A Prospective Study On Ventriculoperitoneal Shunt Surgery Complications In Tertiary Care Hospital

Zahid Khan¹, Seema Sharafat¹, Rabia Nazir², Fatima Younis³

¹Assistant Professor Neurosurgery, MTI LRH, Peshawar Pakistan
²Demonstrator Forensic Medicine, Islamic International Medical and Dental College, Riphah University, Rawalpindi Pakistan
³Medical Office rAnesthesi, Hameed Latif Hospital, Lahore

Corresponding Author: Dr. Seema Sharafat
Assistant Professor Neurosurgery,
MTI LRH, Peshawar, Pakistan
Email address: seemasharafat@yahoo.com

Abstract

Background and Aim: Hydrocephalus is defined as enlargement in ventricles size due to the increase in cerebrospinal fluid volume. Impaired cerebrospinal fluids in terms of absorption and pathways obstruction or subarachnoid spaces are the different causes for hydrocephalus. Ventriculoperitoneal shunt is the most prevalent performed treatment modality on elective or emergency basis for hydrocephalus in neurosurgery. However, this treatment modality is apprehended due to its various complications. There is paucity of data regarding ventriculoperitoneal shunt surgery complications. The present study aimed to evaluate the ventriculoperitoneal shunt complications in a tertiary care hospital.

Methodology: This prospective study was conducted on 96 hydrocephalus patients who underwent ventriculoperitoneal shunt in the Department of Neurosurgery, Lady Reading Hospital, Peshawar from January 2020 to December 2021. Hospital research and ethical committee approved the study protocol and written informed consent was obtained from each patient. Hydrocephalus patients of either gender without age discrimination who underwent first ventriculoperitoneal shunts were enrolled. Patients who underwent external ventricular drain, lumboperitoneal shunts, shunts revision, and ventriculoatrial shunts were excluded. Detailed history, clinical inspections, and full investigations such as cerebrospinal fluid, C-reactive protein (CRP), X-rays examinations, full blood count (FBC), brain CT scans and abdomen pelvis ultrasound has been carried out in all eligible patients. Post-surgery routine follow-up was scheduled one and six months after discharge. SPSS version 25 was used for data analysis.

Results: Of the total 96 hydrocephalus patients, there were 63 (66%) male and 33 (34%) females. Patient’s age-wise distribution was as follows: Age< 1 year 36 (37.5%), 1-10 years 28 (29.2%), 11-20 years 22 (22.9%), 21-30 years 7 (7.3%), and 31-40 years 3 (3.1%). The incidence of ventriculoperitoneal shunt surgery complications such as shunt blockage, infection, shunt erosion, and extrusion was 44 (45.8%), 34 (35.4%), 16 (16.7%), and 9 (9.4%) respectively. The mortality rate was 3.1% due to the complications of ventriculoperitoneal shunt surgery. Brain tumors was the most prevalent cause of hydrocephalus in 37 (38.5%) followed by Post-meningitis 21 (21.9%), encephalocles 11 (11.5%), Cerebellar hematoma 10 (10.4%), Intraventricular hemorrhage 6 (6.3%), Aqueduct stenosis 4 (4.2%), Neurocysticercosis 2 (2.1%) and others 2 (2.1%).
Conclusion: Our study concluded that the most prevalent ventriculoperitoneal shunt surgery complications were shunt blockage and shunt infection. Brain tumors were the common cause of hydrocephalus followed by post-meningitis and encephaloceles. Shunt upper end is more susceptible to complications than the lower end. The overall mortality rate was 3.1%. These complications might lead to severe clinical issues that result in patient’s death.

Keywords: Hydrocephalus, Ventriculoperitoneal shunt surgery, Complications

INTRODUCTION

Hydrocephalus means water collection in the human brain and is well-defined as ventricles enlargement with increases in cerebrospinal fluid volume [1]. Impaired cerebrospinal fluids in terms of absorption and pathways obstruction or subarachnoid spaces are the different causes for hydrocephalus [2]. Other causes of hydrocephalus are brain tumors, post-meningitis, encephaloceles, cerebellar hematoma, Intraventricular hemorrhage, Aqueduct stenosis, and neurocysticercosis [3-5]. Ventriculoperitoneal shunt is the common procedure used for the treatment of hydrocephalus [6]. In USA, ventriculoperitoneal shunt is the reason for 69,000 hospital discharges per annum and CSF shunt are approximately performed in 36,000 cases annually [7]. It is actually a CSF diversion device comprised of a tube with attached pressure regulating valve that carries CSF from ventricular system to brain outside absorption surface such as peritoneum [8]. Other shunts such as ventriculoatrial or ventriculopleural shunts carrying CSF to the vascular system and pleura respectively [9, 10] and such cases can be treated without using shunts. HDC causing extra cranial pressure could be relieved by VP shunting [10].

Infection, leakage of cerebrospinal fluid, placement failure, and mechanical malfunction are the major complications caused by ventriculoperitoneal shunt. Other complications are shunt blockage, infection, shunt erosion, and extrusion [11]. VP shunts might cause intracerebral haemorrhage and peritoneal catheter related complications such as bowel perforation, ileus, and pseudocyst formation [12]. The incidence of shunt failure was 14% in pediatric surgeries and estimated failure of shunt was 4% to 50% might fail within the first year [13]. However, the prevalence of shunt failure was 29% among adults [14]. Previous studies proposed that shunt revision might be required in 45% to 59% cases due to multiple failure and infections [15]. The present study aimed to determine the different complications of ventriculoperitoneal shunt.

METHODOLOGY

This prospective study was conducted on 96 hydrocephalus patients who underwent ventriculoperitoneal shunt in the Department of Neurosurgery, Lady Reading Hospital, Peshawar from January 2020 to December 2021. Hospital research and ethical committee approved the study protocol and written informed consent was obtained from each patient. Hydrocephalus patients of either gender without age discrimination who underwent first ventriculoperitoneal shunts were enrolled. Patients who underwent external ventricular drain, lumboperitoneal shunts, shunts revision, and ventriculoatrial shunts were excluded. Detailed history, clinical inspections, and full investigations such as cerebrospinal fluid, C-reactive protein (CRP), X-rays examinations, full blood count (FBC), brain CT scans and abdomen pelvis ultrasound has been carried out in all eligible patients. Post-surgery routine follow-up was scheduled one and six months after discharge. All the patients were examined in the neurosurgical outpatients department or emergency room. Information such as surgical illness, present complaints, and past medical illness were gathered. Based on clinical indication, ventriculoperitoneal shunting was carried out on elective or emergency basis. Post-surgical follow up of each patient was done from ward till discharge. During the follow-up, complications of any type were recorded. Complications were diagnosed based typical history, radiological evidence, and examination of shunt obstruction.

SPSS version 25 was used for data analysis. Numerical variables such as age were expressed as mean and standard deviation. Continuous variables such as gender, causes of hydrocephalus, and shunt complications were described as frequency and percentage. All the descriptive statistics were done using 95% confidence interval and 5% level of significance. Results were presented in tabulated form.
RESULTS

Of the total 96 hydrocephalus patients, there were 63 (66%) male and 33 (34%) females. Patient’s age-wise distribution was as follows: Age < 1 year 36 (37.5%), 1-10 years 28 (29.2%), 11-20 years 22 (22.9%), 21-30 years 7 (7.3%), and 31-40 years 3 (3.1%). The incidence of ventriculoperitoneal shunt surgery complications such as shunt blockage, infection, shunt erosion, and extrusion was 44 (45.8%), 34 (35.4%), 16 (16.7%), and 9 (9.4%) respectively. The mortality rate was 3.1% due to the complications of ventriculoperitoneal shunt surgery. Brain tumors was the most prevalent cause of hydrocephalus in 37 (38.5%) followed by Post-meningitis 21 (21.9%), encephaloceles 11 (11.5%), Cerebellar hematoma 10 (10.4%), Intraventricular hemorrhage 6 (6.3%), Aqueduct stenosis 4 (4.2%), Neurocysticercosis 2 (2.1%) and others 2 (2.1%). Gender’s distribution is shown in Figure-1. Figure-2 illustrates the age-wise distribution of all the hydrocephalus patients. Prevalence of different complications after VR shunt surgery is shown in Figure-3. Various causes of hydrocephalus is depicted in Figure-4.
DISCUSSION

The present study mainly investigated the post-ventriculoperitoneal shunt surgery complications in hydrocephalus patients present to the tertiary care hospital and found that shunt blockage was the most prevalent complication found in 45.8% patients. Other complications were infection, shunt erosion, and extrusion. Hydrocephalus is caused by
various factors such as brain tumors, post-meningitis, encephaloceles, cerebellar hematoma, intraventricular hemorrhage, aqueduct stenosis, and neurocysticercosis. Complications after ventriculoperitoneal shunt surgery is still a major health issue. Various factors such as improvement in shunt material and techniques had significantly associated with initial surgical risk, long-term risks such as shunt infection, mechanical failure, and shunt malfunction revision, and shunt failure associated mortality [16, 17].

Ventricular or peritoneal end can cause shunt obstruction which may result in blockage of shunt reservoir. Shunt malfunction could be caused by numerous factors such as tumor growth, shunt disconnection, infection, kinking or valve malfunction, choroid plexus causing ventricle end occlusion, and intraventricular blood [18]. The VR shunting most fatal complication is shunt infection. The prevalence of various infections varies from 0.2% to 30% as reported in various studies [19, 20]. Approximately 60% cases of shunt infections are caused by staphylococcus epidermidis. About 30% cases are caused by staphylococcus aureus and the remaining 30% are due to streptococci, coliforms, and propionibacteria [21]. In our study, the incidence of shunt infection was 35.4%.

Shunt extrusion can happen at any point along the catheter pathway. Extrusion might get through the scrotum, abdominal wall, anus or vagina, and scalp [22]. The incidence of shunt erosion was 16.7% in the present study. Most of the cases had upper end erosion followed by lower end erosion. The lower end erosion cases were contributed by umbilical, oral, rectal, and pre-vaginal erosion. Similar results were seen in a previous regional study [23]. Shunt proper function is essential that arises from proper placement of peritoneal and ventricular ends. Malposition could be significantly reduced by the ventricular end placement under endoscope and ultrasound.

Shunting might develop subdural hematomas with thin cerebral cortical mantles and large ventricular. Likewise, cerebrospinal fluid over drainage leads to obdurate low pressure headache and slit ventricle syndrome. In cases of symptomatic subdural hematoma formation, shunt tube’s temporary occlusion should be expatriated. Hematomas were seen in 10.4% cases in the present study.

Age plays a significant role as an important factor swaying shunt survival [24]. Patients were categorized into four different groups, out of which group-I (<1 year) patients had higher incidence of developing complications followed by group-II (1-10 years). The prevalence of complication was lower in a group-IV which is similar to the study conducted by Reddy et al [25]. In contrast, Lotfinia et al. [26] reported no significance association in shunt survival based on infant age. Several studies [27, 28] reported no significant variation in VR shunting complications with gender. In the present study, male patients were more susceptible to shunt complications than females.

Numerous studies reported a significant association between VR shunt complications and hydrocephalus etiology [29-31]. Likewise, in the current study, congenital hydrocephalus was the most prevalent shunt-related complications of VR shunt followed by hydrocephalus infections and tumor associated pathology. The higher prevalence of VP shunt procedures carried out on elective and emergency basis was due to different factors such as road traffic accidents (RTA), trauma, and infected cases. A previous study by Anderson et al [32] found that consultants play a significant role in performing VR shunt procedures. The incidence of VR shunt complications with consultant was 12% compared to the cases 22% without consultant. This study is limited to the small sample size and further detailed investigation needs to be carried out for the evaluating the shunt procedures long term complications.

CONCLUSION

Our study concluded that the most prevalent ventriculoperitoneal shunt surgery complications were shunt blockage and shunt infection. Brain tumors were the common cause of hydrocephalus followed by post-meningitis and encephaloceles. Shunt upper end is more susceptible to complications than the lower end. The overall mortality rate was 3.1%. These complications might leads to server clinical issues that results patient’s death.

REFERENCES


