

CLINICOPATHOLOGICAL STUDY OF HYDROCEPHALOUS & OUTCOME OF VENTRICULO-PERITONEAL SHUNT IN PATIENTS**Raj Kumar Mishra¹, Sona Kaushal Bharti^{2*} and Rangeel Singh Raina³**¹Assistant Professor, Department of Surgery, Muzaffarnagar Medical College, Muzaffarnagar.²Associate Professor, Department of Biochemistry, Government Doon Medical College, Dehradun.³Professor, Department of Pharmacology, Government Doon Medical College, Dehradun.***Corresponding Author: Sona Kaushal Bharti**

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ABSTRACT

Introduction: Hydrocephalous leads to increase in intracranial pressure and progressive enlargement of the head, headaches and convulsion which may also lead to death. **Aims & Objective:** To study the etiology and prevalence of hydrocephalous, and its management with ventriculo-Peritoneal Shunt along with final outcome in respect to re-operation, mortality and morbidity. **Material & Methods:** This prospective observational study was conducted to evaluate the operated patients of hydrocephalous from 1st October 2012 to 30th September 2013. The enrolled patients were treated surgically by ventriculo-Peritoneal Shunt (V.P shunt) procedure and kept in follow up for assessment of outcome. The outcomes were assessed in terms of post operative complications, shunt survival time, and shunt blockage rate, number of reoperation and mortality. **Results:** Out of Forty (40) patients operated for hydrocephalous, most of the patients were of infancy age group (35%). Most common site for obstruction was aqueduct stenosis and most of obstructions were non- communicating type. Maximum number of patients clinically present with fever, increased head size headache and altered sensorium. Thirty one patients were successfully operated once only, whereas 05 patients were operated twice and 03 patients were operated thrice. Twenty patients had complications (Headache, Seizure, Cranial Nerve palsy, extrusion) within 3 months of surgery while 08 patients had shunt blockage after 3 months of surgery. **Conclusion:** Predominantly paediatric age group were affected by hydrocephalous and it's of obstructive type mostly due to aqueductal stenosis. The majority of the patients operated for shunting were under satisfactory condition with single shunt surgery.

KEYWORDS: Shunt, aqueduct, stenosis, complication.**INTRODUCTION**

Hydrocephalus is a medical condition in which there is an abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles, or cavities of the brain.^[1] This may lead to increase in intracranial pressure and progressive enlargement of the head, convulsion, tunnel vision, and mental disability which may also lead to death. An International Hydrocephalus Working Group explains hydrocephalus as "an active distension of the ventricular system, resulting from inadequate passage of cerebrospinal fluid from its point of production within the cerebral ventricles to its point of absorption into the systemic circulation."^[2]

It has been observed that nearly one to two per 1,000 newborns have hydrocephalus^[3] and prevalence rates is much more in the developing countries.^[4] Normal pressure hydrocephalus is estimated to affect about 5 per 100,000 people with rates increasing with age.^[5]

Hydrocephalus, also known as "water in the brain", might result in increased intracranial pressure which may

manifest as headaches, vomiting, nausea, papilloedema, sleepiness or coma. Elevated intracranial pressure may result in uncal and/ or cerebellar tonsil herniation, with resulting life threatening brain stem compression.

According to bulk flow model of cerebrospinal fluid (CSF) flow, CSF is produced mainly by the choroid plexi present within the lateral, third, and fourth ventricles.^[6] CSF travels slowly and unidirectional through the ventricular system, exits the fourth ventricle into the subarachnoid space, and is absorbed through arachnoids granulations into the venous sinuses and systemic circulation. Remarkably, up to 1/3rd of CSF exits the skull along cranial nerve sheaths and into the lymphatic system rather than into the venous sinuses.^[7]

Hydrocephalus is usually treated by surgical procedure to reduce or to prevent brain damage by improving the flow of CSF, generally creating by various types of cerebral shunts like ventriculo-peritoneal shunts, ventriculo-atrial shunts and lumbar peritoneal shunts. Recently new

surgical procedure- Endoscopic third ventriculostomy has been developed.

In this study an attempt has been made to study the clinical & radiological features of hydrocephalous, its management by V.P. Shunt and its outcome in terms of post operative complications, morbidity, mortality, shunt survival and reoperation rate.

AIMS AND OBJECTIVES

To study the etiology and prevalence of hydrocephalous and treatment outcome after V.P shunt surgery in respect to re-operation, mortality and morbidity.

METHODOLOGY

This prospective observational study was conducted to evaluate the patients of hydrocephalous admitted in the Department of Neurosurgery, S.V.B.P Hospital, L.L.R.M Medical College, Meerut from 1st October 2012 to 30th September 2013 after taking the permission from the Institutional ethics committee. The admitted patients were treated surgically with V.P Shunt and kept in follow up for assessment of outcome. All the diagnosed cases of hydrocephalous were assessed by clinical examination and imaging technique by CT brain/ MRI brain and then operated by V.P. Shunt after taking the informed consent from the patient for the surgery. Then operated patients were assessed in terms of post operative complications, shunt survival time, shunt blockage rate, number of reoperation and mortality.

Inclusion criteria for this study were as follows:

1. Patients of hydrocephalous admitted in S.V.B.P hospital
2. All age groups of both sexes were included
3. V.P shunt planned or previously operated cases
4. Patients with known co morbidities were included

Following groups of patients were excluded from the study.

1. Hydrocephalous patients who didn't give consent for operation.
2. Patients unfit for surgery under general anaesthesia.
3. Patient having intra-abdominal peritoneal pathology.

After the enrolment of patients in the study following procedures have been followed

1. History and examination of patient to confirm the diagnosis of hydrocephalus
2. Operation- V-P shunt & Collection of ventricular CSF during surgery
3. CSF examination-Routine & Microscopy, Culture & Sensitivity
4. Collection of data according to working performa
5. Interpretation of data collected and Inference.

RESULTS

Total forty (40) patients of hydrocephalus were admitted and operated in the department of Neurosurgery, S.V.B.P Hospital, L.L.R.M Medical College, Meerut during the

period from 1st October 2012 to 30th September 2013. All the diagnosed cases of hydrocephalous were assessed by clinical examination and imaging techniques by CT brain/ MRI brain and then operated by V.P. Shunt and kept in follow up after that.

Most of the patients were of paediatric age group, out of them 35% were Infants, 27.5% belongs to 1 to 5 yrs and 12.5% patients were of between 5 to 10 yrs age group. (Table 1) Twenty seven patients (65.5%) were male and 13 female (32.5%). Most common site of obstruction was aqueduct stenosis, (19 patients, 47.5%) whereas most of patients have non communicating type of hydrocephalous (29 out of 40) and only 10 patients have communication type. Most common cause of congenital hydrocephalous is aqueductal stenosis (14 cases). Main etiology of obstruction at basal region was basal exudates produced by tubercular infection/pyogenic infection (7 cases). (Table 2).

Although many patients had more than one symptom, maximum number of patients clinically present with fever (15), increased head size (11), headache (10) and altered sensorium (8). It has been found that total 13 patients (32.5%) of hydrocephalous had congenital craniospinal malformations, out of which meningomyelocele and arachnoid cyst were there in 04 (10%) patients each. (Table 3).

On evaluating operated patients of hydrocephalous with V.P. Shunt, it was found that 31 patients were successfully operated only once, and whereas 05 patients were operated twice and 02 patients were operated thrice, so overall Shunt revision rate was 9/47 (19.14%). (Table 4) So altogether, 47 V.P. Shunt surgeries were performed in 38 patients. Out of these 8 were operated for shunt revisions because of shunt blockage (17.02) whereas 01 case due to extrusion. (Table 5) In this study it was also observed that most of the shunt revisions were done within 6 months of previous shunt surgeries. The median time of shunt survival of first time operated case was 13.36 months whereas median shunt survival in the re-operated group (in 7 patients) was found to be 26.06 months.

On analysis of CSF taken at time of shunt surgery, correlations between CSF protein and cell count with the final outcome were studied. The following factors were analysed for their effect on final outcome; CSF cells (<50/mm³): CSF protein (<50 mg/dl &> 50 mg/dl) clinical grade assessed just before shunt surgery. Cellularity has a detrimental effect on shunt survival. Shunt revision chances were greatest to lymphocytic group. Out of total 9 revisions, 6 were of lymphocytic group (probably tubercular). In patients with CSF sugar level <50 mg %, 7 patients out of 15 has undergone shunt revision surgery (46.66%). In patients with CSF proteins level > 50 mg%, 7 patients out of 8 has undergone shunt revision surgery (87.5%).

On consideration of complication after VP shunt surgeries in 38 patients, twenty (20) patients had headache, seizure, cranial nerve palsy, extrusion like

symptoms within 3 months of surgery while 08 patients had shunt blockage after 3 months of surgery.

Table I: Categorisation on the basis of age.

S.N	Age	Number of patients (n=40)	Percentage(%)
1	Infancy < 1yr	14	35
2	1 yr to 5 yrs	11	27.5
3	5 yrs to 10 yrs	5	12.5
4	10 yrs to 20 yrs	4	10
5	20 yrs to 30 yrs	4	10
6	30 yrs to 40 yrs	1	2.5
7	> 40 yrs	1	2.5
	Total	40	

Table 2: Etiology of obstruction.

Site of obstruction	Etiology	Number
Foramen of Monro	Arachnoid cyst (1), Pyogenic infection (1)	02
Aqueduct of sylvius	Congenital stenosis (14), tubercular (3) Arachnoid cyst (1), Arnold chiari II (1))	19
Fourth ventricle	Brain abscess (1), PyogenicMeningoencephalitis (1) Arachnoid cyst (1),cerebellar thmour (1), tubercular (5)	09
Basal cistern/ cisternmagna	Tubercular (7), arachnoid cyst (1), brain abscess (1), Arnlod chiari II (1)	10
Total		40

Table 3: Categorisation on the basis of duration of presenting complaints (Time period from onset of first symptom to presentation).

Duration of Presenting Complaints	Number of Patients (n=40)	%age	Severity	Expiry
With 1 month	17	42.5%	mild (4), moderate (11), severe* (2)	1
1-3 months	09	22.5%	mild(2), moderate (6), severe (1)	0
3-6 months	04	10%	mild(1), moderate* (2), severe* (1)	2
6 months -1 yr	07	17%	mild(1),moderate (5), severe(1)	0
1 yr -2 yrs	02	5%	moderate (1), severe (1)	0
2 yr	01	2.5%	severe (1)	0

*(mortality)

Table 4: Number of times the patients of hydrocephalous re-operated.

Number of time Operated	Number of Patients (%)	Total Procedures done
Once	31(77.5%)	31
Twice	5(12.5)	10(5+5 reoperated)
Thrice	2(5%)	06(2+4 reoperated)
None	1(2.5%)	00
Total	39	47

Table 5: Association of shunt revision with primary etiology.

Revision	Total revision (n=09)	Age/ Sex	Primary etiology	Site of obstruction
Revision due to block	08	5yrs/M	Tubercular	Aqueduct of sylvius
		3.5yrs/M	Tubercular	Aqueduct of sylvius
		2.5yrs/M	Tubercular	Basal cistern
		4yrs/M	Congenital	Aqueduct of sylvius
		1yrs/M	Tubercular	Aqueduct of sylvius
		11yrs/M	Tubercular	Aqueduct of sylvius
		4yrs/F	Tubercular	Basal cistern
		21yrs/M	Arachnoid cyst	3 rd ventricle
Revision due to extrusion	01	2yrs/F	Congenital	4 th ventricle

DISCUSSION

This present study comprises of 40 cases of hydrocephalous admitted in department of Neurosurgery during the period of 2012-2013. In the study, most of the patients were of paediatric age group and Incidence rate of hydrocephalous in this study has decreased with increase in age. One study observed that hydrocephalus is common in infants under one year as in the present study (76%).^[8] In this study male patients outnumber the female patients. Out of 40 patients, 27(67.5%) were male and 13 female (32.5%) (M: F:: 2:1). In a study it was observed that 34 (50.7%) were male and 33 were female (49%) patients of hydrocephalus.^[9]

Majority of the patients were of obstructive hydrocephalous type (72.5%) and only 25% were of communicating (nonobstructive) type. Another study reported that obstructive hydrocephalus (47.9%) was the most common diagnosis followed by communicating type (13.3%).^[10] Most common site of obstruction is aqueduct of sylvius accounting 47.5% of cases followed by basal cistern (25%) and fourth ventricle (22.5%). In only two patients, site of obstruction was foramen of Monro (5%). Aqueductal stenosis was the one of the commonest cause of hydrocephalus in one of the study (17.34%) rivalled only by spinal dysraphism (n=16.32%).^[8]

Hydrocephalus was detected in almost all cases of meningo-myelocele. It developed either after surgical repair of the defect or was present primarily.

In this study commonest cause of congenital hydrocephalous is aqueductal stenosis (14, 35%). Basal exudates produced by tubercular infection/ pyogenic infection were mainly responsible for the obstruction in basal region (7 out of 100). Similar to our results, Another study found that the main cause of ventricular dilatation in the fetus was aqueductal stenosis (33.43%).^[11]

Most common triad of symptoms was fever, headache, vertigo and altered sensorium in the study. One study reported that majority of the infants patients were clinically asymptomatic, however headache was present in 16% cases; vomiting in 14% cases, refusal of feed in 8% cases and lethargy in 4% cases. Patients who reported late were with more severe symptoms in comparison to patients who reported early.^[8] As compared to previous study infection rate is significantly lower but seizure reported in more patients than previous study whereas chances of shunt extrusion was similar in both the studies and chances of diminished vision is slightly higher in present study. The shunt blockage reported in 22.5% in our study as compared to 8.11% in previous study.

In the study, 31 patients were operated (V.P. Shunt) only for once, one revised shunt surgery in 5(12.5%) and two revised shunt surgeries in 2 patients (5%). So, out of total

47 shunting operations, nine revised shunt surgeries were done. Agrawal *et al.*^[12] reported shunt related complication in 11 (30%) children and three of 37 children had to undergo multiple shunt revisions. Palur *et al.* also reported that 26 (22.8%) patients had to undergo one or more shunt revisions and even one patient required more than three revisions.^[13] Sil and chatterjee reported shunt infection rate of 15.6% and revision rate of 43.8% in their series of 37 children who underwent shunt surgery for TBM with hydrocephalus. Multiple revisions were done in 18.7% of patients.^[14] Similar to previous study shunt revision rate is same in our study.

In this study it was found that most of the shunt revisions were done 6 months after the previous shunt surgeries. In only one patient shunt revision was done within 3 months of previous surgery. Rajendra K found that 236 V.P. Shunt operations were performed in children under 12 years of age; and out of these 40 (16.94%) developed shunt complication, Among these 48 shunt revision surgeries were done in 40 patients (28 male & 12 female) and four- fifth of these shunt complications occurred within 6 months of previous surgery^[15] unlike our study in which shunt revisions were done after 6 month of previous surgery.

Sudheer Ambekar *et al.* reported^[16] a higher rate of complications following V.P. Shunt surgery in patients with hydrocephalus due to TBM than in patients undergoing shunt surgery for the other causes. Shunt malfunction rates in various series ranges from 16% to 42.3%. None of the studies analyzed the factors associated with shunt malfunction. It was observed in the study that chances of shunt revision was higher in tubercular group (6 out of 14 undergone shunt revision surgery). The incidence of post – operative complications was significantly higher in tubercular meningitis patients.

On analysis of CSF, shunt revision chances was found greatest in lymphocytic group. Out of total 9 revised surgeries, 6 were of lymphocytic group (probably tubercular). One study also observed that out of 70 shunt revisions performed in 53 patients, presence of infarcts, anemia, CSF cellularty and CSF glucose concentration were not associated with increased incidence of shunt malfunction.^[17] Analysis showed that shunt viability was longer in patients with CSF protein concentration less than 200 mg/ dl.

In the study mortality rate following V P Shunting was found to be 5.26% (2/38). Vedantam Rajshekhar *et al.* found that mortality on long- term follow up has been reported^[18] to vary from 10.5% to 57.1% in those with altered sensorium prior to surgery and 0 to 12.5% in patients with normal sensorium. Mortality rate in our study is lower than previous study (7.89% vs 10.5%) and all the expired patients were associated with moderate to severe type of hydrocephalous.

CONCLUSION

This Study confirms that most of the hydrocephalous patients have obstructive type, mainly due to aqueductal stenosis. These Patients commonly presented with increased head size, fever, headache, altered sensorium and seizure. Patients who presented late were more severe than who presented earlier. Tubercular patients were associated with more complications as compared to other group.

Patients operated for shunting were under satisfactory condition with single shunt surgery. Some post operative complications like surgical site infection, headache, extrusion of shunt from abdominal end, seizure, diminution of vision were encountered Shunt revision chances weremore in tubercular group.

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