

Complications of Ventriculoperitoneal Shunts in Paediatric Patients with Hydrocephalus

Muhammad Akmal Hussain, Khalid Mahmood

ABSTRACT

Objective: To assess the pattern, causes and frequency of Complication of Ventriculoperitoneal Shunt surgery in Paediatric patients. **Material and Method:** 404 patients with hydrocephalus were operated between the period of 2004 to 2013 in the Departments of Neurosurgery and Paediatric Surgery at Allied Hospital, Punjab Medical College, Faisalabad. All patients with provisional diagnosis of Hydrocephalus were admitted in the hospital, detailed history was recorded and general physical examination with special emphases on neurological examination. Diagnosis was confirmed on the basis of investigations like Cranial Ultrasonography, CT and MRI scanning. Data analysis was carried using Statistical package of social Sciences

(SPSS). **Results:** Of the 404 patients 176(81.48%) were male and 40(18.51%) female. Shunt infection was the commonest complication (12.9%) followed by Blockage (8.3%). Shunt related mortality was (1.8%). The mean age among the patients showing disconnection was 20.7 months compared to mean age of 7.8 months for not having this complication($p < 0.04$). **Conclusion:** Infection remains the most significant complication of VP Shunt surgery. Ventriculoperitoneal Shunt operation should be considered a major surgical procedure. Children with VP shunt should receive follow-up through the transition the adult hood.

Key Words: Shunt Complications, Shunt failure, shunt infection, Ventriculoperitoneal Shunt.

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INTRODUCTION

Obstetric Hemorrhage remains the most common Hypercephalus is a common pediatric disorder in which there is increase in CSF volume, which in turn causes enlargement of ventricles, thinning of the cortical mantle, and elevation of intracranial pressure (ICP)⁶. To prevent neurological deterioration associated with increased ICP, CSF diversion is required. Treatment with CSF diversion techniques such as valve-regulated CSF shunt systems increase life expectancy in pediatric

patients with hydrocephalus and improves their intellectual outcome. Hydrocephalus results from a disparity between CSF production and absorption^{1,5}. Most of the children become shunt dependent after they undergo shunting.

Consequently, children with shunts require lifelong follow-up, especially in light of high incidence of failure over the life of a shunt. The probability of the occurrence of shunt failure was 70% at 10 years after the initial shunt insertion, with the highest risk for shunt failure occurring in the immediate postoperative period i.e. 30% risk of failure during the 1st year and a 2% to 5% risk per year thereafter.

CSF shunt systems consist of at least three components: a ventricular catheter, which is placed occipital or frontal horn of the lateral ventricle; distal shunt tubing to drain in the CSF into a distal site for absorption; and a valve.

Corresponding Author:

Dr. Muhammad Akmal Hussain
Associate Professor of Neurosurgery,
Punjab Medical College, Faisalabad
Tel. +92 300-7657724
E-mail: nsakmal@yahoo.com

Differential pressure shunt valves control unidirectional CSF flow by opening at a fixed pressure differential across the valve. So valves are designed as low, medium and high pressure valves.

CSF shunt system malfunction is due to three main factor (1) mechanical failure, (2) infection and (3) overdrainage or underdrainage i.e. functional failure. Proximal obstruction is the most frequent cause of mechanical shunt failure. Other causes include obstruction of the distal catheter, formation of pseudocyst of peritoneum, fracture of shunt, disconnection of shunt, migration of shunt etc.

MATERIALS & METHODS

A total of 404 consecutive patients with hydrocephalus were operated upon during the period of 2004 to 2013 in Neurosurgery and Paediatric Surgery Units Allied Hospital Faisalabad. Imported VP shunt mostly Chhabra univalve ventriculoperitoneal shunt system was installed. Cranial ultrasound was performed in all cases to note the ventricular dilatation and cortical thickness. In most cases CT brain was also performed. The decision to operate was based on the head circumference, which was larger than expected for age or rapidly increasing when correlated with standard head circumference charts. All patients were admitted at least a day before surgery and were examined to exclude preoperative conditions such as chest infection anaemia or skin infection. A pre-anaesthetic visit further confirmed the child's suitability for general anaesthesia and surgery. Intravenous ampiclox was given to all the children at the time of shaving the scalp and for a further 3 days. Intubation anaesthesia was used in all cases. The right occipital access to the lateral ventricle was used for the ventricular catheter and the peritoneal catheter was passed subcutaneously in the usual way. CSF was collected for bacteriological studies. In the cases where CSF was obviously turbid or haemorrhagic the procedure was abandoned and external drainage done for a few days while antibiotics were continued in the case of infected CSF. Operation was rescheduled when CSF was clear. The patients were discharged to the wards after fully recovering from the anaesthetic and

were allowed to breast-feed. Patients were usually discharged home on the 5th to 7th postoperative day. The first follow-up was at 2 weeks postoperative when the wounds were evaluated and occipitofrontal circumference measured. Further follow-ups were at 4 weeks and at three months. There after regularly followed up the children at OPD. At this follow-up the head circumference of the children was measured and any suspected deterioration reported to the us. In this way the children had been followed up for various periods of time ranging from 1 to 5 years. The staff also reported any deaths recorded. Deaths not directly related to the hydrocephalus or shunt implant were recorded as such. At the author's clinics shunt function was reviewed, the occipitofrontal circumference measured and the neurological status documented.

RESULTS

The total number of children operated upon was 404 of whom 216 had complete follow-up information. Table 1 shows the age and sex distribution of the 216 children. There were 176 males and 40 females. Fifty four of the children were less than 1 month old, 60 patients were less than 6 months of age, rest of children were less than 1 year of age at operation. The mean occipitofrontal circumference was 50.7 cm with the lowest measuring 36 cm and the highest 73cm. Table 2 shows the type and frequency of shunt complication. The complications were: shunt infection shunt blockage, wound infection, disconnection and extrusion. Shunt infection was the commonest complication (12.9%) followed by shunt Blockage (8.3%) shunt disconnection(5.5%). The combined complication rate of shunt infection and wound infection was 16.1%. Shunt-related mortality was 1.8 %. There were 2.3% shunt protrusion through anus, 1.8% cases of bowel perforation and obstruction. Inguinal hernia mostly bilateral in 3.2% cases and obstructed inguinal hernia having VP shunt in it 0.9% cases. Abdominal pseudocysts formed in 2.3% of our cases. A rare complication collection CSF along the subcutaneous VP shunt trace seen in 2.3% cases of this series.

Table 1: Age and sex Distribution of the children

Age Group (Months)	Male	Female	Total
Less than 1 month	42(19.4%)	12(5.5%)	54
Less than 6 months	48(22.2%)	12(5.5%)	60
Less than 12 months	86(16.2%)	16(7.4%)	102
Total	176(81.48%)	40(18.51%)	216

Table 2: Frequency of Post-Surgical Complications

Complications	Number	%
Shunt Blockage	18	8.4
Shunt Disconnection	12	5.5
Shunt Infection	28	12.9
Wound Infection	7	3.2
Shunt Protrusion	5	2.3
Bowel Perforation & Obstruction	4	1.8
Inguinal Hernia	5	2.3
Obstructed Inguinal Hernia with VP Shunt	2	0.9
Abdominal Pseudocysts	5	2.3
CSF Collection along Shunt	5	2.3
Died	4	1.8
Total	95	

DISCUSSION

Ventriculoperitoneal shunt is the most common procedure for the management of Hydrocephalus in paediatric group of patients. Although it's a simple procedure the complications related to VP Shunting remain the main cause of concern. We present a review of major complications of VP shunting noted in 411 paediatric patients. The most common complication was shunt infection (12.9%) followed by shunt blockage (8.3%). In many cases the shunt blockage was associated with shunt infection which may be the actual

cause of malfunctioning / blockage of shunt. In some malfunctioning shunts infection could not be detected clinically due to negative CSF cultures¹⁴. The most common symptoms of infection were fever, poor feeding and irritability⁵. The incidence of shunt blockage and shunt infection in literature varies in different series, Kestle J et al reported the incidence approximately 10% and 7.2 per procedure⁸. Lee et al reported shunt blockage as 12.2% of their series of 246 patients⁹. ADA Kinshahet all reported shunt blockage as 32% and infection 24.6% in Africa². In our series the infection rate of 12.9% meaning almost 1 in 8 is not comparable with North American studies with 1 or less than 1% infection rate but our results are comparable with other studies in Asia and Africa. Different studies show contradictory figures as regards age of the patient and the head circumference at the time of insertion or revision of VP shunt. Our study showed remarkable difference of shunt blockage or infection in children less than one year of age^{10,12}. The infection presumably starts with adherence of bacteria to the shunt surface which latter leads to the blockage of the system. The disconnection of the shunt specially in multicomponent shunt systems can be easily diagnosed by the migrations of ventricular catheter with routine imaging and can be confirmed with CT scanning in different planes. Many a times during revision procedure this displaced catheter is not retrievable and endoscopic assistance is required. Disconnection of shunt occurred in 5.5% and was found more frequent in younger children.(p<0.05). Aldrich and Harmann reported disconnection of shunt in 15% of their malfunctioning shunts and Occipitally inserted shunts were more affected. However in other studies no advantage of anteriorly placed shunts was found. (Bierbauer)¹.

CONCLUSION

We have observed a relatively high incidence of VP Shunt complications. Catheter occlusion represented a significant percentage of shunt failures. We recommend that Ventriculoperitoneal Shunting should be considered a major surgical procedure with strict adherence to aseptic techniques and performed by fully trained surgeon.

Children with VP shunt should receive follow-up through the transition the adult hood.

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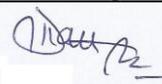
AUTHORS

- **Dr. Muhammad Akmal Hussain**
Associate Professor Neurosurgery
Allied Hospital, Punjab Medical College,
Faisalabad
- **Dr. Khalid Mahmood**
Associate Professor Paediatric Surgery
Allied Hospital, Punjab Medical College,
Faisalabad

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Name of Author	Contribution to the paper	Author's Signatures
Dr. Muhammad Akmal Hussain	1 st Author	
Dr. Khalid Mahmood	2 nd Author	