

# Peroral Extrusion of Ventriculoperitoneal Shunt: An Unusual Complication and Review of Literature

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## Abstract

Several case reports regarding complications of ventriculoperitoneal (VP) shunt have been published, but peroral extrusion of shunt tube is unusual and reported less frequently. A 4-year-old male child with previous history of VP shunt insertion for congenital hydrocephalus along with shunt revisions twice presented with peritoneal end of shunt tube protruding through the mouth following an acute episode of vomiting. He was conscious without any signs of infection or neurologic deficits. The distal portion of the tube was removed uneventfully with the help of upper GI endoscope that, in addition to removal, provided better views for the identification of site and size of perforation. Peroral extrusion of the shunt tube needs immediate treatment that includes removal of extruded shunt tube, treatment of underlying infection, and attention to perforated viscus. We review the possible pathogenesis of this entity and various treatment options.

## Keywords

- ▶ peroral extrusion
- ▶ ventriculoperitoneal shunt
- ▶ gut perforation

## Introduction

It has been reported that in ventriculoperitoneal (VP) shunt insertion, complication rates range between 24 and 47%<sup>1</sup> of which abdominal complications account for approximately 25%.<sup>2</sup> Bowel perforation as a complication of VP shunt is reported to occur between 0.1 and 0.7%, and may lead to significant mortality and morbidity caused by peritonitis or meningoencephalitis.<sup>3</sup>

After gut perforation, the shunt tube may present at one of the natural orifices, of which peroral extrusion is more common.<sup>2</sup> Sigmoid is the most frequent site of gastrointestinal (GI) perforation followed by transverse colon and stomach.<sup>4</sup> Here we report an unusual case of peroral extrusion of the peritoneal shunt tube in a 4-year-old male child as a delayed complication of VP shunt insertion.

## Case Report

A 4-year-old male child presented with extrusion of distal end of shunt tube from the mouth after an episode of projectile vomiting without abdominal pain. The child was full-term born with delayed milestones, a known case of congenital hydrocephalus who had history of being operated for VP shunt at age of 1 year followed by abdominal end revision 6 months later, and at the age of 3 years a left VP shunt revision was done and the old shunt tube was removed. The length of protruded shunt tube was approximately 10 cm from the incisors with no visible cerebrospinal fluid (CSF) flow at tip (▶ Fig. 1A). The child was afebrile, clinically well, and alert without any signs of peritonitis, without clinical evidence of meningitis, neck rigidity, or signs of increased intracranial pressure. Routine laboratory investigations

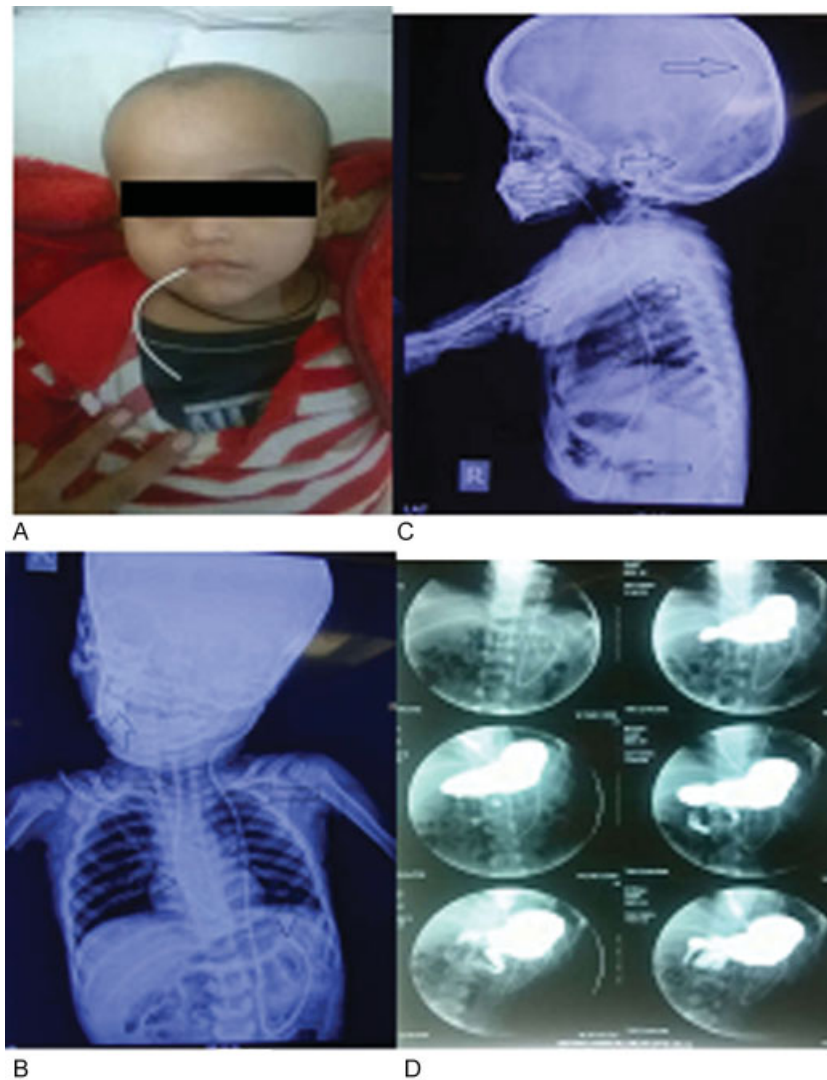
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**Fig. 1** (A). Per oral extrusion of distal end of VP shunt tube. (B and C) Anteroposterior and lateral X-rays showing route of shunt tube and ascending through esophagus and coming out from oral cavity. (D) Barium meal series 3 days after endoscopic removal suggestive of absence of spillage from stomach rent.

turned out to be normal. Shunt series depicted shunt tube ascending through the esophagus and protruding through mouth (►Fig. 1B, C). Ultrasound of the abdomen was normal. Computed tomography (CT) of the brain revealed optimally placed ventricular tip of shunt tube inside the normal-sized left lateral ventricle with resolution of previous hydrocephalus.

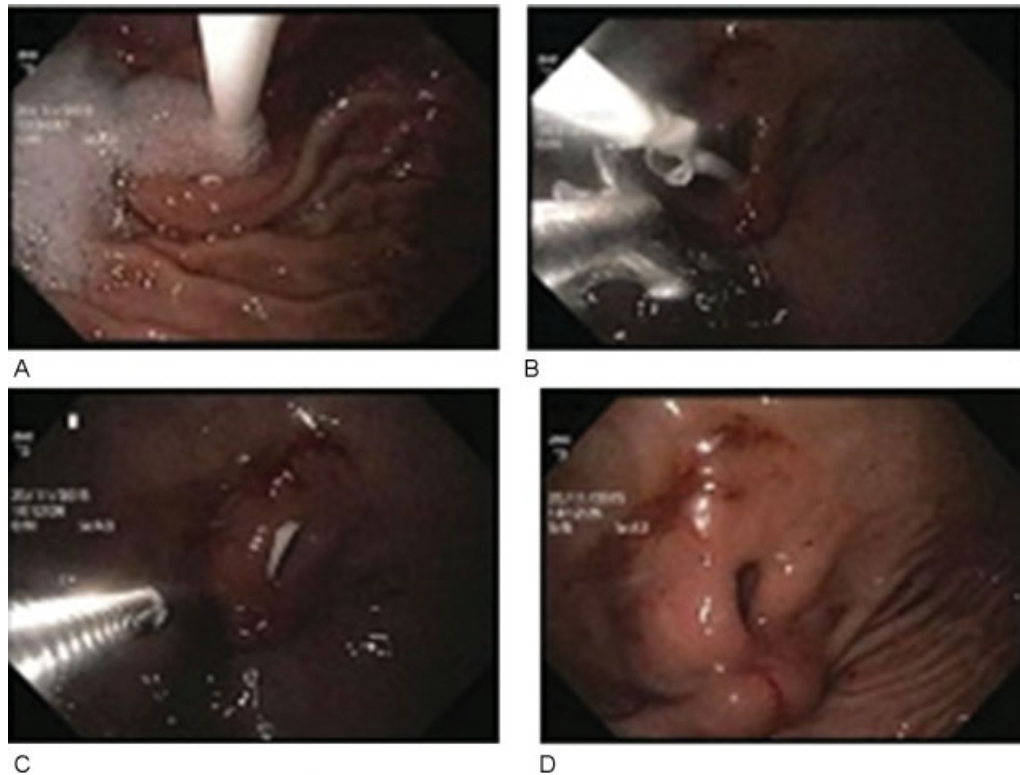
Prophylactic parenteral antibiotics were initiated and the patient was subjected to upper GI endoscopy, where the shunt tube was seen entering the stomach through rent on the greater curvature (►Fig. 2A). The shunt tube was cut near the rent with the help of endoscopic scissors (►Fig. 2B), the proximal end slipped into the peritoneal cavity (►Fig. 2C), and the distal end was taken out and sent for microbiologic examination. The rent in the stomach was small (< 1 cm) with smooth margins (►Fig. 2D). Hence the rent was not closed. The cranial incision was opened, shunt tube disconnected below the chamber, and both the ventricular and abdominal ends were removed through

this incision. The patient was kept on continuous nasogastric aspiration and nil orally for 2 days. On third day barium meal showed no spillage of barium into the cavity (►Fig. 1D).

Meanwhile the CSF collected from the chamber was found to be sterile on culture examination. Cytology revealed no cells, and biochemistry values were within normal limits. On microbiologic examination of the extruded shunt tube, the culture grew colonies of *Enterobacter* spp. However, the patient remained asymptomatic without any episodes of fever or features of meningitis till 14 days after which he was discharged. He had been on regular follow-up for 3 months and had no complaints.

## Discussion

Among reported cases of VP shunt-induced gut perforations, the colon (70%) forms the most common site, followed by the stomach (16%) and small bowel (14%).<sup>5</sup> The incidence of perforation is inversely related to the mobility of gut, and the



**Fig. 2** Endoscopic images. (A) Shunt tube entering through a rent on the greater curvature of the stomach. (B) Shunt tube being cut by endoscopic scissors. (C) Retraction of distal end of remaining portion of cut shunt tube seen through rent in the stomach. (D) Rent in the stomach with smooth margins being left to heal on its own.

colon is the most frequently perforated viscus due to its immobility.<sup>2</sup> According to literature, the shunt tube more commonly extrudes through the anus (61.9%)<sup>2</sup>; however, oral extrusion, as in our case, is relatively uncommon with total of approximately 20 cases reported in literature.

Usually these patients, because of infection by an enteric organism, present with features of ventriculitis or meningitis. Patients with proximal perforations involving the stomach or proximal jejunum are less prone to severe infectious complications than those with the distal intestine like colon.<sup>6</sup> This is in accordance with our case that showed lack of any serious meningeal or peritoneal infection.

The exact pathophysiology of late perforation is difficult to establish. Most cases had a delayed presentation, suggestive of chronic inflammatory process as opposed to traumatic event.<sup>7</sup> Proposed mechanisms suggest that the tip of the shunt tube adheres to the intestinal wall and erodes it, because of continuous friction at the site of contact.<sup>1,8</sup> Another is perforation of gut by a chronic irritative process in which the VP shunt adheres to the serosal surface by way of foreign-body reaction, related to silicone allergy.<sup>5,8</sup> The repeated pressure on the fixed point slowly produces an ulcer and eventually a perforation. In a case reported by Shridhar and Karmarker,<sup>6</sup> the probable mechanism of bowel perforation was infection, leading to inflammation and adherence of the tube to the proximal gut. A belief says that bowel perforation can be the result of occult shunt infection caused by intraoperative contamination. In our case, chronic

irritation by the shunt tube tip to the serosal surface of the stomach might have occurred resulting in perforation. Unlike previously reported cases, our patient has history of revisions twice in past, which might contribute to the above process. Age, male sex, malnutrition, poor general condition, length and type of shunt tube, previous abdominal operation, infection,<sup>1</sup> and silicone allergy from foreign-body reaction are some of the predisposing factors for bowel perforation.<sup>8</sup> Weaker intestinal musculature and stronger intestinal peristaltic activity in children contribute to age standing out as major risk factor for perforation. Sharp peritoneal tip or coiled spring-type shunt tubes are more likely to perforate than silicone ones.<sup>1,9</sup> Predisposing factors in our case included age, male sex, and silicone material of shunt.

Peroral extrusion of VP shunt is rare.<sup>10-13</sup> The shunt tube is normally propelled distally by peristalsis after perforation of bowel, but to come out from the mouth, it has to move against normal peristalsis and cross the gastroesophageal junction and esophagus. Once perforated and lying in the stomach or the jejunum, the tube may be made to travel into the oral cavity by forceful repeated vomiting and retching.<sup>13</sup> The forceful episode of vomiting was responsible for antiperistaltic movement of the shunt tube and its extrusion from the mouth in our case. Gut perforation and shunt tube extrusion can be associated with very high mortality and do not always have a benign course.<sup>14</sup> High suspicion is needed to diagnose bowel perforation, as less than 25% of patients with bowel perforation exhibit signs of

peritonitis.<sup>15</sup> Prolonged diarrhea with abdominal symptoms in a patient with VP shunt should warn of a possible perforation. CSF cultures have been found to be positive in 23 of 45 patients with bowel perforation, with *Escherichia coli* being the most common organism.<sup>15</sup>

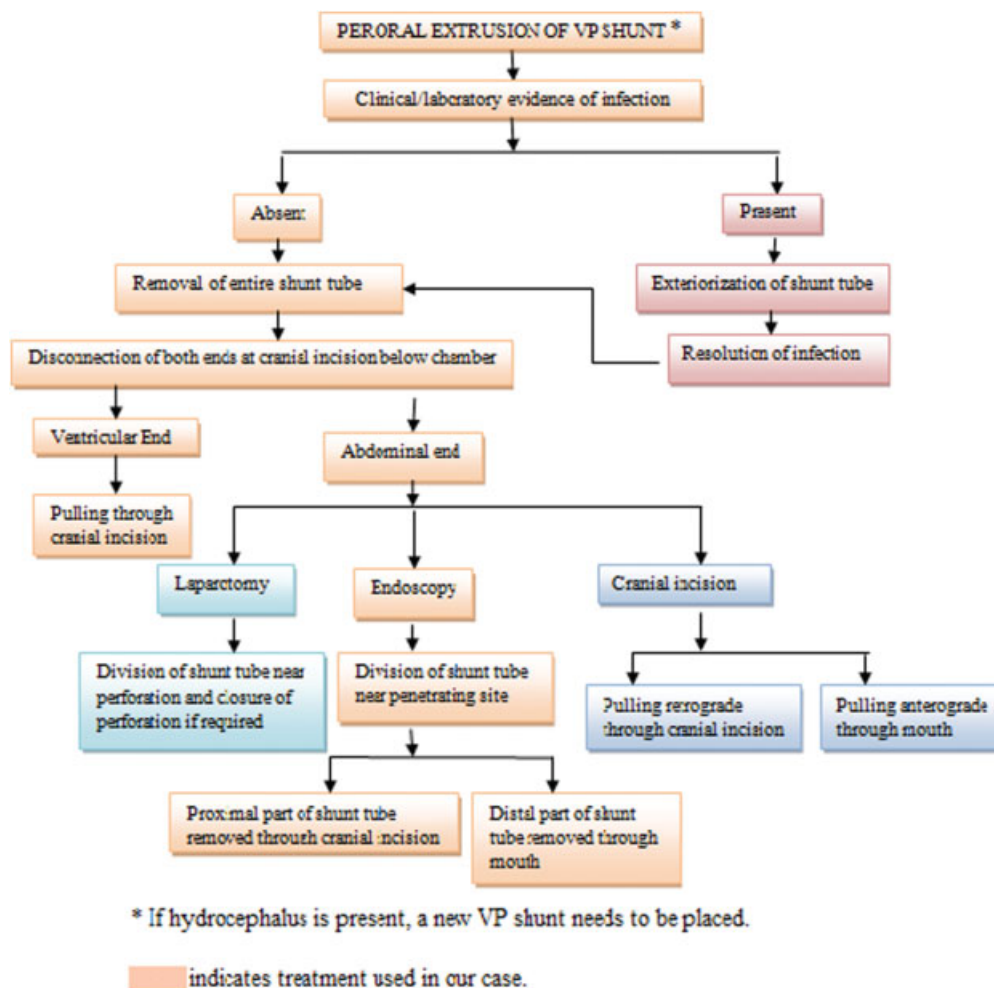
There are various ways of managing such cases. A summary of some selected cases has been tabulated (►Table 1). The management principles (►Fig. 3) of such complications include diagnosis and treatment of CSF infection or shunt tract inflammation, removal of extruding shunt tubing, and attention to perforated viscus.<sup>3</sup> Broad-spectrum antibiotics are initiated early. There are multiple ways to remove distal shunt tube in peroral extrusion of VP shunt. A major laparotomy is probably unnecessary as the opening in the bowel is small and seals off spontaneously.<sup>1</sup> The extruded peritoneal end

can be removed through cranial incision by pulling in a retrograde manner. In this method there is always a theoretical risk of infection as the peritoneal end is exposed to atmosphere and the contaminated gut, as seen in the report by Kothari et al.<sup>12</sup> In another method through cranial incision, both ends are disconnected. The ventricular end is removed through incision, and peritoneal end through the mouth by gentle pull, reducing chances of infection due to lack of contact of contaminated tube to the peritoneum or shunt tract.<sup>7</sup> Laparoscopy alone or endoscopy assisted has also emerged as a means of removing the shunt tube under visual guidance and also enables inspection of entire peritoneal cavity. Endoscopic removal in our case enabled us to visualize the entry point and rule out any associated damage to the stomach, in addition to minimizing invasiveness and its associated morbidities.

**Table 1** Summary of previously reported cases

Reference and year	Sex	Age	CSF INF	Perforated viscus	Management		
					Division	Proximal end	Distal end
Park et al <sup>1</sup> 2000	F	5 y	N	Stomach	The peritoneal catheter was cut at the chest	Externalized at the chest	Removed endoscopically
Low et al <sup>2</sup> 2010	M	1 y	NA	Stomach		Ventricular catheter externalized	Peritoneal catheter removal not explained
Odebode <sup>5</sup> 2007	M	15 mo	N	Jejunum	Laparotomy, division of tube flush to jejunum	Removed via postauricular incision	Removal PO of distal portion
Sridhar and Karmarker <sup>6</sup> 2009	F	8 mo	N	NA	Cranial incision and division of the shunt below the chamber	Ventricular catheter removed via cranial incision	Removal PO of distal portion
Agarwal et al <sup>7</sup> 2011	M	1 y	N	Stomach	VP shunt was divided distal to valve via post auricular incision	Ventricular catheter removed via postauricular incision.	Peritoneal catheter removed PO
Griffith et al <sup>10</sup> 1987	F	9.5 y	Y	Stomach		Exteriorized	NA
Fermin et al <sup>11</sup> 1996	F	15 mo	N	Diaphragm and trachea	Exploratory laparotomy, and revision of VP shunt		Removed PO
Kothari et al <sup>12</sup> 2006	F	18 mo	NA	NA	At post auricular site	Removed via postauricular incision	Removed via postauricular incision
Murali and Ravikumar <sup>13</sup> 2008	M	6 y	N	Stomach	Incision in chest with division of peritoneal catheter	Proximal portion connected to a closed drainage system	Removal PO of distal portion
Gupta et al <sup>14</sup> 2012	M	4 y	NA	Stomach	VP shunt was divided distal to valve via post-auricular incision	Via postauricular incision	Via postauricular incision
Present case	M	4 y	N	Stomach	Endoscopic division of shunt in stomach near rent in stomach	Via postauricular incision	Via postauricular incision and endoscopically PO

Abbreviations: CSF, cerebrospinal fluid; F, female; INF, infection; M, male; N, no; NA, not available; PO, per orally; Y, yes.



**Fig. 3** Flow chart depicting various management options for treatment of peroral extrusion of ventriculoperitoneal (VP) shunt.

## Conclusion

The appearance of shunt tube in the mouth represents gut penetration. Spontaneous penetration or perforation is a rare complication and a high index of suspicion is essential to diagnose it, particularly in pediatric patients, as the abdominal symptoms and signs may be vague. Abdominal X-rays and CT may be required and CSF culture is mandatory for diagnosis of retrograde CSF infection. Endoscopic removal of shunt tube is advocated and laparotomy is not required in the absence of infection or intra-abdominal complications to avoid major operative procedures related to morbidity and mortality.

**Source of Support**  
None.

**Conflict of Interest**  
None.

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