

Post-Operative Complications of Ventriculoperitoneal Shunt in Children at Neurosurgery Department Allied Hospital Faisalabad

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Abstract

Objective: Hydrocephalus is the most common pediatric neurosurgical condition, with a high prevalence in low- and middle-income countries. Untreated, hydrocephalus leads to neurological disability or death. The epidemiology and outcomes of hydrocephalus treated by ventriculoperitoneal (VP) shunts in Pakistan still are not well defined and vary by region and class. The aim of this study was to determine the post operative complications of VP shunt in children presented to Department of Neurosurgery in Allied Hospital Faisalabad

Study Design: Retrospective cross sectional observational study

Place and Duration of Study:

Department of Neurosurgery Allied Hospital Faisalabad from June 2019 to July 2020

Methodology: A total of 52 children were included in this study through OPD and Neurosurgical emergency by non probability sampling. All the children were gone through CT brain and MRI brain before VP shunting.

Results: Thirteen(13) 25% patients were presented with complications. Out of 13 patients 10 children were presented with infection 77% , two(15.4%) with malfunctioning of shunt and 01(7.6%) patient with mal positioning . The mean number of surgeries performed on these patients were 1.6 % . All of these patients with these complications were identified with in 1 week after surgery.

Conclusion: Infection was the most common complication. The infection rate was proportional to the length of hospital stay. All patients with hydrocephalus due to tumors or myelomeningocele presented complications. A higher incidence of infections was observed in children older than 2 years.

Keywords: hydrocephalus, hydrocephalus valve, ventriculoperitoneal shunt, ventriculoatrial shunt, early complications.

Introduction

For many years since 1950 ventriculoperitoneal (VP) and ventriculoatrial (VA) have been effectively used for the surgical management of hydrocephalus. The main and important complication of this type of surgery is infection, which results in severe postoperative complications such as fever, cognitive decline and neurological deficits. Many risk factors that contribute in the development of VP shunt infections, such as secondary hydrocephalus, a history of meningitis, premature baby and lack of expertise of surgical team, prolonged duration of surgery and hospital stay, CSF fistula, wound and scalp necrosis, and perforation or infection of abdominal viscera, among others.

The main causative agents of shunt infections are Staphylococcus epidermidis (52.8 to 88.9%), Staphylococcus aureus (12 to 40%), Gram-negative bacilli (9 to 22%), enterobacteria, Klebsiella pneumoniae, and Pseudomonas aeruginosa¹.

Another important cause of complications is malfunctioning of the shunt valve. Obstruction of the ventricular catheter is responsible for a malfunctioning shunt. Obstruction with choroid plexus tissues, debris and intraventricular glial tissue and inappropriate insertion of the proximal catheter within the cerebral parenchyma or at the border of the ventricular wall contribute to inadequate CSF drainage¹.

VP shunt infection rates range from 0 to 31.4%, with a mean of 10 to 15%¹. VP shunt procedures present higher complication rates than endoscopic third ventriculostomy, but the latter is mainly indicated in selected cases of obstruction of the Sylvian aqueduct or of the fourth ventricle.

Methodology

This observational cross sectional study was conducted in Department of Neurosurgery Allied Hospital Faisalabad/ Faisalabad Medical University from June 2019 to July 2020. A total of 52 children were included in this study through OPD and Neurosurgical emergency by non probability sampling. All the children were gone through CT brain and MRI brain before VP shunting after taking informed consent from their parents. Children with low GCS below 8 were excluded from this study.

Results

A total of 52 children were included in this study, out of which 30 children were males and 22 were female children. Age of children range from 0-13 years with mean 2.21. Distribution of age and gender as tabulated.

Age	Males		Females	
	Numbers	%	Numbers	%
0-2	15	50	13	59
2-7	10	33.33	06	27.27
7-13	05	16.7	03	13.6

Table1:

A total of 98 surgical procedures were performed, corresponding to 1.6 surgeries per patient. Thirteen (13) 25% patients were presented with complications. Out of 13 patients 10 children were presented with infection 77%, two (15.4%) with mal functioning of shunt and 01 (7.6%) patient with mal positioning. Signs and symptoms of infection observed after surgery are shown in table no:02

Numbers	Infectious Manifestation	Number	%
01	Fever	07	70
02	Fistula	01	10
03	Pseudocyst	01	10
04	Skin Erosion	01	10

Table2:

Analysis of the relationship between age and complications showed a significantly higher rate of infection among children older than 2 years (Table 3), a finding that is in contrast to literature data [2,3].

Age	Complications	No of Complications
< 2 years(n:28)	04(14.28%)	16
2 years(n:24)	09(37.5%)	19
Total	13	33

Table3:

Age	Complications	No of Complications
< 2 years(n:28)	04(14.28%)	16
2 years(n:24)	09(37.5%)	19
Total	13	33

Table4:

Complications were more frequent among patients with primary hydrocephalus (8/13, 61%). Hydrocephalus secondary to a tumor or myelomeningocele was responsible for complications in five (38.46%) of the 13 patients with shunt complications.

However, this result was inverted when we analyzed the number of complications in relation to the total number of patients. Forty three of the 52 patients had primary hydrocephalus and only 08 of them (18.6%) presented complications. In contrast, 09 of the 52 patients studied had secondary hydrocephalus, with complications being observed as follows (Table 4).

Relationship between cause of hydrocephalus and complications

Cause of Hydrocephalus	Complications	No of complications	Total
Primary Hydrocephalus	8(18.6%)	33	43
Melomeningocele	3(50%)	00	06
Tumour	2(66.7%)	00	03
Total	13	00	52

Complications were observed in all patients who were hospitalized for 15 days or more, with the diagnosis of complications being made, on average, at 9.3 days.

Discussion

Infection is the first and immediate postoperative complication observed in children undergoing surgery for hydrocephalus. An infection rate of 18.6% was found in our study. This value is high but still within the rates reported in the literature worldwide which ranges from 3 to 30%^{2,3}.

If patients with myelomeningocele and brain tumors were excluded from the present sample, the infection rate further falls to about 17%.

Infection rates are much higher in these patients as compared to children with congenital hydrocephalus because the former normally require a longer hospital stay and most of the children develop other clinical complications such as fever, hospital acquired pneumonia and urinary tract infections which markedly increase the risk of VP shunt infections^{2,3}. According to literature, 70 to 80% of shunt related infections occur within the first postoperative month and 14% occur from the first to the 09 month postoperatively⁴.

Lima et al.⁴ observed a surgical wound infection rate of 27.6% (16/58) per procedure and of 32% (16/50) per patient. Almost 80% of cases being diagnosed within first month postoperatively month. Since this study was carried out for a short period, our infection rate is probably higher than observed in that study³. However, in view of the problems encountered at public sector hospitals and considering a value of 10% observed in patients with primary hydrocephalus, this rate is within an acceptable limit⁵.

In our study, all children who were admitted in hospital for more than 2 weeks developed infections of the shunt system. Although the small sample size, our study suggests that longer the duration of hospital stay is directly proportional to VPS infection by accelerating the chances of bacterial colonization. In a latest publication, Thompson et al.⁶ told that the time of

susceptibility to bacterial infection exceeds much beyond the time of surgery. It was also observed that source of infections were not only surgical field but also exposure and cleaning of the surgical wound as well. This reinforces the need to reduce the duration of hospitalization and to maintain special surgical wound care⁰⁶

Some researchers^{5,07} have also observed an important relation in child's age of less than 6 months vs infections of the surgical wound, whose frequency was 2.6 times higher than in children older than one year. Other literature did not find any significant difference in the infection rate between different children's ages⁰⁸. A significant increased risk of infection was only observed among premature babies⁵ in which immune system is not fully developed. In contrast to the literature, we observed a greater predominance of complications in the age group of 2 to 7 years.

Documented risk factors for Ventriculo peritoneal shunt infection as reported by multiple studies, include premature babies, young age [9],[10], [11], CSF fistula [11], holes in gloves during shunt handling [11], previous shunt infections and intraventricular hemorrhage [10]

Conclusion

Shunt malfunction continues to be a common neurosurgical problem in patients with hydrocephalus, often leading to frequent and sometimes lengthy hospital stays. Although there have been many developments aimed at reducing shunt malfunctions, such as antibiotic impregnated catheters, sterile techniques and programmable valves, patients with shunted hydrocephalus still commonly require multiple shunt revisions throughout their lifetime. To prevent morbidity, early detection and proper management are key. Shunt infection in premature neonates remains to be a serious problem as an underdeveloped immune system makes these patients especially prone to pathogens. With continued advancements in shunt systems and infection prevention, morbidity resulting from shunt complications may continue to be reduced.

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