

Trans-anal protrusion of ventriculo-peritoneal shunt catheter with silent bowel perforation: report of ten cases in children

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Abstract Ventriculo-peritoneal (VP) shunting used in the treatment for hydrocephalus is associated with several complications. Mechanical failure of shunt is the commonest complication of all. Visceral/bowel perforation is an unusual but serious complication of VP shunting. This article reports our experience in the management of ten children who had VP Shunt catheter protrusion from anus. This is a retrospective study of ten patients who had VP shunt catheter protrusion from anus, admitted in the department of paediatric surgery between Jan 1996 and Dec 2005. The records of above ten cases were reviewed for their clinical presentation and management, etc. We had performed 398 VP shunt operations in the last 10 years. Two hundred and seventy one (68.09%) VP Shunts were done for congenital hydrocephalus of which 164 were done in infancy/neonatal period and 107 VP shunts were done in the age group of >1–12 years. One hundred and twenty-seven (31.90%) VP shunt operations were done for patients who had hydrocephalus as a complication following tubercular meningitis (TBM). Out of 398 VP shunts, ten patients (2.51%) had protrusion of the distal end of peritoneal catheter from anus without causing/leading to peritonitis. We observed a 08.29% mortality of all VP shunt operations. Protrusion of VP shunt catheter per rectum can occur without producing peritonitis. Formal exploration and localization of entry of VP shunt catheter in bowel is

not mandatory. Mini laparotomy and revision of peritoneal part of shunt can be done if there is no shunt infection.

Keywords Hydrocephalus · Ventriculo-peritoneal shunt complications · Ventriculo-peritoneal shunt catheter protrusion · Silent bowel perforation · Trans-anal protrusion of shunt catheter

Introduction

Hippocrates, 5th century B.C. (460–377 BC), Greek physician and surgeon, the father of medicine, is thought to be the first physician to attempt and document the treatment of hydrocephalus. Vesalius (1514–1564) at the University of Padua clarified many of the anatomical and pathological characteristics of hydrocephalus. Miculicz first attempted drainage from the lateral ventricle to the subgaleal, subdural, and sub-arachnoid spaces with the use of gold tubes and catgut strands [1]. The use of peritoneal cavity for cerebrospinal fluid (CSF) absorption in ventriculo-peritoneal shunting (VPS) was introduced in 1905 by Kausch, since then VPS is amongst the most frequently performed operations in the management of hydrocephalus. VPS used in the treatment for hydrocephalus is associated with several complications with reported incidence of 05–47% of cases [2, 3]. CSF pseudocysts peritoneal cavity is also being reported as an unusual complication with a reported incidence of less than 01–4.5% of VPS [4]. Visceral perforation is an unusual but serious complication of VPS. Bowel perforation with protrusion of VP shunt catheter from anus is reported to occur in less than 0.1–0.7% of cases. Till 2000, only 45 similar cases of bowel perforation with protrusion of catheter from anus has been reported in the literature, to which few more cases have been added as

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Fig. 1 Photograph of patient showing trans-anal protruded VPS catheter, operative scar at back and CSF collection at scalp

case reports [5–8]. We are reporting our experience with ten cases of VP shunt catheter protrusion from anus in children with a brief review of literature.

Material and methods

This is a retrospective study and included children aged up to 12 years, who had protrusion of VP shunt catheter from anus. Details of clinical presentation, diagnosis, management, etc., of the above ten cases were reviewed (Table 2). All of them presented with protrusion of catheter from anus (Fig. 1). None had features of peritonitis or bowel perforation and out of ten patients; case 1 had raised intracranial pressure. At first VPS operation in all the cases, CSF

sample was collected at the time of insertion of ventricular catheter and submitted for routine examination as well as for culture sensitivity. All patients received broad-spectrum antibiotics for a week–10 days. Anti tubercular treatment (ATT) was also continued in two patients who had TBM with hydrocephalus.

Results

Three hundred and ninety eight VPS operations have been done at the author's department of paediatric surgery from Jan 1996 to December 2005 (Table 1). One hundred and sixty four of 398 (41.20%) of VPS has been done during neonatal/infancy, 26.88% (107 of 398) VPS was done in patients aged more than 01–12 years and 31.90% (127 of 398) VPS was done for hydrocephalus due to TBM. We observed 2.51% (10 of 398) VPS catheter protrusion from anus without peritonitis. Details of clinical presentations, diagnosis, management, etc., of the above ten cases are given in Table 2.

Out of the ten patients, eight had VP shunt operation for congenital hydrocephalus of which four had associated meningocele and were also operated at the same time. Two patients had VP shunt operation for hydrocephalus following TBM. The interval between shunt insertion to protrusion of catheter from anus ranges from 2 to 20 months with an average of 06.1 months. All of these patients presented with protrusion of catheter from anus. None had features of peritonitis or bowel perforation. Out of the ten patients, one patient (case 1) had malfunctioning shunt with raised intracranial pressure. Plain skiagram of abdomen showed no features suggestive of peritonitis or bowel perforations, etc. (Fig. 2). Mini-laparotomy and revision of peritoneal part of shunt was done in seven patients. Entire shunt system was removed in three patients due to shunt block and delayed shunt revision was done in two patients. In one patient (case 3) shunt revision was not done, as relatives were reluctant for more surgical intervention and he was lost to follow up after 2 months. None of the above patients developed features of bowel perforation/peritonitis either after shunts revision or removal. Postoperative recovery was smooth in all patients.

Table 1 Number of V P Shunt operations done from Jan 1996–Dec 2005 and deaths

Years → age group ↓	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total (%)	Deaths (%)
<1 year	14	07	13	20	14	21	13	20	20	22	164 (41.20)	19 (11.58)
1–12 years	03	13	09	09	11	11	13	10	15	13	107 (26.88)	09 (08.41)
TBM hydrocephalus	04	07	10	10	11	13	15	15	20	22	127 (31.90)	05 (03.93)
Total	21	27	32	39	36	45	41	45	55	57	398 (100)	33 (8.29)
Deaths	00	02	05	04	05	04	03	03	02	05	33	



Fig. 2 Plain skiagram of abdomen showing trans-anal protruded VPS catheter (no free gas under diaphragm)

Discussion

Hydrocephalus is a pathologic condition in which accumulation of CSF tends to cause dilatation of the cerebral ventricles. This disorder is caused by an imbalance between production and absorption of CSF or obstruction in the CSF circulation [9]. The use of peritoneal cavity for CSF absorption in VPS was introduced in 1905, since then VPS is amongst the most frequently performed operations in the management of hydrocephalus. Other shunting techniques are ventriculo-atrial (VA) shunt, lumbo-peritoneal shunt, third Ventriculostomy, etc. [10]. Although, the risk in performing a shunt operation is low, the complications related to shunts are many with a reported incidence of 24–47% of which abdominal complications are reported to occur in 25% of VPS. Shunt infection remains a frequent and potentially fatal complication of CSF diversion with reported incidence of 5–10% and approximately 70% of shunt infections manifest within 2 months after shunt insertion [10–12].

Abdominal CSF pseudo peritoneal cysts are uncommon albeit well described complication of VPS malfunctions with a reported incidence of 1–4.5% of VPS operations. Ultrasonography of abdomen remains an excellent imaging modality for diagnosis of CSF pseudocyst and C T scan does not provide any significant additional information. CSF pseudocysts can be well managed by formal laparotomy or laparoscopically with excision of cysts and relocation of catheter. Ultrasonography guided aspiration of CSF cysts can be done in selected cases or conversion of

VPS to VA shunt [13–17]. CSF ascites is also reported as a rare complication of VPS and the treatment of choice is conversion of VPS to VA shunt [18].

Visceral perforation is an unusual but serious complication of VPS with a reported mortality of up to 15%. The bowel is the most commonly involved site for perforation and is reported to occur in less than 0.1–0.7% of cases. Non-enteric viscus perforation has also been sporadically reported in literature and includes urinary bladder, vagina, gall bladder, stomach, scrotum, liver, uterus, urethra, etc. VPS catheter protrusion have also been reported from umbilicus, gastrostomy wound, healed neck wound, knee, mouth, etc. [19–25]. Metastases of a brain tumor via VPS to the abdomen have also been reported in literature [26, 27].

Wilson et al. first reported an intestinal perforation induced by distal shunt catheter in 1966. Park et al. reviewed 50 such cases published in English literature by 2000, of which there were ten deaths [28]. The occurrence of a viscus perforation by the abdominal portion of a VP shunt is often a prolonged clinical phenomenon, which usually does not lead to acute peritonitis. Acute viscus perforation may also occur due to catheter irritation leading to peritonitis; this is the exception rather than the rule [29]. We observed 2.51% (10/398) VPS catheter protrusion from anus in our series. All presented with protrusion of catheter from anus. The interval between shunt insertion to protrusion of catheter from anus ranges from 2 to 20 months with an average of 06.1 months. None of the above patients in our series had features of peritoneal infection/peritonitis or intestinal perforation either at presentation or after shunt revision or removal.

There are many options for the management of patients who presented with protrusion of catheter from anus viz: (1) Mini laparotomy and revision of peritoneal part of shunt, (2) formal exploratory laparotomy and repair of bowel perforation in selected cases having peritonitis, (3) shunt removal and external ventricular drainage, antibiotics, followed by VPS or VA shunt, (4) flexible pediatric colonoscope can be used for localization of enterotomy site and removal of shunt [29–30]. In a prospective study of 409 lumboperitoneal shunts, 40.09% patients were below 15 years of age. The largest reported series in the available English literature concluded that lumboperitoneal shunt is an effective shunting procedure in communicating hydrocephalus. This technique has the advantage of being an entirely extra cranial operation [31]. Endoscopic third ventriculostomy is now the method of choice and a popular alternative to ventricular shunt placement for the treatment of obstructive hydrocephalus in children. This procedure is more physiological and anatomical diversion pathway for CSF and at the same time it obviates the need to place a foreign body such as ventricular shunt, thus avoiding

Table 2 Clinical presentation, managements, etc., of patients who had per rectal catheter protrusion

S. no.	1	2	3	4	5	6	7	8	9	10
Name	V	S	B/S	Gu	Go	Pu	Pa	R	Po	N
Age (months)	17	44	04	26	41	24	11	09	08	05
Sex	M	F	M	F	M	F	M	M	F	F
Primary diagnosis	Cong hydroc	TBM hydroc	D L-MMC hydroc and neurological deficits	Cong hydroc	LS-MMC hydroc and neurological deficits	LS-MMC hydroc and neurological deficits	D L-MMC hydroc and neurological deficits	TBM hydroc	Cong hydroc	Cong hydroc
Primary op. done	V P S	V P S	MMC excision & V P S	V P S	MMC excision & V P S	MMC excision & V P S	MMC excision & V P S	V P S	V P S	V P S
CSF R/M at primary op.	Normal	Sugar-protein ↑	Normal	Normal	Normal	Normal	Normal	Sugar ↓	Normal	Normal
CSF Culture	Sterile	Sterile	Sterile	Sterile	Sterile	Sterile	Sterile	Sterile	Sterile	Sterile
Primary op. done on	May 11, 01	Aug 09, 01	Oct 23, 01	Jan 05, 02	Nov 03, 02	Jun 07, 03	Jun 24, 03	Dec 12, 03	May 31, 05	Oct 01, 05
Operation for shunt protrusion	Apr 04, 02	Apr 02, 03	Dec 26, 01	Feb 26, 02	Feb 01, 03	Mar 06, 04	Oct 01, 03	Feb 11, 04	Oct 26, 05	Dec 13, 05
Interval (months)	11	20	02	02	05	09	03	02	05	02
Clinical presentation	Catheter from anus-1 day	Catheter from anus-6 days	Catheter from anus-1 day	Catheter from anus-1 day	Catheter from anus-1 day	Catheter from anus-4 days	Catheter from anus-4 days	Catheter from anus-2 day	Catheter from anus-2 day	Catheter from anus-1 day
Increased ICP	Yes	No	No	No	No	No	No	No	No	No
Peritonitis	No	No	No	No	No	No	No	No	No	No
Intestinal obstruction	No	No	No	No	No	No	No	No	No	No
Length of protruded catheter	30 cm	05 cm	25 cm	20 cm	15 cm	20 cm	25 cm	15 cm	15 cm	15 cm
X-ray Abd (free gas and air fluid levels)	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Operative procedure done	Mini lap and revision of peritoneal catheter	Mini lap and revision of peritoneal catheter	Entire shunt system removed	Mini lap and revision of peritoneal catheter	Mini lap and revision of peritoneal catheter	Mini lap and revision of peritoneal catheter	Mini lap and revision of peritoneal catheter	Mini lap, revision of peritoneal catheter	Entire shunt system removed	Entire shunt system removed
Remarks	Shunt revision same time	Shunt revision same time	Shunt revision not done	Shunt revision same time	Shunt revision same time	Shunt revision same time	Shunt revision same time	Shunt revision same time	Delayed re-shunt operation	Delayed re-shunt operation

Cong Congenital, *Hydroc* Hydrocephalus, *VPS* Ventriculoperitoneal shunt, *TBM* Tubercular meningitis, *MMC* Meningocele, *DL* Dorso-lumbar, *LS* Lumbo-sacral, *CSF* Cerebro spinal fluid

shunt-related complications such as malfunction, infection, and over drainage [32, 33].

In our series, of the ten cases, mini laparotomy and revision of peritoneal part of shunt was done in seven cases, shunt removal and delayed shunt revision was done in two cases. One of our patients (case 3) who needed removal of the entire shunt, revision surgery was not done as consent for the same was not given by parents. He was earlier operated for gross hydrocephalus and menigomyelocele with neurological deficits. Formal exploration of the peritoneal cavity, colonoscopy or laparoscopy for localization of enterotomy site was not done in any case in our series. Facility for endoscopic third ventriculostomy is not available at our hospital so we have not done in our patients.

A prospective study conducted among 40 children below 2 years of age to compare the efficacy and complication rates of low versus medium pressure shunts for the management of congenital hydrocephalus showed similar complication rates in both the groups [34]. Couldwell WT et al. reported their experience of using extended length in 998 of VPS. They used shunt of 120 cm at primary shunt insertion. Their patients' age ranges from premature neonates to 20 years. Authors concluded that the use of an extended length of shunt catheter is not associated with increased complication rates and it further eliminates the need for shunt lengthening procedures [35].

We used Chhabra “slit n spring” valve and a regular reservoir medium pressure hydrocephalus shunt system (G Surgiwear Limited, Shahjahanpur, Uttar Pradesh, India) as a routine in majority of patients irrespective of the cause of hydrocephalus or the age of patient. According to the manufacturer, the medium pressure shunt would open at 7–12 cm of H₂O and the length of peritoneal/distal catheter is 75 cm. We used a small, supra-umbilical, right transverse, rectus splitting incision for insertion of the distal end of VP shunt. Peritoneal catheter was inserted under vision to prevent injury to bowel, etc. We never used trocar for insertion of distal end of catheter into the peritoneal cavity.

The incidence of 2.51% VPS catheter protrusion from anus in our series is higher than the earlier reported as in less than 0.1–0.7% of cases. We observed that the end of peritoneal catheter was not blunt or smooth. There was sharpness at the tip of the peritoneal catheter and we presumed that this could be the initiative factor for the occurrence of the above complication. We also used whole length of shunt system (75 cm) irrespective of age of patients, may be another factor for high incidence in our series, although one study reported use of extended length (120 cm) shunt was not associated with increase in complications. Other contributing factors are sub-clinical shunt infection, increased protein content in CSF, etc.

Possible sequence of events for the occurrence of the spontaneous, silent bowel perforation with trans-anal VPS catheter protrusion is:

- (1) Due to the effect of gravity the peritoneal catheter may gravitate into the pelvis and penetrate into the colon/rectum.
- (2) Catheter migrate transmurally into the bowel lumen over a prolonged period of time, which being surrounded by fibrous encasement at the enterotomy without subsequent peritoneal infection/peritonitis.
- (3) After eroding into the lumen of the bowel, the shunt usually propelled distally by the intestinal peristalsis.

We observed 08.29% (33/398) deaths of all VP shunt operations in our series (Table 1). Eighty-five percent of deaths were in patients operated for congenital hydrocephalus of which 58% of patients were operated in infancy and also had additional surgical procedures viz. menigomyelocele repair, etc. There were no deaths among the ten patients of per rectal shunt protrusion in our series.

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