

Original Article (BRAIN)

Early Outcome of Ventriculoperitoneal (VP) Shunt in Terms of Improvement and Complications

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ABSTRACT

Objective: To analyze the outcome of ventriculoperitoneal (VP) shunts in terms of improvement and complications.

Material and Methods: This retrospective observational study is done in MTI Mardan medical complex and Prime teaching hospital from September 2017 to March 2020. The hospital record of all patients who underwent ventriculoperitoneal shunts was reviewed for improvement and complications. Patients undergoing ventriculoperitoneal shunt for normal pressure hydrocephalus were excluded from this study. Revision of ventriculoperitoneal shunt was the primary endpoint of the study.

Results: A total of 167 patients were operated on for ventriculoperitoneal shunts with males 106 (63.47%) and females 61 (36.52%). Age ranged from 1 month to 75 years with a mean of 14 years. The most common indication for surgery was congenital hydrocephalus in 102 patients (61.1%) while brain tumors caused hydrocephalus in 25 (15%) patients. Common presenting symptoms were the increase in head size in 75 (44.9%), and headaches in 84 (50.2%) patients. Symptomatic (headache, vomiting, and increase in OFC) improvement occurred in 145 patients (86.82%). Shunt revision was needed in 50.29% (84 patients) in one year.

Conclusion: VP shunt is a life-saving procedure and is an effective treatment of hydrocephalus but is not risk-free. Almost half of the shunted patients will need revision surgery in one year period.

Keywords: Hydrocephalus, Ventriculoperitoneal Shunt, Occipitofrontal Circumference (OFC).

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INTRODUCTION

Hydrocephalus (HCP) is the abnormal accumulation of cerebrospinal fluid in the ventricles which is or has been under high pressure.¹ The incidence of congenital hydrocephalus is 1 per 10000 live births in the developed nations whereas it is supposed to be greater in the developing countries due to more cases of spinal dysraphism.^{2,3} Common causes of

acquired hydrocephalus are central nervous system (CNS) infections, normal pressure hydrocephalus (NPH), tumors, post-traumatic and post subarachnoid hemorrhage.^{4,5} The most common modality for diagnosis is ultrasound head, CT, and MRI brain.⁶ Treatment of HCP always remains a challenging task for the neurosurgeons, which is consistently discussed and improved upon. Irrespective of causes, treatment of hydrocephalus is surgical either by endoscopic third ventriculostomy or CSF diversion via shunting procedures.⁷ However surgical intervention is not risk-free and needs the lifetime commitment of the surgeon and patient.⁸

The Ventriculoperitoneal (VP) shunt procedure is in practice for decades but still has a very high complication rate of 11 – 25% in the initial year of the procedure.⁹ It is a common saying in neurosurgical practice that putting a shunt is putting a new disease into the patient. VP shunt procedure involves the use of a very narrow tube along with a valve mechanism that channels the CSF from the brain to the peritoneum where it is absorbed, hence excess intracranial pressure (ICP) is relieved.¹⁰ Over the decade innovations are brought into the surgical procedure and shunt system with valve design, but dismal results in preventing shunt malfunction are the final progress made so far.¹¹ The most common complications related to the CSF diversion procedure are shunt blockage, infection, breakage, and pseudocyst.^{8,13} Shunt revision and other shunt-related surgeries in a shunt-dependent patient cause economical and social stress to the patients and their families.^{5,13} The purpose of our study is to assess the overall outcome (improvement in signs and symptoms and post-operative complications) of VP shunting in tertiary care hospitals. The study will signify the inherent adversities related to the shunt material and the overall surgical procedure itself. This study is conducted to highlight the importance of

further research in improving the outcome of this life-saving procedure.

MATERIAL AND METHODS

Study Design and Setting

This 2 and half year (from September 2017 to March 2020) retrospective observational study was carried out in Mardan medical complex, Mardan and Prime Teaching Hospital, Peshawar.

Sampling

Sampling was done through consecutive nonprobability sampling. A total of 167 patients were operated on for ventriculoperitoneal shunts.

Inclusion Criteria

Patients of both gender with HCP were included in the patient.

Congenital and acquired HCP both were included in the study.

Exclusion Criteria

Patients with Normal pressure HCP.

Patients have undergone VP shunting previously.

Clinical Management

After getting approval from the hospital ethical committee medical record of the included patients were evaluated. The study was conducted for 1 year or if the patient required a shunt revision due to any cause after the VP shunt was placed to treat HCP. Presenting complaints of all the included patients along with causes of HCP were gathered. Improvement in signs and symptoms of the patients and the complications that occurred after the procedure were all recorded.

RESULTS

Gender and Age Distributions

Total males 106 (63.47%) and females 61 (36.52%) were included in the study. age ranged from 1 month to 75 years with a mean of 14 years.

Clinical Information

The most common indication for surgery was congenital hydrocephalus in 102 patients (61.01%) while brain tumors caused hydrocephalus in 25 (15%) patients. Common presenting symptoms were an increase in head size in 75 (44.9%), headache in 84 (50.2%) nausea and vomiting in 90 (53.89%), and a decrease in

vision in 30 (17.96%). Keen's point for VP shunting was utilized in 130 patients and Kocher's point in 37 patients. Symptomatic improvement (headache, vomiting, increase in OFC) occurred in 145 patients (86.82%). Shunt revision was needed in 50.29% (84 patients) in one year.

Pictures of some common complications of VP shunting



Figure 1: A child with the exposed upper end of VP shunt (used with patient's family's permission).



Figure 2: Exposed shunt through the skin due to infection (used with patient's family's permission).

Table 1: Etiology of shunted patients.

Etiology	Number of Patients	Number of Revisions
Congenital (aqueductal stenosis)	72	45 (60%)
Congenital with spinal dysraphism	30	24 (80%)
Post meningitis	15	6 (40%)
Post-traumatic	10	2 (20%)
Brain tumors	25	4 (16%)
Post aneurysmal bleed	8	2 (25%)
Others*	7	1 (14.28%)

*Two patients of vein of Galen malformation, 3 patients with a colloid cyst, and 2 patients of SEGA (subependymal giant cell astrocytoma).

Table 2: The most common reasons for shunt failure.

Reason	n (%)
Blockage of upper end	60 (71.42%)
Blockage peritoneal end	6 (7.12%)
Infection	9 (10.71%)
Shunt exposure*	5 (5.95%)
Hydrocele	1 (1.19%)
Pseudocyst	2 (2.38%)
Breakage	1 (1.19%)

(Total 84 revisions).

*Four shunts exposed due to skin breakage and one shunt had per rectum exposure.



Figure 3: Lower end VP shunt infection (used with patient's family's permission).



Figure 5: Baby with upper-end shunt blockage and subgaleal CSF collection (used with patient's family's permission).

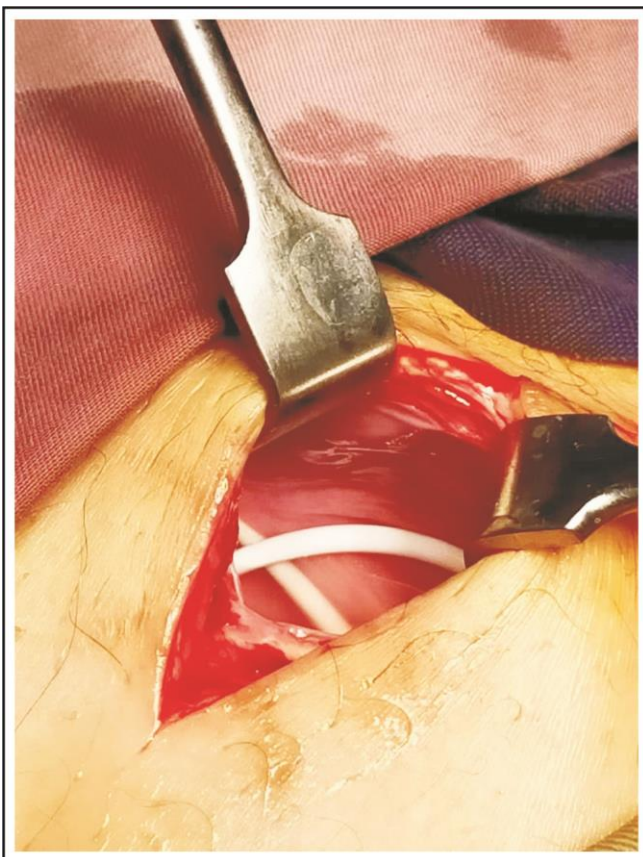


Figure 4: Intraoperative view of intraperitoneal pseudocyst formation (used with patient's family's permission).

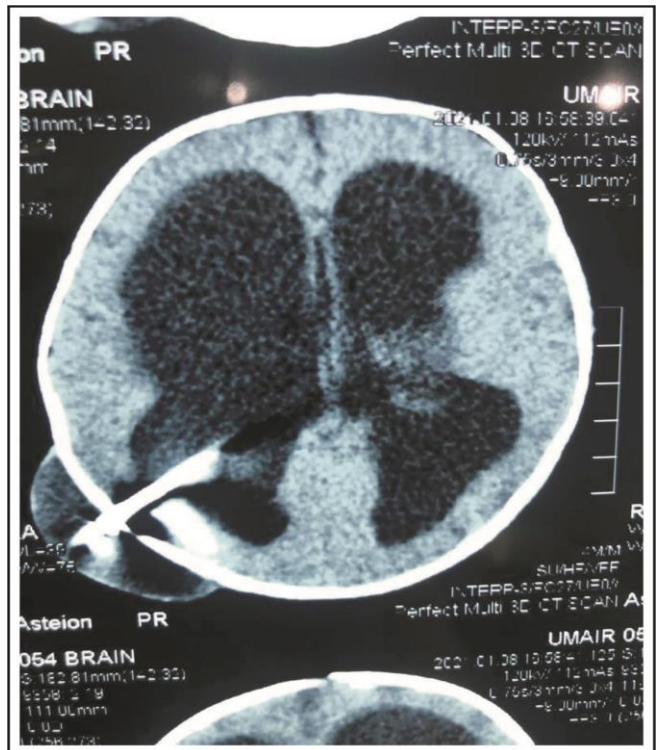


Figure 6: Same baby CT scan with subgaleal CSF collection (used with patient's family's permission).

DISCUSSION

In our study, there is a male predominance for hydrocephalus with a ratio of 1.57:1. This is the same as in a few other studies.^{3,8} This cause of male predominance is not yet clear. The common causes of hydrocephalus in our study are congenital hydrocephalus with or without spinal dysraphism (61.1%) which is comparable to another national study¹⁴ and international study⁵. Brain tumors causing hydrocephalus in our study constitute 15% of patients which is higher than the local study of 5%¹⁴ but are lower than an international study of 24.1%.⁵ The reason for this difference seems to be the greater sample size in the later study. Also, the patient population with brain tumors tends to get treatment in well-equipped tertiary care hospitals. Post meningitis hydrocephalus in our study is 8.98% which is comparable to 11.9% of the study by Elawad.¹⁵ Total shunt revisions in our study are 50.29% which is comparable to the local study by Bakhsh⁹ and the international study of Reddy et al.⁵ Symptomatic improvement (headache, vomiting, increase in OFC) occurred in 86.82% which is comparable to 88.6% of the study undertaken by H. Bilitus.¹⁶ The most common reason for shunt revision surgery in our study is blockage of the ventricular catheter (60 patients 71.42%) which is following the study by Cozzens and Chandler.¹⁷ The rate of lower-end obstruction of 7.12% is comparable to 12.1% of the same study. Infection of the shunt requiring revision surgery in our study is 10.71% (9 patients) is comparable to different local and international studies.^{8,13,&14} Antibiotic impregnated VP shunt catheters have mixed outcomes in different studies while some studies suggest no significant reduction in infection rates, others have positive results in terms of fewer deaths, fewer hospital days, and overall cost savings.¹⁸ Studies have concluded a significant relation between the complication rates and etiology of HCP.^{19,20} In our study, the highest rate of complications resulted with congenital causes of HCP than with other causes.

CONCLUSION

Ventriculoperitoneal shunt for hydrocephalus is an effective treatment option but is not risk-free almost half of these patients will need shunt revision surgery in one year. The most common reason for shunt revision surgery is blockage of the peritoneal end. Giving special importance to the aseptic environment per operatively along with post-operative care is highly recommended to reduce the complication rate of VP shunting.

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Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTION

Sr #	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Muhammad Zubair Bashir	1. Study design and methodology.
2.	Musawer Khan	2. Paper writing and data calculations.
3.	Sajid Khan	3. Data collection and calculations.
4.	Muhammad Ishaq	4. Analysis of data and interpretation of results etc.
5.	Musawer Khan	5. Literature review and referencing.
6.	Naeem-ul-Haq	6. Analysis of data and quality insurer