



A clinical profile on the patients with VP Shunt failure - correlation with ventricular CSF analysis

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

ABSTRACT

INTRODUCTION: Hydrocephalous is common problem seen in paediatric neurosurgical practice. The ventriculoperitoneal (VP) shunt has been a main treatment modality for hydrocephalus since John Holter invented the shunt valve in 1959. Chhabra Hydrocephalus Shunt System is today a widely used low cost system all over the world. It is used in more than 50 countries of all continents. Almost 1/5th Population of the world is benefitted by this simple & low cost system. The development of the shunt device has provided significant improvement to the outcome of hydrocephalus patients. Recently, adjustable pressure valves and antibiotic-impregnated shunt catheters have been used to continue the trend in catheter development for better outcomes. VP Shunt failure is a common problem in management of hydrocephalous specially in children having hydrocephalous due to Neural tube defect and tubercular etiopathogenesis and belong to low socioeconomic status.

MATERIAL AND METHOD: This study was conducted at SVBP HOSPITAL associated with government LLRM Medical college, Meerut and private hospitals of Meerut during period of January 2013 to December 2018. All the patients admitted for revision of V P shunt due to failure of VP Shunt surgery of various etiopathogenesis. Shunt failure can occur due to obstruction ,disconnection, Migration of shunt assembly and fracture of shunt tube. Causes in abdominal cavity like ascites abdominal pseudocyst, infection and constipation .The risk factor for shunt infection include wound complication, leakage of CSF,surgery at very early age ,Pathogens like staphylococcus epidermidis.Shunt blockage may be due to abnormal content of CSF; choroid plexuses enveloping of ventricular catheter, incorrect placement of ventricular catheter (ventricular in brain parenchyma), extra peritoneal placement or abnormal placement of abdominal catheter . , In about 65 patients (61.0%) CSF was found to have normal cell count and all mononuclear and 36 samples (39.00%) was found to contain predominantly of lymphocytes

RESULTS: During the study period from January 2013 to december 2018, among the total of 310 V P shunt surgeries done on 204 patients, 84 patients under went ventriculo-peritoneal shunt revision surgery and 22 patients underwent twice revision (Total revision done in 106) due to failure of VP shunt at the period of 5 years in the Department of Neurosurgery, S.V.B.P. Hospital, associated with L.L.R.M. Medical College, Meerut and some private hospital in city. The CSF protein level seems to be elevated in 72 patients (67.74%) with a mean value of 185.47 mg% and between 15-60 mg% in 34 patients with a mean value of 36.8 mg%. The mean value of protein in all the 106 CSF samples is 145.45mg% and on applying student T test on the CSF parameters between single times operated patient and patients who underwent more than one shunt surgery. This shows that high protein in CSF samples of shunt revision patients is significantly associated with shunt obstruction. Also in patients undergoing more than one shunt revision surgery the ventricular CSF sample protein values are found to be elevated and is significantly associated with ventricular end shunt obstruction patients undergoing more than one shunt revision surgery.

Keywords: VP Shunt failure, ventricular CSF analysis.

INTRODUCTION

Hydrocephalous is common problem seen in paediatric neurosurgical practice. The ventriculoperitoneal (VP) shunt has been a main treatment modality for hydrocephalus since John Holter invented the shunt valve in 1959. Chhabra Hydrocephalus Shunt System is today a widely used

low cost system all over the world. It is used in more than 50 countries of all continents. Almost 1/5th Population of the world is benefitted by this simple & low cost system. The development of the shunt device has provided significant improvement to the outcome of hydrocephalus patients. Recently, adjustable pressure valves and antibiotic-impregnated shunt catheters have been used to continue the trend in catheter development for better outcomes. VP Shunt failure is a common problem in management of hydrocephalous specially in children having hydrocephalous due to Neural tube defect and tubercular etiopathogenesis and belong to low socioeconomic status.

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TABLE-1: CATEGORISATION ON THE BASIS OF AGE

Patients are categorized in 7 groups from birth to >40 yrs age.

Age	Number of patients(n=84)	Percentage (%)
INFANCY <1 YR	20	23.80%
1YR TO 5 YRS	28	33.30%
6YRS TO 10 YRS	12	14.30%
11 YRS TO 20 YRS	8	9.50%

21 YRS TO 30 YRS	12	14.30%
Ø 31 YRS	4	4.25%

Among the VP shunt revision patients most of the patients fall in the pediatric age group with a mean age of 8.9 years, maximum presented in 1 to 5 year age group (33.3%) . Age group below 10yrs constitute 71.4 % patients.

TABLE-2 - SEX RATIO

Sex	Number of patients (n=84)	Percentage
Male	48	57.1%
Female	36	42.9%

In this study male patient out number the female patients. Out of total 84 patients, 48 were male and 36 were female with male to female ratio of 1.3:1.

SEX RATIO (n = 84)

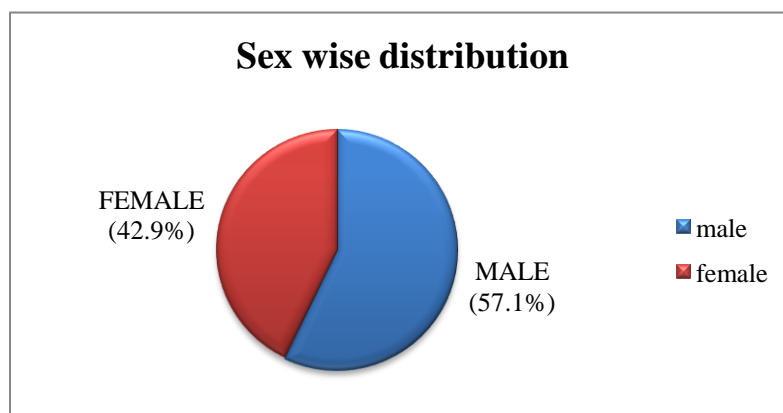


TABLE-3 - ETIOLOGY OF HYDROCEPHALOUS IN SHUNT REVISION PATIENTS

POST TUBERCULAR	40	47.6
POST MENINGITIS	12	14.3
TOTAL	84	100

In this study the most common etiology among the patients undergoing shunt revision surgery is tubercular (47.6%) followed by congenital hydrocephalous (38.1%) and pyogenic meningitis (14.3%) respectively. Hydrocephalous due to infectious etiology either tubercular or pyogenic have higher chances of revision of shunt surgery.

TABLE-4 CLINICAL PRESENTATION IN PATIENTS WITH SHUNT MALFUNCTION

Clinical Features	< 5 years age	> 5 years age
Fever	16	24
Headache	-	40
Altered sensorium	8	12
Seizure	36	28
Vomiting	44	24
Feed Refusal	8	-8
Visual Disturbances	-	8
Others (irritability, excessive cry, shunt tract infection and abnormal migration of shunt)	12	4

Although the patients presented to SVBP Hospital with more than one of the above mentioned symptoms, the most common among them were vomiting followed by seizures in age group <5 years and headache followed by seizure in age group >5 years. The most common symptom in early presented patients is altered sensorium(n=20). Among the other symptoms (n=16) patients also had irritability and other one had shunt tract infection during presentation.

TABLE -6: VENTRICULAR CSF ANALYSIS - PHYSICAL

Physical examination	Amount		10ml in all patients
	Colour	Opaque	22 samples
		Clear	84 samples
	Coagulum		16 samples

On physical examination of Ventricular Cerebrospinal fluid collected during shunting procedure out of 106 patients samples 84 of them were clear (77.4%) and 22 were opaque in which shunt either exteriorized or EVD/reservoir procedure were done. And VP Shunt revision procedure was not done. Coagulum was present only in 16 samples.

TABLE-7: VENTRICULAR CSF ANALYSIS – BIOCHEMICAL

	Parameter	Value	n=106	Percentage
Biochemical	Sugar	50-80 mg%	72	67.74%
		<50 mg %	27	25.8%
		>80 mg %	7	6.45%
	Protein	15 - 60 mg %	34	32.3%

		> 60 mg %	72	67.7%
		< 15 mg %	0	-
	Cells	Total WBC (0 – 5 / cu.mm)	65	61.3%
		lymphocytic	31	29%
		polymorphonuclear	10	9.7%

On biochemical examination of the 106 CSF samples, sugar level was below 50mg% in 27 patients (25.8%) with a mean value of 33.25 mg%, between 50-80 mg% in 72 patients (67.4%) with a mean value of 65.71 mg%.

The CSF protein level seems to be elevated in 72 patients (67.74%) with a mean value of 85.47 mg% and between 15-60 mg% in 34 patients with a mean value of 36.8 mg%. In about 65 patients (61.3%) CSF was found to have normal cell count and all mononuclear and 9 samples (29.03%) was found to contain predominantly of lymphocytes.

TABLE-9 VENTRICULAR CSF ANALYSIS –MICROBIOLOGICAL

Total 106 patients ventricular CSF was analysed .

Microbiology	Parameter		No. of samples	%
	Gram stain		0	-
	Acid fast		12	11.3%
	Fungi		3	2.8%

In this study 12 CSF samples were found to be AFB positive (11.3%).

TABLE: 10- Total 106 patients ventricular CSF .

Microbiology	Parameter		No. of samples	%
	Culture & sensitivity	Positive	30	28.3%
		Sterile	76	71.6%

76 out of 106(71.6%) CSF samples were reported sterile and only 30 out of 106(28.3%) patients culture and sensitivity report came as positive.

TABLE NO.12-CSF culture and sensitivity(n=30): -Organism detected.

ORGANISM	TOTAL POSITIVE SAMPLE (N=30)
STAPHYLOCOCCUS EPIDERMIDIS	N=18 (60%)

STAPHYLOCOCCUS AUREUS	N=9 (30%)
COLIFORM	N=1 (3%)
STREPTOCOCCI	N=2 (6%)

In this study most common organism detected in culture and sensitivity was staphylococcus Epidermidis and in 90% (N=18) cases. Then in 30% (N=9) staphylococcus Aureus, Rest in 10 % cases other organism was detected.

DISCUSSION

VENTRICULAR CSF ANALYSIS

In our study on physical examination of the 106 Ventricular Cerebrospinal fluid samples collected during the shunt revision procedure, most of the CSF samples were clear (77.4%) and it was opaque in 22 (22.6%). Coagulum was present in 16 samples (12.9%). VP Shunt procedure were deferred in patients having opaque CSF on physical examination.

On biochemical examination of the 106 CSF samples, sugar level was below 50mg% in 27 patients (25.8%) with a mean value of 33.25 mg%, between 50-80 mg% in 72 patients (67.4%) with a mean value of 65.71 mg%.

The CSF protein level seems to be elevated in 72 patients (67.74%) with a mean value of 185.47 mg% and between 15-60 mg% in 34 patients with a mean value of 36.8 mg%. The mean value of protein in all the 106 CSF samples is 145.45mg% and on applying student T test on the CSF parameters between single time operated patient and patients who underwent more than one shunt surgery, In about 65 patients (61.0%) CSF was found to have normal cell count and all mononuclear and 36 samples (39.00%) was found to contain predominantly of lymphocytes. This shows that high protein in CSF samples of shunt revision patients is significantly associated with shunt obstruction. Also in patients undergoing more than one shunt revision surgery the ventricular CSF sample protein values are found to be elevated and is significantly associated with ventricular end shunt obstruction.

S. Ambekar et al⁸⁷ 2013 found in a study that the patients who had shunt malfunction had a significantly higher concentration of CSF protein. The CSF cellularity and glucose concentration did not have any significant bearing in predicting shunt malfunction. Patients with CSF protein concentration of more than 200 mg/dL had a four times higher risk

of having shunt malfunction than those with a concentration of less than 100 mg/dL. Patients with CSF protein in the 100-200 mg/dL range represent an intermediate zone. In our study, the average protein value in majority of the patients was found to be 185.47 mg% which falls in intermediate risk group as per the study by Ambekar et al. Also there was no significant correlation between the CSF cell counts and risk of shunt malfunction. The same results were obtained when CSF glucose and cellularity analysed in our study. Also the increased protein values were significantly associated with VP shunt obstruction in our study which is nearly same as reported by S.Ambekar et al.

Dwarkanath Srinivas et al 2013 observed that 70 shunt revisions were performed in 53 patients. Shunt malfunction rate in their series was 16.2%. Presence of infarcts, anaemia, CSF cellularity and CSF glucose concentration were not associated with increased incidence of shunt malfunction. Analysis showed that shunt viability was longest in patients with CSF protein concentration less than 200 mg/dL. This study too is almost similar to our study with a mean protein range of 145.45 mg% with a 1 month shunt failure rate of 14.28%.

Van der Veen et al concluded that for protein concentrations less than 8.5 g/l, increases in viscosity could not be responsible for shunt mal-functioning. He did mention, however, the possibility of the presence of fibrinogen increases the risk of clotting and shunt obstruction. According to Pudenz et al⁹¹ these dysfunctions were caused by obstruction through fibrin particles and cryoglobulin aggregates. It must be remarked here that normal CSF does not contain fibrin particles.

In our study, on microbiological examination 12 CSF samples were found to be AFB positive (11.3%). 76 out of 106(71.6%) CSF samples were reported sterile and only 30 out of 106(28.3%) patients CSF culture and sensitivity report came as positive Most common

organism detected was staphylococcus epidermidis and then staphylococcus aureus. In our study most of the CSF samples obtained were sterile (70.96%) on culture sensitivity.

Sarguna et al⁹² 2006 found in their study that 9 out of 226 (3.98%) of the CSF samples were culture positive. Coagulase negative Staphylococcus was the most common isolate accounting for 36.36%. In all cases the CSF was clear and revealed no pleocytosis and no fall in the glucose levels. All CSF and blood cultures were sterile. In all the nine cases, the organisms were isolated solely from the shunt tube, indicating an early colonization. Cultures may be negative even when the shunt device harbours infection. In such circumstances it could be an indolent infection with colonization of shunt and a sterile CSF.

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