

# A Hospital Based Analytical Study of Ventriculoperitoneal Shunt For Hydrocephalus

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## ABSTRACT

**Introduction:** To make out the spectrum of patients for whom cerebrospinal fluid diversion is done and to study the pattern of presentation based on clinical criteria and symptomatology and radiological investigation. To study the indications for the ventriculoperitoneal shunt and the further course in the hospital from admission to discharge including the complications in the study period designated which spans 2 years and followed up the cases for around 6 months.

**Objectives:** To study the indications of the cerebrospinal fluid diversion procedure and the course of the patient from the time of admission to discharge. This includes the presenting symptoms, radiological investigation, the admitting GCS (Glasgow Coma Scale), cerebrospinal fluid study and the condition at discharge and complications.

**Materials and Methods:** It is a retrospective and prospective analysis of 100 patients in a tertiary care centre from March 2014 to March 2016 for a span of 2 years.

**Results:** Out of the hundred patients who underwent ventriculoperitoneal shunt 59% were done among paediatric patients and 41% were done on adult patients and 77% underwent emergency ventriculoperitoneal shunt and 23% underwent elective VP Shunt. There is no significant short term

outcome difference based on the side of shunt (either left or right).

**Conclusion:** The incidence of hydrocephalus appears to be more in the paediatric population. Early emergency shunting of hydrocephalus carries good prognosis especially if the admitting GCS is 12 or above.

**Keywords:** Hydrocephalus, CSF Diversion Procedures, Ventriculoperitoneal Shunt.


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## INTRODUCTION

Hydrocephalus is one of the most commonly encountered clinical diagnosis in neurosurgical practice. Hydrocephalus (from the Greek words hydro {water} and kephale {head}) has been recognised for over 2000 years.<sup>1</sup> Despite great strides in diagnosis and treatment, hydrocephalus remains a challenge for the clinician. Hydrocephalus is one of the most commonly encountered conditions in neurosurgery.<sup>2</sup>

One recent study by Sipek and colleagues analysed data from the Czech national registry from 1961 to 2000 retrospectively and found the mean incidence of congenital hydrocephalus to be 6.35 per 10,000 live born infants.<sup>3</sup> Another series by Fernell and Hagberg from Sweden found that the prevalence of infantile hydrocephalus was 6.99 per 1000 in the 1970s, increasing to 25.37 in the 1980s.<sup>4</sup> This increase was thought to be due to the increase in the increased survival of the very preterm infants. In

the 1990s the prevalence of infantile hydrocephalus in the Swedish population decreased to 13.69. Despite changes in prevalence rates, outcome in surviving children remained similar.<sup>5</sup>

## MATERIALS AND METHODS

This retrospective analytic study was done at S.M.S. Medical College, Jaipur, Rajasthan.

No. of patients: 100

### Inclusion Criteria

1. All age groups
2. Both Male and Female
3. Patients with a radiological confirmation of a diagnosis of hydrocephalus. No previous shunt insertion done.
4. All patients who are willing to take part in the study and sign the consent form.

### Exclusion Criteria

1. Patients previously operated for hydrocephalus.
2. Patients with a diagnosis of Normal pressure hydrocephalus.
3. Hydrocephalus for whom lumboperitoneal shunt or lumbar drain used to treat hydrocephalus.
4. Endoscopically treated hydrocephalus and currently presenting with hydrocephalus as recurrence.

### Methodology

This is a prospective analytical study and all the patients in the study were entered into the proforma included in Appendix.

1. All the patients' personal details like name, age, sex were entered into the proforma.
  2. The patients' symptoms of vomiting, headache, fever, seizures, altered sensorium and visual disturbance were analysed.
  3. After complete clinical examination, the conscious level was evaluated based on the Glasgow Coma Scale both at the time of admission, after the surgical procedure and at the time of discharge. Paediatric Glasgow Coma Scale used to assess Neurological status for patients aged upto 12 years.
  4. Among the paediatric population, etiology studied was congenital, infection and tumours. In the adult population, the studied causes of hydrocephalus included infection, post traumatic, spontaneous, tumours. In post-traumatic cases, few patients had an extra-ventricular drainage catheter for the intraventricular haemorrhage which further was converted into a ventriculoperitoneal shunt once the EVD started showing clear cerebrospinal fluid in the drainage tube. Most of these were done within 5 days of the insertion of the extraventricular drainage catheter.
  5. This study used the Chhabra medium pressure slit and spring valve ventriculoperitoneal shunt. All the cases done in both emergency and elective surgery were included. The standard protocol for the administration of antibiotics was to give pre-operative dose of Cephalosporins – cefotaxime and continued the intravenous antibiotics for a minimum of 5 days before converting to oral antibiotics which were continued till suture removal.
  6. The patients were followed from the time of admission upto the time of discharge. Thorough clinical examination was made and the outcome was based on the improvement in the clinical condition by assessing the Glasgow Coma Scale and radiological evaluation of a post-operative CT scan.
- Any patients who developed any complications were studied and whether this complication is a result of surgical procedure per se or a further complication of the primary pathology was also studied.

After collecting all the above data, Statistical analysis of all data was done using SPSS (Statistical package of social science) and Microsoft Excel. Base line statistics, correlation agreement (r<sup>2</sup>) and Chi square test have been used for analysis.

## OBSERVATIONS AND RESULTS

100 cases of hydrocephalus were studied in the period – 2014 March to 2016 March at Neurosurgery Department, S.M.S. Medical College, Jaipur, Rajasthan.

### 1. Age Wise Distribution

About 59 patients were less than 19 years of age and 25 patients were less than or equal to 2 years of age. The adult cases were 41 in number and around 6 patients were 60 years and above.

### 2. Distribution Based On Gender

Out of the total 100 patients, majority of the patients were males. There were 41 females and 59 males. In the 25 patients of the paediatric population aged 2 years and less, the number of male babies was 14 and the number of female babies was 11.

### 3. Distribution of Age According To Gender

There is slight male preponderance noted in the age groups 0-9 years, 40-49 years, 50-59 years, 60-69 years, while number of female patients noted in the age groups 10-19 years. Equal number of males and females were noted in the age groups of 20-29 years, 30-39 years.

### 4. Distribution of Symptoms

Vomiting is one of the commonest presenting symptoms noted in this study. The vomiting here was projectile, not associated with nausea and we had a total of 73 cases presenting with vomiting among the 100 cases studied. Headache was the presenting symptom in 39 patients and absent in 38 cases. In the paediatric age group, due to the limitation of the infant patients, this aspect could not be assessed in 23 of the patients. Also, in patients with altered sensorium, headache could not be assessed. Fever was the presenting symptom in 24 cases among the 100 patients studied.

And all these cases had the primary pathology as Infection. Seizures were the presenting symptom in totally 37 cases and altered sensorium was present in 61 cases. Among them, around 28 cases had both seizures and altered sensorium. Only seizures were the presenting symptom in 9 cases and only altered sensorium in 33 cases.

### 5. Distribution of Comorbid Conditions

The comorbid conditions studied were known cases of Seizure disorder, Diabetes Mellitus, Hypertension, Tuberculosis and presence of any congenital anomaly. There were 29 cases of known tuberculosis, 7 cases of known seizure disorder on anti-tuberculosis treatment, 9 patients were hypertensives, and 5 were diabetics and 6 had associated congenital anomaly but they were not mutually exclusive. There were patients who had more than one co-morbid condition.

### 6. Distribution of GCS

Among the 100 patients operated, pre-operative GCS was 12-14 in 88 patients and 3 patients had a GCS of 15 on admission. GCS of less than or equal to 11 was seen in 9 cases but majority of the patients improved after surgery and 35 cases had a GCS of 15 after surgery. Only in 7 cases, the GCS did not improve and these patients had a stormy post op period with shunt complications and succumbed to them. At discharge, 93 cases had a GCS of 15.

### 7. Distribution of Type of Surgery

Among the 100 patient the total number of cases operated as emergency were 77 while 23 cases were electively operated. The distribution of cases operated electively included patients who had a post traumatic sequelae of hydrocephalus developing gradually after craniotomy for head injury, patients who had an extraventricular drainage and after the extraventricular drainage tube the patients developed hydrocephalus in the course of stay in hospital, patients who are being evaluated for a definitive brain tumour surgery and develop hydrocephalus during their hospital stay, patients who were temporarily unfit for surgery due to comorbidities and increased intracranial pressure could be managed conservatively till the shunt surgery is done.

### 8. Distribution of the Side of VP Shunt

As a standard practice, right side ventriculoperitoneal shunt was done in all the cases unless there was an associated condition requiring a left ventriculoperitoneal shunt. Among the 100 cases, right ventriculoperitoneal shunt was done in 87 cases and in 13 cases it was done on the left side. These included 2 paediatric tumours and 5 adult tumours and the site of shunt was to the contralateral side of the existing tumours since the future plan was to do a elective craniotomy and excise the tumour. This further gives us a view that among the 18 adult tumour cases, 5 were right sided tumours requiring a left sided ventriculoperitoneal shunt. In the paediatric age group, among the 9 tumour, left sided ventriculoperitoneal shunt was done in 2 cases. In the traumatic cases most of whom had a decompressive craniotomy with bone flap removal and subsequently developed hydrocephalus, left sided shunt was done for 5 cases among the total 8 cases.

In the cases with intraventricular haemorrhage who had an extraventricular drain insertion as an emergency procedure done and developed hydrocephalus in the course of stay in the hospital had an electively ventriculoperitoneal shunt surgery done in 1 case on the left side.

### 9. Distribution of Complications and Management

Most of the patients did not have any associated shunt complication. In around 10 cases shunt malfunction was noted, shunt infection in 3 cases and meningitis in 7 cases. Among the 20 complication cases, 13 required surgical management.

### 10. Distribution of Management Plan of Complications

Among the 20 complications noted, for around 13 cases surgical management was done. The rest 7 cases were managed conservatively.

### 11. Distribution of Mortality

Among the total 100 cases studied, 7 cases had outcome as mortality. Among the 7 cases, 5 patients had shunt complications and in them 4 had conservative management and for 1 case surgical intervention was done. Among the total 20 cases with shunt complications, the majority improved and were discharged, that is 15 of the 20 patients.

### 12. Distribution of Follow-Up

Among the 100 patients studied, 93 patients improved and were discharged. 56 patients came for follow up which was monthly follow up in the neurosurgery review out-patient department. 6 of these patients developed shunt complications in these 6 months and were re-admitted. Around 37 patients were lost to follow up.

## DISCUSSION

In our study we have analysed 100 patients over a period of two years and the outcomes were analysed. Among the hundred patients included in the study the number of males were 59% and females were 41% and in a similar study by Amey Savardekar et al<sup>6</sup> it was noted that 65% were males and 35% were females. Among the hundred patients, 59% of them were paediatric patients, in them 32 % were females and the rest 68% were males.

It was noted that out of the hundred patients who underwent ventriculoperitoneal shunt 59% were done among paediatric patients and 41% were done on adult patients, in a similar study by Savardekar et al<sup>7</sup> they had included all paediatric cases but the study population they had taken were less compared to our study. Most of the patients came to the emergency room with symptoms

of vomiting, headache and few came with radiological investigations done at a different centre with deteriorating general condition. These were immediately diagnosed as hydrocephalus with signs and symptoms of increased intracranial pressure and warranted emergency CSF diversion procedure. Among the 100 cases studied in this study approximately 77% underwent emergency ventriculoperitoneal shunt and 23% underwent elective VP shunt. The subjects underwent ventriculoperitoneal shunt for multiple varied pathologies, and among them it was observed that 23% of them underwent for congenital defects, 37% of them underwent for infectious etiology, 13% due to traumatic etiology and 27% underwent due to primary tumours.

The primary pathology in the cases were as follows-

1. Congenital: 23% of the cases had congenital etiology for hydrocephalus and all were paediatric cases.

2. Infection: 37 of which 10 were adults and 27 were paediatric. Tuberculous meningitis sequelae being the reason in 7 of the adult population and 22 of the paediatric population. Pyogenic meningitis sequelae in 5 paediatric cases and 3 adult cases.

3. Trauma / Spontaneous: 13 cases in which 5 patients had extra ventricular drainage for the intra-ventricular haemorrhage and electively Ventriculoperitoneal shunt was put once the blood stopped draining from the extra-ventricular drain tube which was done in all the cases within 5 days of the initial procedure.

4. Tumours: 27 cases of which 18 were adult cases, which makes around 44% of adult cases having space occupying lesion as the primary pathology which correlated with the 47% value noted in the study by Farid Khan et al, and the rest 9 were paediatric patients. Among them, 25 were operated on emergency basis and the rest 2 cases were done on elective basis. The requirement of the ventriculoperitoneal shunt was on an emergency basis but the general condition did not permit immediate surgery due to associated comorbidities and the 2 patients were stabilised and operated approximately 24 hours after admission.

The side of ventriculoperitoneal shunt in most of the cases was right side that is in around 87% and on the left side in 13% of the cases while the value is 92% on the right side and 8% on the left side in the study by Khan et al.

The most frequently encountered symptoms were headache (77%) and vomiting (73%). Altered sensorium in 66% being the next most common associated symptom while the symptoms on presentation by Khan et al<sup>8</sup> were 44% with headache, 40% with altered sensorium, 30% with vomiting. 37% patients came with the history of seizures and most of the cases with history of seizures had been admitted with altered sensorium. In which 7% had a diagnosed seizure disorder and were on regular anti-epileptics and a majority did not get admitted with any documentation since they had been admitted on an emergency basis. Tuberculosis was a comorbid condition with almost all the cases admitted with tuberculous meningitis sequelae for hydrocephalus. Other conditions associated included around 5% patients who were known diabetics and 9% patients who were known hypertensives on regular medication. In the paediatric population, 6 patients had a congenital anomaly. Among the complications noted in the course of treatment from admission to discharge, 20% patients had complications and of which 65% (13) patients required a surgery for management in which 2% patients were adults, and in the study by Kan et al<sup>9</sup> the number of patients requiring revision surgery in the same admission was 1.8%.

In this study, there was follow up only in 60% of the patients and 40% patients were lost to follow up and this data correlates mildly with the Farid Khan et al<sup>10</sup> who had an almost 30% lost to follow up.

## CONCLUSION

This study on analysis of ventriculoperitoneal shunt for hydrocephalus has given the following impressions.

- The incidence of hydrocephalus appears to be more in the paediatric population and with a slight male preponderance.
- In a majority of the patients hydrocephalus needed emergency intervention.
- There is significant improvement in the condition of the patient when ventriculoperitoneal shunt surgery is done on time.
- In patients developing post-operative meningitis and shunt infection, the first policy to give parenteral antibiotics and keep a close watch on the patient gives good results before considering surgery. Surgical intervention is the first policy of management in case of shunt malfunction for better prognosis.
- There is no significant short term outcome difference based on the side of shunt (either left or right).
- Shunt complications are higher if the primary pathology is of infective etiology.
- Seizure disorder is a major comorbid factor and affects the overall prognosis of treatment when compared to other comorbid conditions.
- To conclude, early emergency shunting of hydrocephalus carries good prognosis especially if the admitting GCS is 12 or above.

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