: Characteristic of hydrocephalus**

Characteristics	N=160	Percentage
<b>Type of hydrocephalus</b>		
a) Congenital	97	60.6
b) Acquired	63	39.4
<b>Etiology of congenital hydrocephalus</b>		
a) Obstructive	52	32.5
b) Communicating	108	67.5
<b>Etiology of congenital hydrocephalus</b>		
a) Aqueduct stenosis	4	2.5
b) Dandy-walker	6	3.7
c) Chiari-malformation	6	3.7
d) Hydrocephalus with meningomyelocele/spinal bifida	39	24.3
e) Idiopathic	42	26.2
<b>Etiology of acquired hydrocephalus</b>		
a) TB meningitis	17	10.6
b) Bacterial meningitis	9	5.6
c) Brain tumors	19	12.0
d) Post cranial surgery	7	4.3
e) Trauma	5	3.0
f) Intraventricular hemorrhage	6	3.7

**TABLE 3: Presenting complaint and outcome of VP shunt in hydrocephalus**

Character	N=160	Percentage
<b>Presenting complains in congenital cause</b>		
a) Increasing head size	72	45.0
b) Irritability	25	15.6
<b>Presenting complains in acquired cause</b>		
a) Headache	53	32.3
b) Vomiting/ nausea	38	23.17
c) Vision problem	26	15.8
d) Seizure	16	9.75
e) Drowsiness	24	14.6
<b>Complication of VP shunt</b>		
a) Meningitis	26	16.2
b) Shunt obstruction	18	11.0
c) Pseudo cyst	07	4.4
	01	0.6

## DISCUSSION

The aim of our study was to increase awareness regarding hydrocephalus and its management. In our study we found that most common cause of hydrocephalus was congenital (60%), of those 24% had hydrocephalus with meningomyocele. This may be because most patients belonged to rural area, where awareness regarding use of folic acid before pregnancy is limited. In comparison to other studies, that described aqueduct stenosis as most common cause of congenital hydrocephalus, with development of shunt associate complication within first 6month shunt placement, our study showed most patients that developed complication after 7 months of VP shunt surgery.<sup>9</sup>

Shunt infection was seen more commonly in preterm infants, due to underdeveloped immune system prone them to serious shunt infection. Even after many developments which are aimed at reducing shunt infection, such as sterile technique, programmable valves, antibiotic-impregnated catheters, but still patient commonly require revisions of shunt throughout their lifetime.<sup>10</sup> A study in 2018 showed that birth weight less than 1.5 kg, presence of associated congenital anomalies, gestational age less than thirty-seven weeks were prominent factors in shunt failures.<sup>11</sup> In our study no preterm baby went for shunt. Infection were seen in children belonging to rural area, possibility of poor hygienic condition may be the risk factor for this.

Anderson et al found in his study that rate of shunt failure was 8.8% for primary shunts and failure rate for revision shunt was 23.4% and they found that if the more number of the surgeon involved during surgery, the rate shunt failure increased significantly.<sup>12</sup> Comparatively study at our center was performed by an experienced surgeon, not involving many doctors in operation theatre which decrease in the rate of infection shunt.

Bawa et al showed VP complication up to 32.0% (89/278) of cases. Most common complications with which patient presented were chamber migration and Shunt block (29.21%), while other complications were abdominal wound, shunt erosion of overlying skin and new seizures onset. Over all 21% out of total required redo shunt and they had 2 mortalities.<sup>13</sup> In our studies limited number of complication and redo shunt was done

only in patient with shunt obstruction in 4.3%. Rehman S et al regional study showed that among 204 patients who were operated in the first year of their life had infected CSF in 19.1% infants. Female were infected more than the male. Most of the infection was occurs in children under the six months of age.<sup>14</sup> Dabdoub et al study showed that abdominal pseudocyst was more common in children in comparison with adults. In the literature they complied about abdominal pseudocyst, they found among 393 cases of abdominal pseudocyst, 295 were children. Positive culture was found in 33% of children, while higher rate was found among children aged less than 10years.<sup>15</sup> The Study comparing the effectiveness of endoscopic third ventriculostomy and VP shunt with follow up till one year, they found no superiority among these two procedures in surgical failure in pediatric population.<sup>16</sup>

Erol et al highlighted that fracture shunt or Disconnection of shunt are important cause of mechanical dysfunctions of shunt and must be researched adequately. Furthermore, in asymptomatic patients, the possibility of shunt independence, although low, do exists, however, making definitive decisions regarding the removal of the shunt may be very challenging.<sup>17</sup> Pan P et al concluded in his study that complications and morbidity of hydrocephalus and VP shunt, significantly associated with the aetiology of the hydrocephalus. Parameters such as age and gender did not affect the overall shunt function.<sup>18</sup> Brogg M et al proposed simple algorithm with less invasive technique practical, approach to accurately diagnose of VP shunt malfunction, identifying the exact localized level of failure, this can allow VP shunt revision to be tailored, which can avoid unnecessary complete replacement of shunt.<sup>19</sup>

## CONCLUSION

Most common etiology was congenital hydrocephalus and with meningomyocele was 24%, which is preventable through use of folic acid. Shunt infection was more common in children who belong to rural area, possibility of unhygienic condition which is well known risk factor for shunt infection.

**Disclosures:** No conflict of interest.

**Conflicts of Interest:** Nil.

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