FREQUENCY OF CAUSES OF VENTRICULO-PERITONEAL SHUNT FAILURE IN HYDROCEPHALUS PATIENTS

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ABSTRACT

Objective: *To analyze ventriculo-peritoneal shunt (VP shunt) failure cases in hydrocephalic patients, in a tertiary care hospital.*

Methodology: *This descriptive study was carried out in the Department of Neurosurgery Lady Reading Hospital Peshawar, from June 2009 to May 2010 (one year).The medical record of all cases operated in last one year was checked from record room. Documentation was done according to proforma designed indicating age, sex, clinical features, investigations with findings on X-rays, CT and MRI and per operative findings. Complications related to upper end, lower end and shunt track were noted. Data was analyzed to assess the causes for shunt failure in hydrocephalus patients.*

Results: *A total of 56 patients were included in this study. There were 43 children and 13 adults. Among children, 26 were males and 17 were females while in adults, 5 were males and 8 were females. Out of these, 28 patients were having blocked shunt, 20 cases with infected shunt, 6 patients had eroded and 2 patients displaced shunt.*

Conclusion: *Although shunt surgery is a common procedure performed for hydrocephalus, different complications were associated in our study where shunt failure was mainly due to shunt dysfunction, infection or breakage of shunt system. Complications were more with upper end. Infection was common in pediatric age group.*

Key words: *Shunt complications, Infection, shunt dysfunction, Pseudocyst, shunt erosion, Hydrocephalus.*

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INTRODUCTION

Shunt is mainstay of treatment for hydrocephalus since 5 decades but the consequences of its complications have remained a major problem. Although advances in surgical technique and shunt material have reduced the risk related to initial procedure, long term risks include repeated shunt malfunction, shunt infection, blockage, mechanical failure (breakage) and death associated with shunt failure[1-5]. Amongst These different complications, shunt malfunction and infection are frequent which present a significant problem in neurosurgical practice resulting in multiple hospital admissions.

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Shunt malfunction and infection are obvious from the clinical presentation in the form of headache, nausea/vomiting, lethargy, irritability[6], fever, redness over shunt track, discharge or abscess formation. But in spite of these features, these complications still present a diagnostic dilemma. This is because negative results on CT scan do not always rule out obstruction[7,8]. Likewise dilated ventricular system on CT and MRI is not always suggestive of blocked shunt[9,10]. Shunt is physiological mechanism by putting a mechanical device in human body and physiology of CSF dynamic cannot be tested by static images of morbid anatomy. Faced with the troubling clinical picture and an unhelpful CT scan, in certain cases, shunt tap is tempted to rule out a shunt malfunction. Considering the possibility of introducing infection, it is a contro-versial method of diagnosing shunt failure[11].

Different risk factors for shunt dysfunction and infection have been studied extensively. These include age, cause of hydrocephalus[6,12], clinical

status, CSF cytology, duration of surgery[13,14], number of preceding shunt operations[15], late timing of surgery, overcrowded operation theatre[1], preceding period with external drainage of CSF[16], premature status of infant[16,17], poor immunity / nutritional status, metabolic status, pre existing source of infection (the July phenomenon) and skill and experience of the surgeon[13,18].

The incidence of these complications varies in different countries and different centers with different groups of patients selected for VP shunt. We analyzed those patients, who needed revision surgery in our department, from different perspectives. By knowing the frequencies of causes of shunt failure will help us in adopting measure to decrease these complications.

METHODOLOGY

This descriptive study was conducted in all those patients in whom revision surgery of VP shunt was performed in the last one year from June 2009 to May 2010 in the department of neurosurgery Lady Reading Hospital Peshawar. All patients presented with symptoms of shunt related problems were examined according to surgeon's usual clinical practice. A part from clinical examination, x-rays, CT and MRI were performed when needed. In selected cases, shunt tap was also performed and fluid was sent for microbiological analysis. Common clinical symptoms were deteriorated sensorium, headache, vomiting, seizures, lethargy, fever, meningism, wound erythema, purulent discharge from the wound, erosion of shunt equipment through skin, swellings at upper and lower end and abdominal cyst. Majority of these patients presented in emergency and were operated on the same day.

In patients with opened fontanelle, with suspected infected shunt, shunt was removed and another shunt surgery was planned electively, till CSF examination was made clear after ventricular tap and antibiotics cover. While in patients with closed fontanelle, exteriorization of lower end was performed to divert infected CSF flow in separate sterilized bag. In patients with shunt dysfunction without infection or with eroded shunt equipment, new shunt was put in on opposite side.

RESULTS

A total of 56 patients were included in this study during one year duration. All the patients were divided into different groups according to age, sex and various causes of shunt failure.

The age range was from 2 months to 27 years. There were 43 children and 13 adults. Patients below 15 years were included in pediatric age group. In this group, 20 (35.71%) patients were infants, 11 in the age range of 1-5 years, 8 patients from 6-10 years while age of 4 patients was from 11-15 years (Table 1). Mean age of the patients was 7.64 years and standard deviation 8.2949. Gender-wise distribution of the patients in the study is also given in Table 1. There were 5 males and 8 females in adult group while 26 males and 17 females in children group. Thus as a whole, male to female ratio was 1.24 to 1.

These patients were classified in 4 groups according to the shunt status as, Blocked shunt, Infected shunt, Eroded shunt and Displaced shunt. The groups of shunt failure along with age and gender relation are given in the Table 2.

Table 1: Age and Gender Wise Distribution

Age	No: of patients	% age	Gender
<1 Year	20	35.71	Male 12 Female 8
1-5	11	19.64	Male 5 Female 6
6-10	8	14.29	Male 6 Female 2
11-15	4	7.14	Male 3 Female 1
>16	13	23.22	Male 5 Female 8

Table 2: Causes of Shunt Failure

Groups	No. of Patients	%Age	Age Group	Gender
A: Blocked shunt	28	50	Childerns 22 Adults 6	Male 21 Female 7
B: Infected shunt	20	35.71	Childerns 15 Adults 5	Male 16 Female 4
C: Eroded shunt	6	10.72	Childerns 5 Adults 1	Male 4 Female 2
D: Displaced shunt	2	3.57	Childerns 1 Adults 1	Male 2 Female 0

Shunt blockage was found in 50% of patients, with the cause of upper end obstruction being choroid plexus in 12 cases, brain debris in 2 and very long ventricular catheter lying in brain parenchyma in 4 patients. Thus upper end was found to be blocked in18 (64.29%) patients which is in consistence with published literature[11, 19].

Lower end was blocked in 8 (28.57%) patients, with sludge in peritoneal catheter being causative factor in 3 patients. Extra peritoneal shunt lower end placement and pseudocyst was noted in 2 and 1case respectively. Kinking of peritoneal catheter was detected in1 patient while in 1 case, omentum was found to be adherent with lower end. In 2 (7.14%) cases, no obvious cause for obstruction was found.

In our study, infection was the 2nd most common cause of shunt failure that was determined in 20 (35.71%) patients with the lower end being the common site in 12 cases (9 children and 3 adults) and upper end in 8 cases only.

Eroded group C included 4 cases of upper end and 2 cases of lower end while in displaced group, per rectal displacement of peritoneal catheter was seen in 1 case and in 1 patient, shunt reservoir was displaced in lower neck .We observed CSF around shunt reservoir in 3 cases as concomitant finding in infected group.

DISCUSSION

Infection in shunt surgery is well established complication and ranges from 10 to 40 % of patients depending upon different risk factors. Shunt infection usually requires removal or externalization of shunt and antibiotic therapy for variable period of time followed by insertion of new shunt. In infants and unclosed fontanelle children, removal of shunt device is better rather than externalization because of toleration of CSF pressure by open suture while in children with closed suture and elder patients; externalization of shunt with antibiotic therapy is justified due to problem of shunt dependency[2,3]. We observed infection in 15 children and 5 adults in whom majority were under 5 years (11 cases).

Shunt erosion with secondary infection was seen in 3 children while erosion without infection in 2 children and 1 adult patient. Upper end infection is more common in children with large head, poor nutritional status, post meningetic and shunt after external ventricular drain. We noted almost similar cases of both upper and lower end infection in children and 3 cases of lower end in adults while pseudocyst was seen in 1 case. Shunt track infection was seen in 4 cases. Extra peritoneal placement of shunt with blocked picture was noted in 2 cases. Abdominal pseudocyst and ascites are two relatively uncommon abdominal complications (2%) following VP shunt insertion procedure. Both are separate complication. The diagnosis is made possible on plain x-ray abdomen and ultrasonography; otherwise it may not be practical to distinguish a large abdominal pseudo cyst from an ascites. High protein level of CSF, chronic serosal inflammation, foreign body reaction to the peritoneal catheter and CSF production in case of choroid plexus papilloma and shunt disseminated metastasis have been proposed as possible mechanisms. We noted each of these complications of pseudo cyst and generalized ascites in 1 patient individually where the lower end was infected in patient with pseudo cyst only[20].

Extra peritoneal placement or its coming out phenomenon in extra peritoneal space due to wide opening of peritoneum for peritoneal catheter placement is more often seen as compared to abdominal trochar technique where small peritoneal puncture is made and extra peritoneal space is negligible during dissection. Since we have started this technique, extra peritoneal

placement of lower end has not been seen. Erosion of shunt is common in enlarged hydrocephalic head with small cranial flap for burr hole and in patient with poor skin status. Children are lying on reservoir side with pressure ischemia and secondary erosion. This complication is common at keen point rather than Kocher's point burr-hole cases. Displacement or dysfunction is more commonly seen with spring reservoir which is not fixed properly and can slip down from shunt track. Total intra cranial migration or migration per rectum, or rectal perforation has been documented in published literatures[21].

CONCLUSION

Although shunt surgery is a common procedure performed for hydrocephalus, different complications were associated in our study where shunt failure was mainly due to shunt dysfunction with the blockage being the most common cause followed by shunt infection while erosion and displacement of shunt were less common complications. Moreover, shunt failure was frequent in pediatric age group particularly infants as compared to adults. Complications were more with upper end. Infection was more common in children.

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CONTRIBUTORS

MA conceived and supervised the research work. RA, ZK, KMK, KK, SA & MP collected the data. MS & SA analyzed the data. All authors contributed significantly to the research that resulted in the submitted manuscript.

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None Declared